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Thanks to Robin Alexander and Fess Parker for providing several of the below articles.

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

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What jobs will flying robots be doing in future? **(Interesting illustrations and videos)**

Global commercial-drone market expected to soar - it could be held back in the US by the FAA

NAVY/USMC:

US Office of Naval Research Tests Drone Swarms

The Department of the Navy's Office of Naval Research this week released this video showing a 30 aircraft flight of UAVs directed in tandem by the Navy and researchers from the Georgia Tech Research Institute of the Georgia Institute of Technology.

The ONR's LOw-Cost Unmanned aerial vehicle Swarming Technology (LOCUST) program envisions a tube based launcher that could deploy with Marines ashore or from the decks of Navy ships and operate in masses that could conceivably reach hundreds, overwhelming an enemy. This video shows a swarm test launching where they rip off 9 drones in 9 seconds.

"This level of autonomous swarming flight has never been done before," said ONR program manager Lee Mastroianni in a previous media release by the Navy. "UAVs that are expendable and reconfigurable will free manned aircraft and traditional weapon systems to do more, and essentially multiply combat power at decreased risk to the warfighter."

http://www.uasvision.com/2016/05/26/us-office-of-naval-research-tests-drone-swarms/?utm_source=Newsletter&utm_campaign=8fe7dc20fb-RSS_EMAIL_CAMPAIGN&utm_medium=email&utm_term=0_799756aeb7-8fe7dc20fb-297560805

Navy 'Finalizing' Details of CUSV Contract for Mine Hunting Mission

Textron Systems Unmanned Systems not only built flexibility into its Common Unmanned Surface Vehicle (CUSV) hull design but also into its acquisition program, enabling the company to potentially sell some craft to the Navy for the newly assigned mine hunting mission before signing off on a contract for the original mine sweeping mission, a company official said.

The company hopes to sign a low-rate initial production contract with the Navy for the Unmanned Influence Sweep System (UISS) - a CUSV towing a minesweeper - in the third quarter of Fiscal Year 2017, but the Navy may buy CUSVs without the sweeper sooner than that through a separate user evaluation program with rapid development and acquisition authority, Wayne Prender, senior vice president of control and surface systems, told reporters earlier this month.

The Navy identified CUSV as one of three possible solutions to the mine hunting challenge it faces in the Littoral Combat Ship mine countermeasures mission package, and the service hopes to start testing the unmanned vehicle soon to determine if it could be a long-term solution for that capability gap. Prender said he couldn't talk about the timeline for a CUSV contract to support mine hunting testing and fleet experimentation, but he said it would not be tethered to the more stringent timeline for the UISS, which is governed by standard Defense Department acquisition rules.

"We proposed and the Navy accepted as part of the UISS program a nontraditional critical design review (CDR) philosophy where we drove the design reviews into three different phases: a hull and structure phase, a software phase and a systems phase. That allowed us to begin the build of the vehicle upon completion of the hull and structure CDR earlier than you would traditionally do if you waited for the full system-level CDR to be complete," Prender said.

The UISS program is more than halfway through its 30-month contract duration, with in-water testing expected in July and delivery expected late this year or early next year. However, since the Pentagon has already signed off on the hull design, Textron and the Navy are looking at flexible contracting options to support user assessments for the CUSV in a mine hunting mission, completely independent of the remaining UISS milestones.

Prender said the Navy has also expressed interest in buying more CUSVs for mine hunting, not only as a solution for the LCS MCM package but also for expeditionary mine countermeasures off a pier or a platform such as the expeditionary transfer dock USNS John Glenn (T-ESD-2).

Though the CUSV is only officially on the record as a tow for the minesweeper, Prender said Textron has demonstrated the vehicle's ability to tow four different payloads: side-scan sonar; mine neutralization; intelligence, surveillance and reconnaissance (ISR); and nonlethal weapons. If the Navy were to buy more vehicles for mine hunting or other missions, "that's going to really allow the Navy to demonstrate flexibility: the flexible ship concept is very big in the Navy. Multi-payload: so here we have one craft, the

CUSV, intended to be used for the sweep mission, also capable with minor changes to support mine hunting and mine neutralization."

Navy Researchers are Analyzing Findings from Drones Beneath Arctic Ice

The pace of melting ice is leading the Navy to prepare sooner for more Arctic activity and confront growing competition with Russia in the region.

The Navy is analyzing research findings from efforts to deploy underwater drones beneath the ice in the Arctic Ocean to assess how quickly the ice is melting and understand how soon the U.S. and Russia will be competing for new strategic waterways in the region.

The drones had been measuring the temperature and salt content to help scientists develop more accurate computer models with which to predict the anticipated future pace of melting ice, Martin Jeffries, science advisor to the Office of Naval Research, or ONR, told Scout Warrior.

The Navy's unveiled its Updated Arctic Road Map that explains how increasing water temperatures and decreasing ice layers mean the service will need to increase the number of ships in the region over the next 20 years, Jeffries said.

As a result, Navy scientists are using unmanned underwater autonomous robots, or drones, to examine what's called the marginal ice zone – the portion of frozen ocean's packed ice that meets open water, Jeffries explained.

The idea behind the research is to assess the pace of change in the Arctic environment as a way to better predict the pace of melting ice. Faster ice melting means the opening up of new strategic waterways, passage routes and overall activity in the region among nations.

Jeffries explained the scientific basis for the phenomenon by pointing to what's called the ice "albedo feedback mechanism," a term used to describe the reflectivity of the surface ice. Surface ice has a much higher "albedo," allowing it to reflect sunlight and solar radiation back into the atmosphere.

Underwater Drones Beneath the Ice

Navy scientists have had success in the Arctic using an underwater drone called the Seaglider, a 110-pound, 2.8-meter autonomous underwater robot able to lower acoustic sensors to depths of 1,000 meters. The Seaglider, originally developed by the ONR for open ocean data collection, can be used to gather information beneath the surface of the ice, Jeffries explained.

By the end of the summer in 2014, the science team had deployed over 100 robotic platforms in the ice and the ocean, Jeffries explained.

The Seagliders were programmed to receive acoustic signals or "pings" from underwater sources suspended on cables beneath buoys frozen into the ice at fixed locations, providing precise latitude and longitude information for the drones, Jeffries explained.

An acoustic signal was sent to help us determine where in the water column below the ice the Seaglider was located so that we know accurately where each temperature and salinity measurement is, Jeffries said. Scientist then learned temperature and salinity content in the water column from the surface down to depths of 1,000 meters, he added.

Measuring the temperature of the water beneath the ice helps scientist understand how much greater exposure to wind and sunlight is mixing up the water column and potentially raising the water temperature.

Knowing the precise temperatures of water beneath the surface of the ice and water can provide scientists with valuable information about the extent to which wind is mixing up an otherwise highly stratified water column, moving up warmer water from deeper beneath the surface.

Warmer water currents from both the Pacific Ocean and Atlantic Ocean currently flow into the Arctic region; warm waters from the Pacific are roughly 50 meters below the surface, whereas warmer waters from the Atlantic flow as deep as 200 to 250 meters below the surface, Jeffries said.

Wind-mixing could break down this water stratification and bring heat from deeper into the ocean up closer to the surface, creating warmer water which leads to more ice melting, Jeffries said.

These efforts include technologies that allow weapons and sensors to better operate in an arctic environment and using special gear to "knock" ice off of the superstructure of a surface ship. This could also include working on technologies to build heating elements into the superstructure of the ship itself, Navy officials said.

The largest existing Arctic shipping route, called the Northern Sea Route, largely parallels the Russian border with the Arctic. This route has seen a large increase in traffic in recent years, officials said.

The Navy's Arctic Road Map addresses these threats and explains how the U.S. will require more ships in the region as the ice melts away. Predicting how quickly it will melt helps Navy leaders plan how many ships that will entail, Jeffries said.

The Navy has updated its 2009 Arctic Road Map which includes mission analysis and "fleet readiness" details for the Arctic environment, including search and rescue, maritime security, C4ISR, cooperation with the U.S. Coast Guard, strategic sealift and strategic deterrence, among other things.

http://www.scout.com/military/warrior/story/1673047-navy-drones-patrol-beneath-arctic-ice

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Aurora Test New Capabilities for Marines

Aurora Flight Sciences tested new capabilities of the Autonomous Aerial Cargo/Utility System in Bealeton, Virginia, May 25, 2016.

The AACUS is an autonomy applique kit that enables operations of full-scale rotary-wing aircraft in and out of austere landing zones, tactically, with little human assistance.

"We know how to make things fly, we've been doing it for over 100 years," said Retired Brig. Gen. Frank Kelley, formerly the Deputy Assistant Secretary of the Navy for Unmanned Systems. "What we don't yet know how to do, is how to couple aircraft and autonomous systems together, but great programs like this are helping us get there."

The company's mission is to find a way to make flight missions in a combat environment safer and easier for the pilots through the AACUS.

"The AACUS is a sensor package that when installed on an aircraft allows for it to be unmanned," said Capt. Christopher Alfaro, MAGTF logistics integration officer, logistics division and strategy branch, Headquarters Marine Corps. "Which means we can put this kit on any aircraft and as long as we do the science and engineering behind it, it can fly autonomously."

AACUS enables a warfighter to control the aircraft via an intuitive application on military issued tablets.

"This system is going to allow pilots to let the system do the risky jobs," said Maj. Jason Jewell an osprey pilot with Marine Medium Tiltrotor Squadron 774, Marine Aircraft Group 49, 4th Marine Aircraft Wing. "By this time next year we should be flying with the AACUS on the UH-1H."

Aurora says they plan on testing the capabilities of the program on a UH-1H aircraft from 2017 to early 2018 and plan to implement this technology into the Marine Corps fleet sometime in 2018**.**

http://science.dodlive.mil/2016/06/03/aurora-test-new-capabilities-for-marines/?source=GovDelivery

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Defense Department Official Sees Promise in DARPA's Unmanned Boat

A senior Defense Department official sees the Defense Advanced Research Projects Agency's new unmanned boat as an example of how the department is working to maintain its scientific and technological edge through innovation.

Assistant Secretary for Research and Engineering Stephen Welby singled out the DARPA's anti-submarine warfare continuous trail unmanned vessel (ACTUV) - intended to track quiet diesel electric submarines without any need for human operation aboard - as an emerging technology that could have an impact in future operations.

Now that the ACTUV has been christened and is currently training with Navy fleets, it could open up a whole slew of new opportunities, Welby said June 2 at a National Defense Industrial Association sponsored executive breakfast in Washington, D.C.

"It allows us to think about what the future of unmanned shipping might look like ... and what kind of capabilities it would offer," he said. Its "very capable sonar" makes it ideal for anti-surface warfare, Welby said, but the ACTUV could also be helpful in demining operations or as a picket for manned vessels. It could also influence commercial shipping operations.

"There's a whole range of options that this kind of system offers," he said. "And we're trying to get at the hardest parts of those operations with this vessel."

The watercraft was christened in Portland, Oregon, two weeks ago, and is now stationed in San Diego with the Navy fleet, Welby said. It will exercise with the fleet for the next 18 months, so officials can better understand the ways it might be able to operate with the fleet in the future. "We'll find new missions that we had not considered," he said.

Welby stressed the need for the department to bring innovation, both in new ideas and existing technology, to the services. Autonomy and robotics and electronic warfare capabilities were two he mentioned. In the biomedical sphere, technology such as Fitbits could help scientists monitor soldiers' alertness and levels of sleep deprivation in the field. Hypersonic technology and manufacturing are other major areas for innovative opportunities, he added.

Funding is nevertheless a factor, especially with the pressures of personnel costs and modernization. The nation's ability to remain competitive depends upon research investments, both within and outside of the department, Welby said.

The department is requesting $12.5 billion for science and technology in the 2017 defense budget, with the brunt going to advanced technology development and applied and basic research. The hope, Welby said, is to increase the speed of transitioning projects from the lab to the fleet or troops and get "more bang for the buck, [which] needs to be a key component in everything we do, including science and technology."

