Unmanned Systems Sentinel

Thanks to Robin Alexander and Ray Young for providing several of the below articles.  29 MAR 2016

Please keep in mind that in most instances the below summaries are excerpts from the original article. The full articles can be viewed at the accompanying hyper-links. The inclusion of these links does not represent an endorsement of the organization, service, or product. All opinions expressed are those of the respective author or authors and do not represent the official policy or positions of the Naval Postgraduate School, the United States Navy, or any other government entity. Immediately below are this edition’s highlights with links to the respective articles:

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NAVY/USMC:

GAO: Change in Navy’s UCLASS Mission Will Push Contract Award to 2018

The Navy’s decision to switch its carrier-based unmanned aerial vehicle program from an intelligence-gathering platform to a refueling aircraft will force contractors to resubmit their proposals and push the contract award to 2018, the Government Accountability Office said in a March 24 report.

The change of plans will also reduce the overall development costs by $1 billion. The unmanned carrier-launched airborne surveillance and strike system (UCLASS) was to cost some $3 billion through fiscal year 2022. The redubbed carrier based refueling system (CBARS) will cost $2 billion through 2021, the report said.

The fundamental debate over the UCLASS’ role caused initial delays, the report said. Discussions within the Defense Department centered around whether the drone would be mostly a strike platform capable of penetrating robust air defenses with some intelligence-gathering capabilities, or primarily a sensor platform. The indecision pushed back the expected contract award date from 2014 to 2017, the report said.

The 2017 budget proposal outlined the Defense Department’s decision to scrap both ideas and make the drone a tanker that can conduct intelligence, surveillance and reconnaissance missions when needed.

Four teams submitted proposals for the UCLASS program: Boeing, Lockheed Martin, Northrop Grumman and General Atomics. The Navy will issue a new request for proposals in early 2017, the report said.

The contractors’ UCLASS designs centered on a mostly surveillance aircraft, GAO said.

“The preliminary designs were based on a more surveillance-centric set of requirements. We concluded that if the final UCLASS requirements emphasized a strike role with limited surveillance, the Navy would likely need to revisit the technologies and proposed designs for the system, as well as the amount of funding that would be needed for development,” the report said.
Michael Novak, deputy director of the unmanned maritime systems office under the office of the chief of naval operations, told National Defense March 3, that the change in missions may mean a new competition. “There is going to be some discussion: ‘Do you open it up again?’” he said.

Yet Novak said the UCLASS designs had already been through a program design review process