But in order for the services to maintain their competitive edge, especially in the areas of biotechnology, autonomy and software, the best and brightest minds need to decide that they would rather serve their country than choose a higher-paying private sector job.

Welby wants to prove that "the department is able to recruit and retain those A-students who are going to make a difference," he said. That means working to change the way the department recruits new employees: perhaps with shorter commitments, where a worker could leave after only a few years to start his or her own company or move into the commercial sector, and hopefully return at a later date with new knowledge and experience.

The task at hand - making sure the services are ahead of the curve - has not changed. "Ensuring that we are able to disrupt others, not that they're disrupting us, that we can set potential opponents with surprising disruptive capabilities ... is key to the American way of warfare," he said.

http://www.nationaldefensemagazine.org/blog/Lists/Posts/ViewPost.aspx?ID=2207

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ARMY:

Army to test driverless vehicle technology in Michigan

A convoy of Army vehicles will be cruising Michigan's Interstate 69 in St. Clair and Lapeer counties in late June.

The vehicles will be testing a piece of technology that is a critical piece in the development and testing of driverless and connected vehicles.

"This is the first time these tests are being done on a highway," said Doug Halleaux, public affairs officer for the U.S. Army Tank Automotive Research, Development and Engineering Center.

The convoy will test vehicle-to-vehicle and vehicle-to-infrastructure radio communications, Halleaux said. The technology used to communicate between the Army line-haul vehicles and between the vehicles and infrastructure is the type of computerized communication that would be used in an autonomous vehicle.

"In order for automated vehicles to work and work correctly and work safely, that automated vehicle needs to talk very fast, sending data back and forth, first to the vehicles around it," Halleaux said.

The vehicles also need to send communication to radio points set up within the infrastructure to anticipate changes such as an upcoming curve in the road or a widening of the roadway.

"This is a huge safety upgrade not only for the Army but for car manufacturers, truckers and everyone else as this technology progresses and becomes more widely used," he said.

Morosi said a total of six radio units are installed along the highway infrastructure, five that are temporary and one that is permanent.

"We plan to outfit the I-69 corridor with permanent ones as time goes on," Morosi said.

Halleaux said the stretch of I-69 in St. Clair and Lapeer counties was chosen for the project because of its relatively light traffic and its proximity to TARDEC's headquarters at the U.S. Army Detroit Arsenal in Warren.

"Essentially, I-69 was chosen for a couple reasons," Morosi said. "One, its proximity to an international border crossing; and, second, it's a two lane highway."

Halleaux said the exact date and location of the exercise will not be announced to avoid extra traffic on the roads.

Morosi said the meetings are meant to allay concerns that might arise at the sight of the military vehicles and to assure residents that a driver will be behind the wheels of the vehicles participating in the exercise.

http://www.armytimes.com/story/military/tech/2016/05/26/army-test-driverless-vehicle-technology-michigan/84988698/

Redstone Test Center now has new UAS test capability

The Redstone Test Center is now fully capable of full-spectrum Unmanned Aircraft Systems testing.

According to RTC, the center has been involved in UAS testing on a 'witness-only' basis until recently when the RTC UAS test team planned, executed and reported on the integration of new technology to an unmanned system.

"We have methodically built our unmanned flight test capability to the point where we can now execute full-spectrum UAS testing with the same precision and expertise we have long brought to manned system testing. This test will be our first opportunity to validate our execution of full-spectrum UAS testing," said Experimental Test Pilot Sokol Cela.

This was also the first time an active-duty Army Experimental Test Pilot controlled a UAS during a test flight, which provides valuable insight to the system operation and performance.

"This is the very first time an Army Experimental Test Pilot with an exceptional pedigree of experience and training has served as a UAS vehicle operator. The knowledge that he brings to this process is invaluable in helping our customer get to the finish line, which is what we are all about," said RTC Commander Colonel Patrick Mason via press release.

The testing took place at Dugway Proving Ground near Salt Lake City, UT, May 16- May 27, 2016.

http://m.waaytv.com/redstone_alabama/rtc-now-has-new-uas-test-capability/article_def2acb8-276e-11e6-9c77-bbf73e9228d4.html

USAF:

USAF to Automate MQ-9 Takeoffs and Landings

The US Air Force is pressing forward with a General Atomics Aeronautical Systems MQ-9 Reaper upgrade that would allow the widely fielded armed aircraft to takeoff and land automatically.

This is a capability already inherent in the US Army's MQ-1C Gray Eagle system, but the air branch has been slow to adopt it.

Col Travis "Flare" Burdine, the air force's division chief for remotely piloted aircraft operations at the Pentagon, says the MQ-9 is still launched and recovered manually at an airfield the same way the RQ-1 Predator was back in 1995.

With automation, he says learning to fly the MQ-9 will be as easy as launching as training to operate the Northrop Grumman RQ-4 Global Hawk, which has flown automatically since it introduction.

Burdine says automatic takeoff and landing would make training Reaper pilots easier. It would allow access to more runways and take the control link off the current frequency band, which he says it "not a very good one to be in".

MQ-9s are typically operated via satellite from operational bases in the USA, like Creech AFB in Nevada. Airmen who launch and recover the aircraft must be forward deployed to the Middle East or wherever else those aircraft are stationed for combat operations.

"If we had automatic takeoff and landing, we could do that a lot faster and have less people back home in the training schools," says Burdine, speaking at AUVSI's Xponential conference in New Orleans, Louisiana on 3 May. "It would allow us to go to other airfields, which we're serious about, and not have to divert because of weather so often.

"We are seriously looking at how to integrate auto takeoff and landing. We're going to look to the army, who figured it out with the same manufacturer."

In a recent interview with Flightglobal, General Atomics' senior director of strategic development, Chris Pehrson, noted that the air force tried last year to shift money from other accounts to begin implementing the automatic takeoff and landing system, but the request was denied by Congress. The air force has since put it into its regular, five-year MQ-9 programme plan for fiscal year 2017. Pehrson says the system is ready now and that General Atomics is keen to move faster if needed.

He explains that MQ-9s are capable of operating from 3,000ft (0.9km) runways. However, because it is landed manually from a control station, the air force requires an extra 1,000ft safety margin at each end of the landing zone for a total runway length of 5,000ft.

"With automatic takeoff and landing, we can put it down on the same spot consistently," he says. "That's going to give you a 3,000ft runway capability."

http://www.uasvision.com/2016/05/17/usaf-to-automate-mq-9-takeoffs-and-landings/?utm_source=Newsletter&utm_campaign=fe64710917-RSS_EMAIL_CAMPAIGN&utm_medium=email&utm_term=0_799756aeb7-fe64710917-297560805

Air Force Academy Cadets Take Top Prize at Corrosion Detection Competition - UAS & UGV

Six cadets from the U.S. Air Force Academy won first prize at a corrosion-detection design competition held April 18-19 at the George R. Brown Convention Center in Houston, sponsored by NACE International and funded by the Department of Defense (DoD) Corrosion Policy and Oversight Office.

NACE International's inaugural University Student Design and Applied Solutions Competition challenged bachelor's- and master's-level students to create an autonomous system to detect corrosion and coating defects in difficult-to-reach areas of a fabricated structure.

USAFA's winning design included an iRobot PackBot ("Mother Ship") capable of maneuvering a smaller team-built InspectorBot into a tight space where the latter could use a robotic arm equipped with sensors. "After maneuvering the InspectorBot into the structure using the Mother Ship, we used a camera along with lighting, lasers, a distance-measuring device, and a humidity sensor to document corrosion in the floor and sides of the test structure," said Cadet 1st Class Casey Keilbarth, a senior-level mechanical engineering major. "During our demonstration, everything worked smoothly except for a signal interference issue we had with the robotic arm on the InspectorBot."

Five university teams rose to the challenge of developing a system for corrosion inspection in difficult-to-access areas. Each team had to devise a system that would autonomously inspect and document inaccessible areas of a steel and aluminum structure, while also communicating information to an operator. On day one, the five teams presented an overview of their system designs before three judges. On the second day the teams were challenged to test their corrosion detection systems within a hitherto unseen structure riddled with various types of corrosion and defects. Besides the three winning teams, students from Texas A & M University and The University of Akron also participated.

A seven-person team from the U.S. Military Academy at West Point took second place for their design and maneuvering of a wheeled, tracked corrosion-inspection rover with a retractable arm. The team offered a solid performance during the demonstration phase, and experienced a few challenges. "Before the demonstration our camera died, so we outfitted an iPhone on the rover to do a video feed," said Pascal Brun, First Class Cadet majoring in Engineering Management. "With this work-around we sacrificed wall climbing capability for the ability to see what the rover might detect inside the structure."

A five-person team from Alfred University placed third for their manipulation of a four-rotor quad-copter equipped with cameras and sensors. "After looking at many possible multi-rotor remotely operated vehicle (ROV) technologies, we designed a quad-copter ROV that could fit comfortably in the test environment and have all additional sensors required to support our visual corrosion detection process," said Max Wilson, a senior majoring in mechanical engineering. "The design of the ducts was initially shaped to increase static thrust production, which theoretically increased flight time at low translational speeds. However, the motors themselves weren't performing as advertised, so this design had to be scrapped for a more generic, protective duct shape. Our major challenge was trying to control the ROV in a confined space, because once you're in a confined space, the air flow and turbulence are amplified significantly, conditions that typically make an ROV inoperable," Wilson explained.

Texas A & M University sent a six-person team to demonstrate a sophisticated robotic system equipped with corrosion-monitoring equipment consisting of a wireless camera, electrochemical probe, potentiostat, ultrasound probe, and computer tablet. The University of Akron (UA) was represented by four students from the Corrosion Squad. The team demonstrated a corrosion-monitoring device designed to detect and measure corrosion depth based on the Eddy current method, while also evaluating coating degradation using the electrochemical impedance technique.

"We hope that by participating in this competition, students gained a strong understanding of how their solutions to this challenge may translate directly to solving real-world problems," said Dan Dunmire, director of the DoD Corrosion Office. "The DoD is one of many sectors that will benefit from new and unique perspectives brought by university teams."

The University Student Design and Applied Solutions Competition has grown out of a strategic partnership between the DoD Corrosion Office and NACE International. In developing the event, both partners sought to solve problems faced by all military departments, which involve material degradation that can affect the readiness of weapon systems and facilities.

"In the years to come, we expect this competition to be transformative for all industries affected by corrosion," said Bob Chalker, CEO of NACE International. "No one has approached solutions to corrosion control in this way before, and we are already seeing inspiring new perspectives from the students in this year's competition."

"Because universities are now the principal source of scientific advancement that leads to new technology, DoD increasingly supports science and technology research within university engineering departments to solve specific challenges in the field," said Dunmire. "DoD benefits greatly from programs that challenge aspiring corrosion scientists and researchers to develop engineering and management skills before they earn undergraduate and graduate degrees."

http://science.dodlive.mil/2016/06/03/air-force-academy-cadets-take-top-prize-at-corrosion-detection-competition/?source=GovDelivery

NATIONAL AIR SPACE:

Amazon's Prime Air VP outlines proposed UAS airspace system

Questioned about when we can trust technology that enables the safe integration of unmanned aircraft systems (UAS) into the national airspace, Gur Kimchi asks people to think about whether they've ever been on an airliner landing in bad weather with limited visibility.

"We already trust automation every day in the world's worst conditions," said Kimchi, vice president of Amazon's Prime Air UAS package delivery project. "Why don't we trust it the rest of the time?"

As a keynote speaker at the Association for Unmanned Vehicle Systems International (AUVSI) annual conference and exposition, Kimchi provided a look at the approach Amazon has proposed to integrate small UAS into the national airspace below 500 feet. He described the concept as not only beneficial to Amazon, but also one that would enable the UAS industry to quickly implement an automated, integrated airspace.

After listing key UAS applications such as videography, photography, mapping and surveying, Kimchi noted, "What's important, though, is to have a model that's heterogeneous—it supports all these applications at once. It supports them from day one."

Kimchi proposes overlapping traffic areas managed by what he described as "federated controllers," a network similar to a cellular phone network.

"Your phone connects to your phone network. Your phone network talks to other phone networks connected to other phones.—they federate," he explained. "Your drones will connect to your controller. My drones will connect to my controller. These controllers will federate. They'll cooperate and communicate following standard protocols."

Just as cell phones and laptops can communicate with each other almost anywhere in the world, Kimchi said a UAS traffic management system using standardized protocols could work internationally.

"Regulators will have their own high-level controllers that have visibility and oversight over the airspace that they manage," Kimchi continued. "You don't have to manage the airspace as the regulator; you have visibility and oversight over it. You know what's happening at any given time. You can set controls. You can set policy."

The UAS traffic management concept Kimchi outlined includes a buffer from 400 feet to 500 feet between manned aircraft and small UAS. An air corridor between 200 and 400 would be reserved for high-speed UAS equipped with sense-and-avoid systems, permanent Internet communications and that met industry-established standards. The airspace from ground level to 200 feet would be used by local traffic including hobbyists and commercial operators.

Kimchi described examples of a high-speed drone descending to deliver a package. Drones operating below 200 feet would be notified and cleared out of the airspace until the delivery is completed. In similar fashion, an air ambulance helicopter would receive priority clearance when landing or taking off from an urban setting.

He emphasized that at some point, the airspace would get crowded, which is why he recommends a system designed from the beginning to scale with increased UAS traffic using proven technology.

"We want to enable safe integration of the low-altitude airspace," Kimchi said. "The concept of automated, federated traffic controls will build a scalable and robust capability. You really make it future-proof. The Internet doesn't require a big re-plumbing—it just keeps scaling. Telephone networks keep scaling because of their architecture."

He recommends testing the automated system in rural areas where its safety can be demonstrated.

"We don't have to reinvent the wheel," Kimchi said. "The only way this will work is by everybody speaking the same language. We need interoperable protocols, and they have to be global, just like your phone, just like your laptop."

ADS-B Extend Supplements ADS-B Network

Harris Corporation has introduced a comprehensive solution to increase the safety of drones and other commercial unmanned aircraft systems (UAS) flying at low altitudes in the U.S.

Harris' ADS-B Xtend service provides critical surveillance information to help UAS operators and airspace managers to increase safety of their operations by providing them with a real-time view of other aircraft flying at low altitudes under 500 feet.

Harris-ADS-B-tower-Xtend-WThe system supplements the FAA's existing ADS-B network, which provides precise and reliable satellite-based surveillance for the nation's air traffic control system. The solution features a networked, dual-band receiver and relay system that can be attached to existing structures or to mobile vehicles for roaming coverage.

ADS-B Xtend expands the benefits of the company's existing UAS situational awareness tool, Symphony RangeVue, which provides data for higher altitude flight traffic. Symphony RangeVue puts real-time FAA aircraft tracking data, flexible background maps and weather information in the hands of UAS operators through a web-hosted platform so they can make better informed decisions.

Data from networks of ADS-B Xtend relays is fused with all FAA system derived real-time aircraft surveillance data from more than 650 ADS-B ground stations with more than 425 FAA radar systems. This unique combination of local infrastructure and NAS surveillance data makes ADS-B Xtend a comprehensive situational awareness solution for the UAS market.

"Strategically deploying ADS-B Xtend receivers will close gaps in ADS-B coverage, significantly increasing the quality and quantity of data available UAS operators," said Ed Sayadian, president, Harris Mission Networks. "This will increase surveillance data available to UAS operators and enhance safety and efficiency. ADS-B Xtend is yet another step in our commitment to develop the most comprehensive surveillance airspace data set available."

Drone owners now outnumber planes and helicopters

The number of registered drone owners has surpassed the number of registered airplanes and helicopters, the Federal Aviation Administration says.

Almost 460,000 drone owners have registered with the FAA. Drone owners only have to register once, so it's likely there are far more unmanned aircraft, reports The Baltimore Sun.

The FAA's main aircraft data base includes about 315,000 planes and copters.

Just before Christmas in 2015, the FAA required any drone pilot or model aircraft owner with a vehicle weighing between 0.55 pounds and 55 pounds to register with the agency.

In Maryland there are 9,259 drone owners, according to The Sun.

By ZIP code, Pasadena, Maryland, has the greatest number of drone pilots, with 148. Many drone owners also live in southern Maryland and the Eastern Shore, where testing of the unmanned aircraft systems is centered.

Only 159 drone owners in Maryland registered as "non-hobbyist" users, in large part because codifying commercial use rules has lagged.

The Washington metropolitan area has the most stringent rules restricting drone usage.

Unmanned flights are forbidden within a 15-mile radius of Reagan National Airport, meaning it's illegal to operate a drone within the Beltway.

Between 15 and 30 miles, drones must weigh less than 55 pounds, fly below 400 feet within the pilot's line of sight, and steer clear of any airport by at least 5 miles.

http://wtop.com/tech/2016/05/faa-drones-now-outnumber-planes-helicopters/

NBAA Highlights Advantages of Integrating sUAS

With more than 2.5 million small unmanned aircraft systems (sUAS) operating in the U.S., and the FAA poised to release its new Part 107 rules governing commercial sUAS use, interest in the technology has never been higher.

To assist flight departments considering the use of sUAS within their operations, NBAA has released a new resource – Integrated Operational Management and Oversight for sUAS – providing background information on the subject matter, as well as a detailed guide to vetting sUAS service providers.

"Flight departments have the knowledge, they're very well-versed in safety management, operational risk assessment, a lot of the considerations that need to be made to end up with safe and responsible operations," said Terwilliger. "You need to understand the level of training your operators have to have, their experience level, what the repair and maintenance cost and efforts are going to be, where resources and knowledge can be found specific to what you're trying to do – manned aviators know that information and more importantly they know where to find it."

Integrated Operational Management and Oversight for sUAS provides examples of how flight department expertise can make the integration process smoother, including regulatory compliance experience, increased safety awareness and economy of scale benefits. It also contains a checklist of relevant factors to consider when choosing a sUAS service provider.

"This resource offers a starting point for flight departments exploring what sUAS can bring to their operation," said Sarah Wolf, NBAA senior manager, security and facilitation. "This technology has the potential to offer many benefits to business aviation, and NBAA wants to make sure operators begin the integration process with as much information as possible."

A growing number of businesses are exploring the use of small unmanned aircraft systems (sUAS) across their enterprise. With the recent advancement and accessibility of sUAS as tools to support business pursuits and services, desire for use by engineers, technicians, marketing personnel and other company employees continues to increase. However, such individuals may not have received the appropriate aviation training, certification or practical experience development to safely and effectively operate these platforms, in accordance with operational requirements.

As experienced professionals within aviation, flight departments are well-versed in ensuring compliance with such requirements, while also offering a wealth of knowledge, skills and abilities (KSAs) garnered from their extensive training and experience in this safety critical field. Integrating the responsibility for management and oversight of all sUAS operations in a company under a flight department can provide improved compliance, operational safety and effectiveness, standardization, economies of scale and collaborative benefit.

This resource – developed by NBAA's Business Aviation Management Committee – provides guidance for operators interested in adding sUAS to their operations. It contains background information on general aviation flight department preparedness for integrating drone technology as well as a detailed checklist of relevant factors to consider when selecting a service provider.

http://www.uasvision.com/2016/05/17/nbaa-highlights-advantages-of-integrating-suas/?utm_source=Newsletter&utm_campaign=fe64710917-RSS_EMAIL_CAMPAIGN&utm_medium=email&utm_term=0_799756aeb7-fe64710917-297560805

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Lead NASA UAS Traffic Management Researcher to ND, Continues Advancing the Integration of UAS into National Airspace

FARGO, N.D. – Senator John Hoeven today kicked off the second annual Drone Focus Conference in Fargo, a gathering of local, national and global leaders in the unmanned aerial systems (UAS) industry. Hoeven stressed North Dakota's many strengths that position the state as a prominent hub for UAS innovation and outlined the opportunities that the growing industry offers.

"For more than a decade, North Dakota has been positioning itself to be a leader in the UAS industry," Hoeven said. "Our efforts continue to pay off. Activities throughout the Red River Valley are advancing the integration of UAS into our national airspace and empowering businesses, from local startups to international corporations, to find new applications for this technology, whether it's improving agriculture operations, delivering goods to consumers, supporting law enforcement or securing our nation. We are making this happen right here in our state."

During his remarks, Hoeven introduced the conference's keynote speaker, Dr. John Cavolowsky from the Aeronautics Research Mission Directorate at the National Aeronautics and Space Administration (NASA). Dr. Cavolowsky is NASA's lead researcher in the development of unmanned traffic management systems and is attending today's conference at the senator's invitation.

Dr. Cavolowsky's visit to the state dovetails with Hoeven's ongoing work to support the integration of UAS into the national airspace. As a member of the Senate Appropriations Committee, Hoeven worked to secure funding and language supporting UAS research, development and operations at NASA, the Federal Aviation Administration (FAA), the Department of Defense (DoD) and other federal agencies in Fiscal Year (FY) 2017.

Hoeven also successfully included a provision in the 2016 FAA Re-authorization, which has been passed by the Senate, to extend the FAA UAS test site program through FY22. At the same time, the bill includes a second amendment offered by Hoeven and Senator Thad Cochran to strengthen existing UAS research programs. The legislation instructs the FAA Administrator to leverage to the maximum extent possible the capabilities of the Center of Excellence on UAS (COE), co-led by the University of North Dakota (UND), and the UAS test sites, including the Northern Plains Test Site, when establishing standards for UAS safety and certification of UAS aircraft.

These accomplishments stand as the senator's latest efforts to establish North Dakota as the northern hub for UAS technology research and development. Since his time as governor, Hoeven has successfully:

• Established the Center of Excellence for UAS Research, Education and Training at UND, the first collegiate degree program of its kind in the nation.

• Supported the establishment of and preserved UAS operations at Grand Forks Air Force Base, including the RQ-4 Global Hawk.

• Authorized the FAA UAS Test Site program and led efforts to secure Grand Forks' designation as one of the six national test sites.

• Funded the formation of and secured ongoing support for the UAS COE through the Senate Appropriations Committee.

• Helped secure an Enhanced Use Lease between Grand Forks County and the Air Force to develop the Grand Sky Business and Technology Park.

• Secured the first tenants for Grand Sky, including Northrop Grumman and General Atomics.

https://www.hoeven.senate.gov/news/news-releases/hoeven-kicks-off-second-annual-drone-focus-conference-

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PUBLIC SAFETY:

Wyvern Extends Safety Assessments to UAS

U.S.-based Wyvern has advised business aviation on safety best practices for more than two decades. It also now assesses vendor compliance with quality- and safety-management practices for end users of UAV services.

"They want to know when they're going out and sourcing these vendors—do they meet a certain benchmark? These are [vendors] that have no experience for the most part," said Wyvern CEO Art Dawley.

Until recently, there has been no regulation of commercial UAVs to help guide the industry, Dawley noted. But the situation will change in the U.S. once the Federal Aviation Administration (FAA) releases its Part 107 final regulation for small unmanned aircraft systems. At a minimum, vendors of UAV services will have to comply with the regulation to gain access to the airspace; to be successful as accredited operators they will need to implement proven safety management processes.

"This is the challenge," said Dawley, who spoke with AIN during the Xponential 2016 conference in New Orleans earlier this month. "We're not working with aviation providers, number one," he explained. "We found that in the acceptance, even the recognition, of these types of processes, most operators have no clue. Safety management is not even part of what they do. These are people who have never had to document and implement organizational policies, risk management processes—all these kinds of things."

At the Xponential conference, which is sponsored by the Association of (for) Unmanned Vehicle Systems International, Wyvern announced the launch of a safety assessment program for UAVs called EXACT, short for "Excellence through Assessment, Consistency and Training." It provides a certification process for UAV operators benchmarked from the International Civil Aviation Organization's Document 10019 Manual on Remotely Piloted Aircraft Systems. The goal of the program is to both help UAV consumers "make informed decisions" about the vendors they use, and measure vendors' "commitment to mitigate risk" in their operations.

EXACT "takes many of the processes that have become the focus of safety management for manned aircraft but recognizes and tailors to the unique challenges of unmanned operations," the company says. The program's UAV-specific standards and recommended practices address technical performance of operations from remote pilot stations, command and control datalink, support equipment, payload management and other areas.

RTI Forensics uses small drones for property insurance, casualty investigation, infrastructure inspection and other purposes. "We see the EXACT certification as a key differentiator for us to demonstrate our strong commitment to safety, quality and reliability, benchmarked against industry best practices," COOJeremy Reynolds stated in a press release.

Wyvern developed the EXACT program after hearing from its business aviation clients, including "big corporate groups" such as General Electric, Boeing Flight Services and Disney, Dawley said. Asked if these companies planned to use unmanned aircraft, he replied: "They already were; they already are." He observed that RTI's use of drones in forensic investigations represents one of the many applications of unmanned aircraft.

"You name it—entertainment, pipeline patrol, search and rescue, real estate, law enforcement, the list goes on and on," Dawley said. "The applications are never-ending."

http://www.uasvision.com/2016/05/26/wyvern-extends-safety-assessments-to-uas/?utm_source=Newsletter&utm_campaign=8fe7dc20fb-RSS_EMAIL_CAMPAIGN&utm_medium=email&utm_term=0_799756aeb7-8fe7dc20fb-297560805

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More Fire Departments Using UAVs, Despite Controversies

As firefighters braved the smoke and flames from the ground and rooftops, a small object soared above their heads Wednesday morning, trying to assist their efforts as a five-alarm fire ripped through a Santa Clara, California, strip mall.

The drone was sent up by the Santa Clara Fire Department volunteers to try to pinpoint how to best fight the blaze, which affected about a dozen small shops and restaurants in the Koreatown mall.

•11 States Sue Obama Administration Over Federal Transgender Directive

The use of drones by fire departments and police agencies has grown across the country from Connecticut to Spokane, Washington, though there are some controversies and hurdles surrounding their use.

"It's not a perfect application for every fire," Santa Clara Fire Chief Bill Kelly told NBC Bay Area. "But a view from that vantage point helps us figure out tactical methods, like where to put the hose stream."

Kelly said the quality of the hobbyist drone isn't all that great, and the video doesn't provide deep thermal images. "But it was useful today," he said. "It gives you a bird's eye view."

Santa Clara police began using an amateur drone a year ago, and nearby Menlo Park has been using them, too.

There are basically two types of drones — ones used by hobbyists and ones used by the military, explained CalFire spokeswoman Lynne Tolmachoff. And there are a few types in between, including commercial-style drones used for crop spraying and making movies.

CalFire does not own either of the types, she said. Rather, the state agency borrows U.S. Forest Service-owned, military-grade drones that can fly above 10,000 feet to document how large fires have spread, find hot spots and survey damage. The California National Guard in 2013 operated the MQ-1 "Predator" over the Rim Fire in Yosemite National Park to stream real-time video down to the command post.

At this point, CalFire is doing some research into whether a non-military-grade drone, which flies more directly over the scene, would be of practical use, Tolmachoff said, noting their use is gaining in popularity with local departments, such as Santa Clara.

While the images could be helpful, Tolmachoff said, there are challenges with using drones, too. The small aircraft can get in the way of large firefighting helicopters dousing the fires with buckets of water.

For example, a private drone hindered CalFire efforts in June 2014 as firefighters were fighting a fire in the Sierra Nevada foothills, and a hobby drone prevented CalFire from launching air tankers during the San Bernardino wildfire last July.

Coordinating between the drone and the helicopter — so that they don't crash into each other — would be a large effort. "One of those drones could bring down a chopper," Tolmachoff said.

Any kind of technology has advantages and disadvantages, said DroneLife.com editor-in-chief Frank Schroth, who nevertheless added that he is a staunch drone advocate.

Flying drones takes skill and practice, he said, and shouldn't be taken lightly, just as a driver wouldn't get behind the wheel without lessons and a license.

Schroth compared drones today to smart phones 15 years ago - there is a lot of room for growth and improvement.

http://www.nbcwashington.com/news/national-international/Use-of-Drones-Growing-in-Firefighting-Efforts-Use-Controversial-380842741.html

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Repairing gas leaks with the help of a robot

The century-old cast-iron pipe runs beneath one of the city's busiest streets, and like thousands of other service lines across Massachusetts, it's leaking potentially explosive and environmentally damaging natural gas.

Until recently, National Grid would have had to dig nearly 200 holes to plug the leaks beneath Berkeley Street in the Back Bay, months of tedious work that would have forced road closures, detours, and repeated service interruptions for residents living nearby.

Now, the utility company, which is repairing or replacing some 3,400 miles of mains and gas lines, has a new tool in its arsenal: a robot that can do the job about three times faster, without any need to turn off the gas.

Even better, the repairs require only a single hole in the ground, one small enough to keep the traffic flowing beside it.

"We don't need to do a major construction project that bothers a lot of people," said Walter Fromm, director of gas construction in New England for National Grid, one of the state's largest utilities.

The squat robotic machine uses lasers, cameras, and drills to seal joints. In one day, it can seal six leaky joints — the area where two pipes come together.

On Berkeley Street, a team of contractors has spent the past few weeks using the robot to methodically seal joints on a project that would have otherwise taken as long as six months.

Without the robot, National Grid would have had to dig a trench every 12 feet along the main, about 133 holes in all.

Next, they cut into the main, creating a valve to prevent gas from releasing, and fitted the opening with what is known as a launch tube.

Using joysticks, video cameras, and an array of computers, the crew guided the robot through the 24-inch main, spending about an hour on each joint and injecting a special sealant that should allow the line to remain in service without leaking for another 50 years, they said.

"It's very safe," said Eric Even, the team's leader, as he monitored the robot's progress. "You could put a match down there, and it would go right out."

One of the main benefits for utilities is that the robot lets them allocate their crews and resources elsewhere, said Nathan King, a spokesman at ULC Robotics, in Hauppauge, N.Y., which built and operates the 3-foot aluminum robot, known as CISBOT.

National Grid began testing the robot in 2010 and now uses it as much as it can to repair its aging network of lines, many of which have been leaking for decades.

Natural gas is mainly composed of methane, a greenhouse gas that's about 25 times more potent than carbon dioxide.

Repairing the lines also reduces safety risks — some leaks have caused explosions, including one that injured about a dozen people in Dorchester in 2014 — and saves ratepayers money. A 2013 federal study found that in Massachusetts, residents paid as much as $1.5 billion from 2000 to 2011 for gas that was lost to leaks.

In March, utility companies reported to the state that they had 16,596 gas line leaks as of December 2015, down from more than 20,000 leaks two years before.

National Grid, which owns pipes that account for more than half of the state's gas leaks, has committed $3 billion over the next five years to repair its mains and service lines, with the goal of replacing all of its leak-prone pipes in 20 years.

Since 2010, the company has replaced more than 650 miles of pipes, and it plans to replace another 845 miles over the next five years.

National Grid has the robot scheduled for jobs throughout the region this summer. Company officials said using it costs about three times less than sealing the leaks conventionally.

But ULC Robotics, which says it makes the only robots that repair leaks in gas mains, has only four of the machines, and the crews require extensive training.

The company plans to deploy more robots in the coming years.

As the Back Bay crew sat in their van on a recent afternoon, using the robot's drill to bore holes into the cast iron, traffic flowed along without a problem.

The project is scheduled to be completed sometime in early June, according to the company.

http://www.bostonglobe.com/metro/2016/05/29/repairing-gas-leaks-with-help-robot/nBaIm3Z2upw1s6smQR59yH/story.html?s_campaign=email_BG_TodaysHeadline&s_campaign=

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SENSORS/APPLICATIONS:

Quadcopter Outdoor Perching

A disaster site. A rainforest. A battlefield. These places have something in common: we have a need to understand what's going on where established infrastructure can't give us good data. Advances in computation, fabrication, and materials over the last half-century have resulted in small, cheap, and lightweight sensors that can provide us with these data; now the task is to find ways to deploy such sensors rapidly and effectively.

One way to do this is with small, agile aerial vehicles like quadrotors. Quadrotors are becoming affordable, ubiquitous platforms that can fly quickly over rugged terrain to collect critical data. There's a

catch, though: most small (less than 1 meter in diameter) quadrotors can only stay in the air for tens of minutes at a time, and this limited endurance makes some missions unachievable. However, if the goal is to collect data from a fixed vantage point, there is an alternative to hovering in place that might extend mission life from minutes to days or even longer: perching.

Perching allows a quadrotor to shut down its power-hungry motors and let its sensors get to work acquiring data over an extended period of time, tracking parameters like the stability of a building after an earthquake, the nocturnal activity of a jaguar, or enemy troop movements. While perched, the quadrotor can also happily continue to operate in weather conditions that would make flying impossible. At Stanford's Biomimetics and Dexterous Manipulation Laboratory, we have been working on perching with the goal of making landing on a wall as easy as landing on the ground. By adding a few grams of structure and mechanism to an off-the-shelf commercial quadrotor, we are now able to perch on both vertical and inverted surfaces without using any special firmware or flying techniques. While it's still not as foolproof as landing on a level surface, we are closer than ever to making perching accessible outside of a research environment.

Perching Drone

This solution originated when Hao Jiang, a graduate student in our lab, took a closer look at another recent result from our group, a perching/climbing robot I built called SCAMP, which uses a climbing mechanism mounted on top of the robot. Mounting the mechanism in this way meant that the thrust from the robot's rotors actively push the robot onto the wall during perching, assisting with the maneuver. By first impacting the wall with a rigid carbon fiber "tail," SCAMP creates a stable pivot point to transition from level flight to pitching up parallel with the surface.

SCAMP also used an on-board computational routine to detect impact and actively pitch the quadrotor into the surface. However, as Hao and I investigated this behavior, we realized that this active maneuver wasn't strictly necessary. If Hao could outfit the machine with a gripping system that was centrally located between all four rotors and hit the wall with a reasonable incoming velocity, the physics of the system should consistently lead to good contact with the surface.

To test out this new perching technique, Hao built a gripping system that, while unable to climb like SCAMP, has the advantage of being centrally located and capable of attaching to an inverted surface like a ceiling (a useful feature when you want to get your robot out of the rain). He then distilled the mechanical design of SCAMP into a simple tail structure that helps the robot engage with the wall. After some trial and error, Hao found that he could perch successfully by simply flying the quadrotor straight into the wall: as long as the quadrotor is moving at a reasonable pace and is pitched forward (usually the case when flying forward) and squared up with the target surface, the rotors reliably bring the mechanism into contact to engage the wall using an opposed grip.

This opposed grip strategy works by dragging two sets of microspines—hardened steel spikes on a special suspension— along a surface in opposite directions. The spines catch against tiny bumps and pits on the surface and hang on using friction. Pulling the opposed sets of spines against each other produces a tight grip that lets the quadrotor land not only on vertical walls, but also on angled or

overhanging surfaces. As Hao explains it, "the opposed-grip strategy for microspines is just like a human hand grasping a bottle of water, except that while humans require some macroscopic curvature to get our fingers around both sides of an object, the microspines can go deep into the micro-features of a rough surface and latch on those tiny bumps and pits." When the frequency of small bumps and pits is high, as with stucco or cinderblock, the grip is more reliable than on surfaces like polished concrete. Soon after perching on the wall, Hao started flying the quadrotor up into ceilings, and found that the inverted surfaces were often even easier to perch on because the quadrotor was already aligned to the surface in its normal flight configuration.

Once perched securely on a wall, Hao had to figure out how to enable the quadrotor to release and fly off. On an inverted surface, it was easy: a servo releases the spines and gravity does the rest. On a vertical surface, it took a little more thought to make sure the quadrotor would rotate away from the wall properly, since the thrust from the rotors tends to keep the robot tucked tightly against the surface. As Hao explains, the solution was to add some spines on the tail: "During take-off, as the mechanism is released and the quadrotor starts to fall, the microspines on the tail catch on bumps and pits [on the surface] again. The quadrotor then pivots on the tail spines backward away from the surface, and can fly away."

Speaking about challenges and future ways to address them, Hao says that, "even if the perching strategy is robust, the quadrotor can still fail to perch due to improper choices of target surfaces. While we have achieved robust perching failure detection and recovery for indoor environments, we will investigate failure recoveries for outdoor applications, possibly with wind disturbances and surface uncertainties." We are also interested in pursuing new gripping strategies and possibly combining microspines with dry adhesives to stick to a larger range of surfaces. We're excited by the recent advances in perching and are hoping to refine our approach even further, so that people can start putting sensors where they need them the most.

http://www.uasvision.com/2016/05/17/quadcopter-outdoor-perching-at-stanford/?utm_source=Newsletter&utm_campaign=fe64710917-RSS_EMAIL_CAMPAIGN&utm_medium=email&utm_term=0_799756aeb7-fe64710917-297560805

Come Fly With Me - UAS

On a breezy winter day in 1903, Orville Wright made the first controlled, powered and sustained heavier-than-air human flight in the world's first airplane near Kitty Hawk, N.C. In the century since, humans have adopted flight technologies to perform other firsts, like landing on the moon, breaking the sound barrier and making a vessel-to-vessel cookie delivery.

The Maersk Group did just that earlier this year to test the feasibility of using unmanned aerial systems (UAS) or vehicles (UAV), aka drones, to deliver small packages to vessels. Launched from the back deck of a barge, the Xamen Technologies-built LE 4-8X Dual octopod delivered across the fog-covered waters

off Kalundborg, Denmark, a 2.6-lb cookie payload 250 m (820 ft) to the Maersk Edgar tanker, where it hovered 5 m (16 ft) above the tanker's deck before dropping the sweet treats via a remotely activated switch.

The successful test was the first step in what the company sees as the future of deliveries to vessels of smaller packages that could cut time and trim costs. Other potential uses for UAS are developing rapidly, with the company seeing the technology as way to carry out inspections of challenging areas. The ability and versatility of UAS is not lost on other organizations that are adapting and adopting for their own use.

Airborne surveys

One such organization is the American Bureau of Shipping (ABS). As its employees survey many offshore assets, the organization wants to ensure that safety is at the forefront of their work day.

"Drones provide a safer environment for our surveyors to get up-close views of something not in a normally accessible area. They can do so with a video camera attached to the drone," said Jim Wolling, principal surveyor for ABS. "It also eliminates the need for the asset owner to provide another means of access such as staging the tank or providing some other temporary platform for the surveyor to use.

"The drones are being used to extend the reach of the surveyor. The surveyor will always be onsite and doing his visual examination. In many cases, the requirements are for the surveyor to do a visual examination of accessible locations. The use of drones might be used to increase the area that is considered accessible. In the future, consideration might be given to the use of drones as an alternative means of access to areas not readily accessible."

"Drones allow that assessment to be done, which may reveal whether or not repairs or action needs to be taken, so it would be a bit of a costly expense for an owner to provide access only for the surveyor to verify that, as it turns out, everything is OK," Wolling said. "Now the owner has incurred some additional time and expense just to satisfy ourselves and do a proper survey, so we eliminate that need.

"If the drone does indicate a condition exists that does need to be repaired, the owner can have a good idea of the scope of it and can plan for it accordingly, minimizing expenses and downtime."

"We can basically do most of the things that rope access does with a much smaller footprint," he said. "Sky-Futures has performed these inspections for five years globally, many of those in the North Sea and now the Gulf of Mexico and Far East. We can inspect in five days what it would take a rope access team to inspect in eight weeks, which is pretty astounding. We charge similar day rates, so that's where the efficiency and cost savings comes in."

James Bond, vice president of marine technology for ABS, added that the organization sees the use of drones as adding another tool for the surveyor to use in the inspection process.

"It's really providing an enhanced visibility. We have certain survey methods that are successful, and based on what surveyors are seeing on site, they can request a closer look at some areas. Having the

drone provide that capability rather than the need for the costly staging and so forth is where it's going to enhance the process."

Third-party operations

Working in tandem with a licensed pilot provided by a third-party UAS operator that holds the U.S. Federal Aviation Administration (FAA) Section 333 exemption, the surveyor can focus on the task of surveying.

"Our surveyors are there to take a look and understand what is there. We don't want them distracted by all the things that have to be thought about with flying the drone," Bond said. "We want a clear separation of the responsibilities, so we continue to do the job we need to do and do it well."

ABS is currently developing a set of guidelines to allow UAS operators to be certified by ABS as external specialists, Wolling noted.

"We're nearing completion of some guidelines that will allow UAS operators to be certified by ABS as external specialists. It's a series of guidelines in place for what's required to achieve the certification," he said. "To complement that, we'll also have instructions to our onsite surveyors on various aspects of use of the drones from safety to visual capability of the cameras and equipment."

To be clear, the drones used for surveying are not the run-of-the-mill variety one would find on the shelves of an online retailer like Amazon or a hobby store. These commercially rated drones are subject to regulation and require a private pilot license to operate per FAA guidelines.

"One important trait of commercial UAV is that they're stable in wind. For example, ours can fly in up to 29 knots of wind, with a battery time anywhere from 15 to 20 minutes. We limit our flights to about 10-minute intervals because we gather so much data during that 10 minutes that we just found that it's easier to break it off into 10-minute flights," Forte said.

He added that one of the best things about their drones is that it is equipped with three levels of autopilot and Intel processors that send 1,000 corrections a second to the drone's motors to keep it more stable in wind.

"When a gust of wind comes along, the UAV doesn't get shifted 5 m [16 ft] away; it gets shifted maybe 1 m to 2 m [3 ft to 6 ft], and then it corrects itself, with the GPS returning it right back where it's supposed to be," he said.

The recorded data are uploaded to the cloud and analyzed with Sky-Futures' proprietary software, where the client is able to access and share it, he added.

http://www.epmag.com/come-fly-me-850366#p=full

UAV Design Challenges: Game On

Imagine this: You go online, order a pair of shoes and have it delivered to your door in 30 minutes. But the delivery vehicle isn't a human driving a truck, car, or motorcycle. It's an unmanned aerial vehicle (UAV). Sounds like science fiction, but it is quickly becoming reality.

Amazon Prime Air is working to offer delivery services via UAVs, getting products to consumers faster. Image courtesy of Amazon.

Amazon Prime Air — the company's proposed package delivery service of the future, will deliver packages up to five pounds in 30 minutes or less using small drones. According to Amazon, the UAVs will fly under 400 ft. and take advantage of sophisticated "sense and avoid" technology, as well as a high degree of automation, to safely operate beyond the line of sight to distances of 10 miles or more.

According to market research conducted by the firm Tractica, drones are expected to grow in number from about 80,000 units today to nearly 2.7 million in 2025. They expect this surge in drone production and use could generate revenues of $8.2 billion annually.

For many design engineers, this is a whole new arena. Within it are components that make it go: highly engineered sensors that use wireless channels. Designers will test their innovation savvy by creating UAVs that meet the limitations of size, weight and power. Their efforts could mimic the ingenuity of Orville and Wilbur Wright as they pioneered flight, against the odds, over 100 years ago. However, design engineers face many challenges in the incorporation of sensors in UAV design.

SWAP: Size, Weight and Power

According to Raghvendra Cowlagi, assistant professor in the Aerospace Engineering Program at Worcester (MA) Polytechnic Institute, the main challenges are summarized in what is called SWAP: size, weight and power.

"Bulky sensors introduce undesirable aerodynamic drag," he says. "Heavy sensors can cause undesirable shifts in center of gravity location, which in turn can cause instability during flight, and call for expensive design modifications to produce additional lift to sustain the heavy sensors, or reduce the amount of fuel [or] size of batteries that can be carried — and consequently reduce duration of flight. Similarly, sensor power requirements directly and adversely affect the UAV flight time, because all power supplies, either batteries or fossil fuel engines, must obviously be carried on-board."

Dr. C. J. Reddy, vice president of Business Development for Electromagnetics at Altair, also sees SWAP as the pervasive challenge. "Most of the UAVs are usually much smaller than any other platform — fixed wing aircraft or rotorcrafts," he says. "And also [the] size of UAVs are decreasing to make them more viable for commercial use. This limits the real estate on the UAV to place different sensors. Weight of the sensor contributes to fuel consumption and power requirement adds to the battery power and size of the battery on-board."

Each UAV requires a multitude of sensors to provide operating feedback and collect in-flight data.

Another option is to build larger drones, such as the SB1 that SkyBridge UAS designed and is initially being used for precision agriculture applications. The SB1's fuel-injected engine and on-board generator provides up to 60W of electrical power for avionics and sensors, according to the company. At the Siemens PLM Connection conference last month, SkyBridge COO Ian Henderson said the multi-spectral infra-red sensors used in precision ag only account for about 2 lbs. of payload, leaving an additional 20 lbs. of payload that can be used for other sensors. SkyBridge engineers used Siemens PLM Software's Solid Edge to design the SB1 to accept pods of different sensors so it can be easily adapted for different uses.

Connectivity poses another set of challenges. The wireless channels by which UAVs operate can be a limiting factor when deploying them.

According to Derek Campbell, a senior applications engineer at Altair, wireless connectivity is rapidly expanding in both popularity and potential, and will be useful in connecting with UAVs and their sensors via antenna arrays.

"Incorporating antenna arrays on both ends of the wireless channel realizes this potential by facilitating beam steering and increased directivity. From an operations vantage point, these capabilities reduce transmit power, increase data rates and extend communication range," says Campbell. "Antenna arrays also facilitate forming nulls toward antagonistic regions to hide information and thwart easily accessible jamming devices."

Campbell adds that these performance characteristics of antenna arrays address several critically important challenges for UAV operation. Maintaining wireless communication channels over extended ranges that can potentially cross into antagonistic regions helps accomplish precise, adaptable mission objectives. In addition, efficiently utilizing power, a scarce commodity often drawn from solar panels, facilitates extended flight duration's. Finally, the reduced transmit power also reduces the aircraft weight that can further extend flight duration.

Integration and High Performance

"There are many performance benefits to integrating common circuits and sensors on monolithic ICs (integrated circuits)," he says. "For example, devices can often achieve better symmetry — not pulling units from different wafer lots, smaller parasitic effects on performance due to elimination of extra connections and wire bonds. There can also be optimization of trimming and calibration by devices being integrated and on-chip rather than discretely connected."

Winkler adds that the greatest impact of integration comes from improved cost structures and reduced component size. The ability to shrink devices and place them into smaller form factors, with lower weight, is critical to SWAP and expanding their reach and growth.

According to Phil Solis, research director of Semiconductors and Strategic Technologies at ABI Research, sensor designs and overall UAV design will be ramping up to meet the demands of high performing UAVs. He predicts that you will see more semiconductor vendors doing what Qualcomm did – reworking

smartphone-integrated platforms and sensor hubs to be used for UAVs as well as other robotic products.

"These markets are experiencing explosive growth with new applications rapidly appearing at a break-neck pace," says Winkler. "Consider that drones and UAVs will replace many functions that humans perform today – and doing them more reliably and ideally more safely: Delivery of medical supplies, surveying and monitoring in remote hazardous locations and law enforcement to name a few."

http://www.deskeng.com/de/uav-design-challenges-game-on/

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GPS Anti-Jam (GAJT) On Board UAV

NovAtel's compact GAJT anti-jam antenna is now on-board the CAMCOPTER S-100 Unmanned Air System (UAS) from Austrian manufacturer Schiebel.

According to NovAtel, Schiebel was evaluating NovAtel's GAJT antenna in 2015 as an option for its CAMCOPTER S-100 when the company received an urgent call from a customer with an immediate operations requirement to combat GPS jamming. The commercial-off-the-shelf (COTS) GAJT antenna allowed NovAtel to quickly supply Schiebel with the requested anti-jam capabilities, which in turn was able to rapidly deploy the strategically equipped CAMCOPTER for its customer.

Peter Soar, business development manager for NovAtel's Military and Defense group says, "Every once in a while, timing is on your side. The opportunity to prove our ability to meet urgent supply requests, followed by demonstration of our antenna capabilities in real conditions, has allowed us to positively impact the success of our customer's business."

GAJT is a null-forming antenna system that renders GPS receivers more robust by rejecting signals from the direction of a jammer and only receiving signals from satellites not experiencing interference. It can be integrated into new platforms or retrofitted with the existing GPS receivers and navigation systems on existing and legacy military fleets.

Schiebel's CAMCOPTER S-100 UAS is a vertical takeoff and landing (VTOL) unmanned aerial vehicle (UAV) that does not require a prepared area or supporting launch or recovery equipment. It operates during daytime and at night, under adverse weather conditions, with a beyond line-of-sight capability out to 200 kilometers. The S-100 navigates via preprogrammed GPS way-points or is operated with a pilot control unit. Using "fly-by-wire" technology controlled by a triple-redundant flight computer, the UAV can complete its mission automatically.

http://www.insidegnss.com/node/4996

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COUNTER UAS:

British Counter-UAV Technology (AUDS) Selected by FAA for US Airport Trials

AUDS to be Tested by Federal Aviation Administration (FAA) as Part of the Agency's Pathfinder Program to Detect and Identify Unmanned Aircraft Systems (UAS) Flying too Close to US Airports

The world's first fully integrated detect-track-disrupt-defeat Anti-UAV Defence System (AUDS) - developed by a trio of British companies including Blighter Surveillance Systems, Chess Dynamics and Enterprise Control Systems, and integrated/supported in North America by Liteye Systems Inc. - has been selected by the United States Federal Aviation Administration (FAA) for evaluation at US airports as part of its Pathfinder Program.

This FAA research program is designed to evaluate technologies that can be used to detect and identify unauthorized unmanned aerial vehicles (UAVs) or drone flights near airports. To this end, the FAA has signed a Co-operative Research and Development Agreement (CRDA) with Liteye Systems, the AUDS team's manufacturing and integration partner in North America, to test AUDS at US airports selected by the FAA. (See FAA release - https://www.faa.gov/news/updates/?newsId=85532)

According to the FAA, each month it receives more than 100 reports from pilots and others who spot what appear to be unmanned aircraft flying too close to an airport or manned airplane. It has become a serious safety concern for the agency and a potential security issue for the Department of Homeland Security (DHS).

Mark Radford, speaking for the AUDS team, said, "We are delighted to have been selected for this strategic counter-UAS programme through Liteye. The FAA contacted our team following the success of AUDS at US Government sponsored counter UAV trials at the end of 2015. These trials confirmed that our production system was able to detect, track, disrupt and defeat a wide range of micro, mini and larger unmanned aerial vehicles (UAV) or drones - even on unscripted sorties."

The AUDS counter-UAV system can detect a drone six miles (10km) away using electronic scanning radar, track it using precision infrared and daylight cameras and specialist video tracking software before disrupting the flight using an inhibitor to block the radio signals that control it. This detect, track, disrupt, defeat process is very quick and typically takes 8-15 secs. The AUDS team has now carried out over 400 hours of 'live' testing in government related trials against more than 400 flown sorties of group 1 UAVs.

"The system can also assist airport authorities to track down the UAV pilots for prosecution by providing evidence (video footage or radar tracks) to the relevant authorities. We can also integrate 'friendly' assets' into the AUDS platform - for example a 'friendly' drone - to extend the threat detection and situational awareness capabilities of the system and to help capture rogue drone pilots."

The Anti-UAV Defense System (AUDS) integrates the Blighter Surveillance Systems' A400 Series Ku band electronic scanning air security radar, Chess Dynamics' stabilised electro-optic director, infrared and daylight cameras and target tracking software, and a directional radio frequency (RF) inhibitor from Enterprise Control Systems to detect, track, classify, disrupt and defeat UAVs at ranges of up to 10km.

The AUDS system is even effective against so-called Group 1 micro UAVs at ranges of up to 2km and Group 1 mini UAVs at ranges of several kms.

The AUDS system is designed for countering drones or remotely piloted aircraft systems (RPAS) in remote border areas, at key infrastructure sites such as airports, air fields, nuclear power stations, oil refineries or for protecting political or sporting events in urban areas. It can be operated from fixed locations and from mobile platforms.

A promotional video of the AUDS system can be seen here:

https://www.youtube.com/watch?v=P8aZ0zWX3SA

http://www.prnewswire.com/news-releases/british-counter-uav-technology-auds-selected-by-faa-for-us-airport-trials-581349641.html

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DroneDefender and Dronebuster - anti-drone technology

The more drones enter our lives, the louder the calls for anti-drone technology. At the recent US Navy League Sea Air Space Exposition two companies showcased their very promising solutions to this problem.

One is the DroneDefender from nonprofit research and development organization. DroneDefender carries two punches with two triggers. One jams the signal from a the drone's command and control systems, thereby preventing the remote operator from controlling the drone. The other trigger disrupts the drone's GPS or GLONASS autonomous guidance system, making it unable to get wherever it was headed.

DroneDefender looks like a futuristic shotgun, but this backpack-powered gun shoots nothing but "directed RF energy" in the Industrial, Scientific and Medical (ISM) bands or global positioning bands. With a 400m range and an optical sight it's a real nonlethal drone killer.

The other hot item at the expo was the Dronebuster from Flex Force. The California-based company set out to create a drone-disabling tool for law enforcement and first responders after "drones interfered with with firefighters in California last year," Ars Technica reports. And it's already doing the job it was created for.

Several federal agencies are already trialing the Dronebuster, which works like the DroneDefender by jamming the signal used to control the drone. The major difference is that the Dronebuster is significantly smaller, making it easier to use out in the field.

Dronebuster can be aimed with an optical sight like the DroneDefender, but also comes with an integrated radio frequency power meter and signal analyzer. Someone trained on the device can apparently distinguish the type of signal the drone is emitting – whether telemetry or control.

Sky nets: the new anti-drone defense system

In the early hours of January 2015, a drone crashed on the lawn of the White House causing a major panic. In July, a drone dropped a package of marijuana and heroin into the yard of a prison in Ohio. In January 2016, UK airline pilots called for action after four near misses between drones and aeroplanes at Heathrow and other airports.

Drones are no longer just toys. They're a serious hazard and a tool for criminals and terrorists.

As always, surveillance is the first layer of defense. The DroneShield sensor system, used to patrol the 2015 Boston marathon, listens for a drone's tell-tale buzz, alerting authorities to its location and even its make.

But once you detect a drone, how do you take it down?

Blasting it out of the sky is not a good idea if it's above a crowded city street or sports stadium. UK company Enterprise Control Systems is working on technology to jam the radio-frequencies used to control the drones. The idea is to set up a drone-free perimeter around public events or sensitive zones.

Another option is to use an anti-drone drone. Enter the "robotic falcon" developed at Michigan Technological University. This predatory unmanned aerial vehicle (UAV) captures its prey in air-to-air combat by firing a net. With a casting range of 12 meters, the challenge is to swoop in close enough to the target.

Of the anti-drone systems that are close to being ready for market, the most polished is SkyWall, says Pounds. Developed by UK-based OpenWorks Engineering, this net-gun bazooka uses a gas-powered launcher fired from the shoulder to blast a net at a drone up to 100 meters away. It delivers it safely to earth via parachute.

Net-guns have been used to take down drones before but what distinguishes SkyWall is the smart technology embedded within the launcher and the projectile.

First off, the operator sights the target down a digitally augmented scope. A laser system keeps tabs on the target's range, while an on-board movement detector, like the one that tells your smartphone to reorient its display when you flip it, monitors the orientation of the launcher, feeding these data into the SkyWall's on-board computer. The computer calculates the ideal trajectory of the net-loaded projectile, including corrections such as firing a little ahead of a moving target.

Once a drone is spotted, auto-aim kicks in. Levers within the launcher activate to adjust its bearing, helping the operator achieve a perfect shot.

Range information is also fed into the projectile's control circuits so it knows how far to fly before deploying its net.

Compared with net-guns that open immediately on firing, this smart opening system extends the range by about tenfold. When the target is locked on, the SkyWall emits a beep – the signal to pull the trigger. The projectile is gas-powered so it fires without a frightening bang that might scare a crowd.

Besides the mobile, shoulder-mounted version, SkyWall offers a semi-permanent installation that has an increased range. It can be set up at key locations to protect the entire area of a major event.

SkyWall's most powerful offering is a permanent anti-drone defense unit for the most sensitive locations – airports, prison walls or the White House. It can be remotely operated from a control room and its semi-automatic design means it can reload itself with projectiles.

The quicker it reloads, the better. Pounds predicts that with drones getting cheaper, criminals will likely try to overwhelm defense systems by flying groups of drones. "They can't catch them all."

The anti-drone arms race is on.

The SmartScope scans the field of view for drones, then displays the distance to the target as measured by lasers.

Auto-aim

On-board levers adjust the way the launcher is pointing, to make sure of a direct hit. This auto-aim also takes account of gravity drop and how far to aim in front of a moving target.

Intelligent projectile

As the trigger is pulled, distance data is loaded into the projectile, telling it how far to fly before opening its net.

Net and parachute

After the net envelops the target, the projectile fires its parachute to bring it safely to earth. The target drone can now be recovered and examined for forensic evidence.

https://cosmosmagazine.com/technology/sky-nets-new-anti-drone-defence-system

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COMMENTARY:

Should You Be Allowed to Prevent Drones From Flying Over Your Property?

Two legal experts debate who has the right to decide when and where drones can fly

Rising commercial and personal use of drones is raising tough legal questions about where and when they should be allowed to fly.

Drone use across the U.S. is soaring, and the skies may soon get even more crowded, as the Federal Aviation Administration expects sales of these unmanned aerial vehicles to jump to seven million in 2020 from about 2.5 million this year.

Interest in drones for both commercial and casual purposes is raising not only safety and privacy concerns, but also thorny legal questions about where and when drones should be allowed to fly—and who gets to decide.

On one side are those who say property owners' rights generally extend up about 500 feet, which gives them the right to prevent drones from flying or hovering over their land. They say drones pose a much bigger threat to security and privacy than jets and airplanes, which travel at higher altitudes, in airspace regulated by the FAA.

Others aren't so sure. They say drones represent the next frontier in aviation, and as such, decisions about where and when they can fly should be made collectively, not by landowners through tort law. Commercial air travel never would have flourished, they say, had individuals been allowed to sue anyone who flew over their property without permission.

A. Michael Froomkin, the Laurie Silvers and Mitchell Rubenstein distinguished professor of law at the University of Miami School of Law, says that drones pose a huge threat to security and privacy, and that property owners should be able to keep them from flying over their land. Ryan Calo, an assistant professor of law at the University of Washington, says decisions about where and when drones can fly should be made collectively, not by individual landowners.

YES: Our Privacy and Safety Are at Risk By A. Michael Froomkin

Drones don't have, and shouldn't be given, a legal right to fly over private property in defiance of the wishes of the landowner. Such overflights threaten privacy and safety, and destroy Fourth Amendment rights.

Just as homeowners have a horizontal curtilage in which property rights extend to include the grounds and buildings that immediately surround a home, homeowners have—or ought to have—a vertical curtilage. Property rights in the curtilage include the right to sell the land and, crucially, the right to exclude others. Before airplanes, the right to exclude went up indefinitely; now it usually ends at 500 feet, where navigable airspace managed by the FAA begins. Lowering it any further, however, would be a big mistake.

We asked readers on social networks if one should be allowed to prevent drones from flying over one's property. Here's what we heard.

Today, if someone flies a drone over your land below the FAA's reserved airspace, the drone operator is, quite simply, trespassing in the same way as if the operator ran through your backyard. That trespass matters because drones can carry surveillance gear, and can be operated from long distances or fly autonomously. Drones can film, record sounds or listen in on Wi-Fi and other signals, and no fence is high enough to keep them out.

Today, camera-wielding drones can peer in through windows and skylights even from great height; increasingly sophisticated sensors on the drawing board promise even greater surveillance power. In a country where there may be seven million drones flying by 2020, giving them free rein to fly or even hover over private property would be enormously destructive to everyone's privacy.

Limitless low-level overflights mean you could be spied on by anyone with a few hundred dollars and a voyeuristic streak. In this, drones differ radically from the jets and satellites for which we previously changed the property rules that once made high-altitude overflights a trespass; jets and satellites can take high-resolution photos, but they don't hover and are rare and expensive. Also, when we made that change—about 90 years ago—neither cameras nor aircraft could cause anything near the privacy risk drones pose today.

Removing or reducing the vertical curtilage would have another serious consequence: Police likely wouldn't need a warrant to run drone surveillance anywhere they want. Generally the government needs a warrant to intrude on private property but doesn't need one to conduct surveillance from public places—including what the Supreme Court has called "public navigable airspace." If we reclassify the airspace above property as accessible to private drones, that likely takes the warrant requirement along with it. Cheap, continuous drone surveillance might make the Fourth Amendment almost irrelevant.

We should ignore claims that the needs of progress require that we allow drone overflights so that Americans can enjoy home delivery via TacoCopter or, more likely, by the Amazon Prime Drone. If the delivery is to you, we'll treat that as implied consent, just as we do with United Parcel Service. UPS -0.16 % Otherwise, GPS-enabled drones can fly above public roads in regulated traffic layers. They don't need to fly over private property.

Delivery firms convinced their drones need shortcuts can buy the right: micropayments and mapping technology make putting together flight paths feasible (perhaps we can charge drones more when we are sunbathing?). Firms like Amazon might make allowing overflights a condition of their Prime service and turn their network of shortcuts into a competitive advantage. At least we'll know who is up there.

At this time, drone overflight rights aren't an open question. There is a relevant body of law that gives the power to property owners, and the case for changing the rule via legislation is weak.

If we give drones overflight rights, every time you see one in the air you will have reason to fear it may be spying on you or could crash. And let's not even talk about armed drones.

NO: It Is the Way to Kill Innovation By Ryan Calo

The year is 1910. Orville and Wilbur Wright are testing their plane and happen to fly hundreds of feet over a stretch of land you own. Could you sue them?

Technically, you could. In 1910, your property rights extended ad coelum et ad inferos—up to heaven and down to hell. Anyone who flew over your property without permission was trespassing.

As the fledgling aviation industry began to take off, the U.S. had the foresight to adjust its laws and norms accordingly. Eventually, property owners' airspace rights were limited to what they could reasonably use, and the area above 500 feet or so became navigable airspace, regulated by the federal government. Today, pilots and airlines contend with the FAA, not individual property owners, in planning when and where to fly.

Drones represent the next frontier in aviation, and ultimately we may come to view the technology as an indispensable mode of transportation in much the same way we view commercial air travel today. For that reason, decisions about where and when drones can travel should be made collectively through thoughtful limits, not individually through tort law or self-help.

There will be no end to the uses Americans dream up for drones once we solve the difficult problems of energy storage and autonomous flight. Companies want to use drones to revolutionize the way they deliver goods to offices and homes. Journalists want to use drones to cover breaking news, or to access spaces denied to them by local officials. Activists want to use them to hold police accountable during a protest. Police have used them to locate a missing child.

While we could require today's pioneers to run every use by every property owner in town, there are several reasons why that is a bad idea.

First, it would be terribly inefficient. Even with innovative tools like AirMap, which provides an easy way for drone operators to determine if a particular airspace is legally navigable, few have the time or resources to secure every property owner's permission. Functionally, an opt-in system amounts to a permanent ban, foreclosing any young entrepreneur's plans to do something innovative and useful with a drone.

Second, there will be holdouts. No doubt there are property holders with sincere objections to drone delivery. But not all holdouts would be sympathetic ones. Why would an energy, pharmaceutical or agricultural company permit an activist or journalist to fly over its property in search of abuses?

Those who believe property owners have a right to prevent drone overflights often cite concerns about privacy and safety. I agree that privacy is a crucial issue when it comes to drones—and as I've testified before the U.S. Senate, we need to do more to ensure that privacy laws keep up with the technology. No one expects you to suffer a drone hovering over your backyard watching you sunbathe or waking you up at 3 a.m. on its way to deliver a six-pack to a graduate student. And if a drone damages your property or injures your person, there ought to be—and already is—legal recourse.

Indeed, government and industry already are starting to work through some of these issues. Companies such as Amazon.com Inc. and Google (a unit of Alphabet Inc.) are working with the National Aeronautics

and Space Administration to create an air-traffic-control system for drones; they also have to demonstrate to the FAA that their technology is safe.

We can and should set sensible requirements and terms for drone use, with input from all stakeholders. We should be cognizant of the trade-offs.

But what makes sense is for us to act collectively. To leave the future of drones to individual homeowners is inefficient and unwise. "Keep off my lawn" is no way to manage what we may soon come to see as an integral component of our delivery infrastructure.

Sometimes the answer is the statute or the regulation, not the lawsuit or the shotgun.

Prof. Calo is an assistant professor of law at the University of Washington. He can be reached at reports@wsj.com

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Surveillance technology has advanced far beyond the laws that govern it

Last week, we filmed our second episode of Ars Technica Live in Oakland, California, and we had a tremendously interesting conversation with UC Davis law professor Elizabeth Joh, who researches surveillance technology and policing. Right out of the gate, Joh made it clear that the problem isn't surveillance per se—governments "need surveillance," she said, to figure out what its citizens require in terms of benefits, help, and security. The problem is when this surveillance becomes invasive, and the government inhibits freedom of expression and punishes unconventional behavior. How do we balance the need for surveillance and the need for free expression and privacy in a democratic society?

Joh talked a lot about the future legal landscape we're creating with cutting-edge technologies like self-driving cars, facial recognition, and body cams. When you're talking about law and policy, the issue is always that adoption of devices like body cams tends to precede careful thought about what rules will govern them. After the Ferguson protests, for example, police departments started using body cams as an accountability measure. But there are no federal guidelines for how cops will use these cams. Will they be able to turn them off whenever they want? Who has access to the data they collect? Can they use facial recognition in body cams? All of these questions remain unanswered, yet body cams are in widespread use across the US.

A similar problem dogs our use of DNA databases, Joh explained. The US government gives states financial incentives to develop databases and biological sample libraries with the DNA of everyone who gets arrested. These aren't convicts, mind you—just anyone who gets arrested, regardless of whether they were released the next day or found guilty of a felony. Again, the question here is how to regulate these databases, as well as other digital databases full of our "information microbiome." The key, Joh argued, isn't going to be found in the courts or Congress. Instead, "public vigilance" is the only social force that moves fast enough to push government to behave responsibly with new surveillance technologies.

Of course, public vigilance is only as good as public information, and if the public doesn't know what data law enforcement has, we can't push for better rules. That's why the rise of private security forces is so troubling. Joh estimated that private security forces, from guards at 7-11 to "Target's private crime lab," are 3-5 times larger than public forces. And they are not regulated by government in any way, which means that it's impossible for the public to know what kinds of data private forces are gathering.

In the question and answer period, Joh talked about the future of surveillance tech in the US. Though self-driving cars may be great for safety, they will also log everywhere you go. Who will have access to all the information generated by these cars? She also believes very strongly that robots will become a key part of law enforcement, whether via surveillance drones or actual Robocop-style police officers who arrest people. She's also very concerned about "predictive policing," or using algorithms to predict where crimes will happen and who is likely to be involved in them. The idea of "pre crime police" is straight out of a Philip K. Dick science fiction story, but it's not far from reality at this point.

Watch the whole video for more of her insights and to find out what law enforcement will look like ten years from now, when your car tracks your every move and robots swoop down from the sky to prevent you from smoking a joint in the park.

http://arstechnica.com/tech-policy/2016/05/surveillance-technology-has-advanced-far-beyond-the-laws-that-govern-it/

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The Drone War Crosses Another Line

America took an unprecedented step over the weekend when Obama authorized the Pentagon rather than the CIA to carry out an airstrike inside Pakistan.

Following the death of Taliban leader Mullah Akhtar Muhammad Mansour in an American drone strike in Pakistan on Saturday, U.S. Secretary of State John Kerry remarked that "Peace is what we want" in Afghanistan. "Mansour," he said, "was a threat to that effort." Confirming Mansour's death on Monday, President Barack Obama said the Taliban's chief, who had held the position officially for less than a year, had "rejected efforts by the Afghan government to seriously engage in peace talks and end the violence that has taken the lives of countless innocent Afghan men, women and children."

The strike that killed Mansour crossed numerous lines that have constrained America's fight with the Taliban, and its drone war in Pakistan, up to this point. It was remarkable for its location and timing, as well as the public acknowledgment that accompanied it. Mansour was reportedly killed while traveling in Pakistan's Baluchistan province, where much of the Taliban's leadership has been based since being driven out of Afghanistan following the U.S. invasion in 2001. Yet despite the well-publicized Taliban presence there—the group's leadership council, the Quetta Shura, is named after the province's capital city—the U.S. drone war in Pakistan hadn't targeted the insurgent leadership at its home base prior to Saturday. It has stuck to alleged militants in safe havens in the tribal areas farther north. As Bill Roggio noted in Long War Journal over the weekend, "A strike in Baluchistan is unprecedented."

Even in the tribal areas, the American drone campaign in Pakistan has been decelerating in recent years as the Obama administration has sought to facilitate peace talks between the Taliban and the Afghan government. Kerry and Obama both suggested that Mansour's death could remove an obstacle to those talks; as Ali Latifi and Shashank Bengali noted in The Los Angeles Times, Mansour, having earlier signaled support for reconciliation, "presided over a resurgence of the Taliban's fighting capabilities and made a public statement last year calling for 'jihad until we bring Islamic rule' to Afghanistan."

And Saturday's strike was carried out not by the CIA, which runs and doesn't acknowledge the U.S. drone campaign in Pakistan, but by the military—which means that unlike the supposedly covert strikes carried out by the intelligence agency, this one was publicized by the Pentagon spokesman, on Twitter. And it means that, like the 2011 commando raid into Pakistan that killed al-Qaeda leader Osama bin Laden, Saturday's strike involved public celebration of an attack in a country with which the United States is not, technically, at war—and which, in theory, is an ally in the war on terrorism.

Meanwhile, America's longest war continues over the border, and as American troops have changed their focus to support and counterterrorism after declaring an official end to combat operations in 2014, the sides in Afghanistan's civil war are fracturing. "Pro-government" forces sometimes fight each other. The Wall Street Journal reported over the weekend, citing Afghan and U.S. officials, that the Afghan government is paying one faction of the Taliban in order to exacerbate divisions within that group. (Though spokesmen for the U.S. military and the Afghan government, as well as a commander of the Taliban faction allegedly receiving support, all denied this to the newspaper.)

It was the chaos of a multi-sided civil war that brought the Taliban to power in Afghanistan to begin with. Those divisions were prominent when Mansour officially took the helm of the movement a year ago, after the announcement that Mullah Mohammed Omar, the Taliban leader, had died two years earlier—news that sparked a succession struggle. Though some Taliban figures may prove more receptive to negotiation than Mansour did, it doesn't necessarily follow that his death will be a force for peace in Afghanistan, especially if there's a new succession struggle or if the next leader proves unable to enforce cohesion within the movement. (Indeed, one possible successor, is Mansour's former deputy Sirajuddin Haqqani, who is opposed to talks.)

At the same time, research on duration of civil wars suggests that the more sides there are in a conflict, the more difficult it is to end. David E. Cunningham, an associate professor in the Department of Government and Politics at the University of Maryland, has found that "civil wars last longer, and are more resistant to negotiated agreement, when they contain more actors who can block settlement."

It was the chaos of a multi-sided civil war that brought the Taliban to power in Afghanistan to begin with. The United States and Saudi Arabia, via Pakistan, funded, armed, and helped train the groups of fighters that drove the Soviet Union from Afghanistan in the 1980s; in the 1990s, with no particular group strong enough to impose its will on the others or the rest of the country, but several plenty strong enough to help destroy Afghanistan, they turned their weapons on each other. As America tries to conclude its 15-year military engagement in Afghanistan, American leaders appear to be betting on splintering the insurgency even as they inadvertently sow divisions on the pro-government side through

the liberal distribution of arms and cash. The risk is leaving behind another fractured battlefield of independent armed groups like the ones that stoked so much misery in Afghanistan two decades ago. Except that this time, the sides have more money and better weapons.

http://www.defenseone.com/threats/2016/05/drone-war-crosses-another-line/128534/

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The Future of Sea-Air Drones and Protecting Maritime Assets

What are some of the ways the U.S. and other countries could defend maritime assets against swarms of Sea-Air drones? Consider a convoy system with human centered technology, algorithms from nature, and elements of gaming.

The FAA estimated that one million drones would be sold during this 2015 holiday season. This estimate was based primarily on the proliferation of flying drones, however new domains of operation may open up soon. Premiering in 2015, the Loon Copter proves that, in time, these devices will be capable of traditional aerial flight, on-water surface operations, and sub-aquatic diving. Embedded Systems Research at Oakland University created the Loon Copter in 2014. In 2016, the design placed third in the UAE Drones for Good competition. The system works in air as well as in water because the four rotors balance and cut through air and water equally well.

According to the New America Foundation, at least 19 countries possessed or were acquiring armed drone technology as of 2015. The Washington Post and The Aviationist reported in July of 2014 that even non-state actors like Hamas have manufactured drones capable of firing rockets or missiles. At the time of reporting it was unknown whether this specific group had the ability to launch missiles, but the story does show the willingness of non-state actors to weaponize technology. The same Washington Post article describes how low-tech "suicide" drones effectively function as guided missiles. With the history of state actors increasingly acquiring armed drones and non-state actors weaponizing drones, Sea-Air drones could open new realms of battlespace.

"The profound influence of sea commerce upon the wealth and strength of countries was clearly seen long before the true principles which governed its growth and prosperity were detected." –Alfred Thayer Mahan

Sea-Air drones are not currently available off the shelf, so their ramifications are not yet recognized. If non-state or state actors designed suicide drones with sufficient range, it would be very difficult to defend global maritime trade against these threats due to the sheer size of the oceans. The Canadian Military Journal hypothesized that it is only a matter of time before pirates use drones offensively. Articles like these contemplate an important issue, but are limited by only considering the skies. Currently, our ability to detect air drones far exceeds capabilities to detect devices beneath the surface of the ocean. Even by diving ten or fifteen meters beneath the surface, Sea-Air drones may be able to elude satellites. NASA's Ocean surface topography site describes how the best satellites measuring ocean temperature pierce only one inch below the ocean's surface.

Shrouded by shadowy depths, would-be aggressors could potentially take down or ransom large freight vessels and trade flows that are so essential to many countries' survival. According to Rose George in "Ninety Percent of Everything," nearly 90% of goods are transported by sea. The stakes are high and the arena is huge. While it's unlikely that every inch of the sea will become a combat zone, NOAA estimates that there are nearly 321,003,271 cubic miles of water in the world's oceans. To this end, DARPA is re-thinking distributed defense by creating small aircraft carrier cooperatives. In the face of such a large and deep strategic chessboard, what are some of the ways the U.S. and other maritime nations could defend shipping from Sea-Air Drones? One option would be to revive the convoy system. The tipping point for such a decision may have to unfortunately be a tragedy with lives lost at sea. By contemplating these scenarios now, we could build in defenses before deaths occur.

"When [the enemy] concentrates, prepare against him." –Sun Tzu

The cost of drone technology, like other innovations, continues to decrease; beginners models are available for less than $100. As this trend is likely to also occur in the maritime arena, it would be wise to match high-value vessels with an accompanying group of friendly Sea-Air drones offering constant defensive protection. In other words, a convoy must have the ability to destroy or electronically neutralize attacking drones. A ship with a 24/7 security presence would likely be safer than standard battle group coordinated operations. This is because there are simply too many ships at sea at any given time to protect them all through traditional means. The International Chamber of Shipping estimates there are least 50,000 merchant ships plying the oceans at any given time. Having constant convoys would reduce vulnerability amidst the uncertainty of when, where, and how an enemy might attack.

These convoys could be combinations of complex programmable drones capable of truly autonomous decisions and human operated systems. The most successful formations might be inspired from millions of years of evolution and derived through phenomena like flocks of birds and schools of fish. In such swarms it would be possible to make a human operator the "lead," balancing machine autonomy with human decision-making. To this end, P.W. Singer and August Cole's futuristic Ghost Fleet novel describes human helicopter pilots flying missions in conjunction with drones. The video below shows many different formations that could be programmed for swarms.

In order to recruit talent, the defense community might consider incorporating crowd-sourcing and gaming to meet increasing demands, at least until convoy defense systems can function in fully automatized ways. Pilots could be given a convoy interface (like Eve Online) and point systems tied to real world rewards to incentivize behavior. With this approach, the U.S. could capitalize upon large reserves of talent to protect trade, coasts, and even fishing vessels. This is merely an opening suggestion. There would, of course, be clear difficulties with such a strategy, such as ensuring a clearance system, similar to that of the Merchant Marine, payments to operators, and contract stipulations surrounding the use of force. However, the proliferation of third-party defense contracting proves that new types of defense arrangements can be made quickly in the face of emergent threats.

It may be many years before Sea-Air drones, suicide drone piracy, and other forms of maritime threats emerge in full force. However, there are already clear modes of attack and high valued targets. The future may be hard to predict but that shouldn't it preclude it from strategic thinking.

What jobs will flying robots be doing in future?

That future is fast becoming a reality.

But thankfully, instead of trying to wipe out humanity, these drones could soon be an indispensable component of our lives: building skyscrapers using 3D printing technology; transporting cargo across town; crop spraying; or helping find people trapped in buildings.

War and peace

Lockheed Martin's K-Max is a full size, unmanned helicopter, capable of both autonomous and remote-controlled operations.

Previously deployed in combat zones, it is now increasingly being used for civilian applications, from fire fighting, to heavy lifting and oil drilling.

And the firm's Aerial Reconfigurable Embedded System (Ares) aircraft features rotating engines that allow it to take off and land vertically like a helicopter, but also fly fast like a conventional aeroplane.

Lockheed Martin's Ares remote-controlled drone concept could carry pods for different purposes

Thunderbird 2, from Gerry Anderson's famous TV show, could also swap cargo pods

"It can carry lots of different types of pods under it. This allows the system to be used for a wide range of tasks, such as transporting personnel or carrying cargo or medical supplies," he says.

"From a business perspective, Ares could be used to reduce operating costs by sharing aircraft across different organisations, each with their own pod."

Delivery drones are feasible for small packages, but are they safe flying over urban areas?

Fire, police and ambulance services could all share a common pool of the aircraft, he believes. Ares is scheduled to begin flight tests next month.

Amazon has grabbed the headlines with its plans for delivery drones, but the Japanese government has also tested unmanned drone deliveries in a de-regularised zone in the city of Chiba.

The drones carried wine and milk from different points in the city to parks, businesses, and a residential building.

Singapore has also recently launched its own experiment in collaboration with Airbus.

Collaboration

When drones can collaborate, their impact could be even greater.

Lockheed recently tested an unmanned helicopter carrying and then dropping off an unmanned ground vehicle to conduct a resupply mission.

Mr Horler says: "This sort of collaboration could have been used during the recent Ebola crisis [in West Africa] to reduce the risk of the disease spreading by safely stretchering patients out of the contamination zone."

And Dr Mirko Kovac and his team at the department of aeronautics at Imperial College, London, envisage drones communicating with each other and an AI network as part of a complete ecosystem.

"They'll sense the environment, detect water quality and pollution levels, respond to emergencies, inspect structures and buildings," he says.

Delivery drones will need to avoid each other and stick to flightpaths

"They'll also be used to detect and repair gas leaks from pipelines and maintaining buildings, and eventually to construct those buildings."

Dr Kovac's team is also developing aerial construction-bots equipped with 3D printing technology that will excrete materials for use in building and repairing structures.

Line of sight

Authorities are naturally wary of drones flying into places they shouldn't and generally causing havoc - particularly near airports. So they usually stipulate that pilots have to maintain line of sight.

But French company Uavia has developed tech that allows unmanned vehicles to be controlled remotely using cloud-based technology.

In recent tests, the firm was able to fly a drone in San Francisco from its base in Paris.

"We are currently working with large companies in France and we will be launching our first suite of products later this year," says Clement Christomanos, Uavia's co-founder and chief executive.

"We fly multi-rotor drones nearly every day for beta-test purposes. These are flown at our research and test site, and controlled from our headquarters 500km away in Paris, with nothing but a laptop and our web application."

The technology offers the prospect of companies being able to carry out inspections of electricity cables, gas pipes or other infrastructure networks much more cheaply.

Power problem

But for this drone ecosystem to become a reality, a number of challenges have to be overcome.

The main one is power. If they're to stay aloft for significant periods new methods of keeping them fuelled need to be found - electric batteries just don't cut it, with most flight times lasting under an hour.

When those drones start carrying heavy payloads, the flight times fall dramatically.

So UK firm Intelligent Energy has developed a hydrogen fuel cell-powered range extender that can keep them aloft for up to two hours at a time.

Could Yeair's traditional combustion engines improve the drone's range?

And German start-up Yeair has launched a successful Kickstarter campaign to fund development of its combustion engine-powered drone that can fly for up to an hour and travel at up to 62mph (100km/h) carrying 5kg.

Google and Facebook are developing "wifi delivery" drones with large wingspans that could stay aloft for long periods using solar power and rechargeable electric batteries.

Traffic management

The other big issue is how all these drones will be able to fly around without crashing into each other and potentially injuring people below.

US space agency Nasa's Unmanned Aircraft System Traffic Management (UTM) project aims to monitor and direct drones flying at low altitudes without the need for a human controller.

Nasa and US Federal Aviation Administration operators recently flew 22 drones simultaneously using the UTM system.

During the tests the system was able to recognise live and virtual aircraft and respond by sending messages and alerts to the drones.

But while drone "sense and avoid" technology is developing rapidly, regulators will need a lot of convincing before allowing aerial motorways above dense urban areas.

This isn't stopping investors piling into this sector, however.

The commercial drone market is already valued at more than $127bn (£88.5bn; €112bn), according to a study by accountancy firm PwC, with infrastructure, agriculture and transport industries accounting for the bulk of the market.

The FAA has issued more than 3,100 commercial drone permits, and unmanned aerial vehicles are now cleared to fly commercially in all 50 states as well as Puerto Rico.

Flying, intelligent robots may be buzzing our way sooner than we think.

Global commercial-drone market expected to soar - it could be held back in the US by the FAA

Commercial drone use in the United States is advancing at a snail's pace, while other countries are far ahead. Global predictions see the commercial drone market booming in the future, but whether or not that will be the case in the U.S. is dependent to an extent on the Federal Aviation Administration releasing comprehensive regulations.

A report released last week by Research and Markets estimated that the commercial drone market will grow at a compound annual growth rate of 109 percent and reach $1.27 billion by 2020. Law enforcement is expected to hold the largest share of the commercial drone market at 25 percent.

However, this projected growth might not be as robust in the U.S. market. According to a recent article by Fortune, whether or not the commercial drone industry takes off in the U.S. depends to a considerable extent on the FAA.

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So far, the FAA has only issued around 3,000 Section 333 exemptions permitting commercial drone use. Of those exemptions, Fortune noted, 90 percent are held by small businesses.

That's why companies like PwC are looking to other countries for opportunities in providing drone services. PwC recently announced the establishment of a global center of excellence in Poland that uses drones and data analytics for business clients.

Fortune attributes PwC's decision to locate the center in Poland to the much less restrictive regulatory environment in that country. Poland along with South Africa are the only two countries that have put in place comprehensive regulations for commercial drone use that allows operation of drones beyond the operators' line of sight, according to the article.

PwC is lot more aggressive than Research and Market about its forecast of the drone market. The company says that the global market for business services using drones will total more than $127 billion.

Whether the U.S. market can get a slice of that huge pie could lie in the hands of the FAA.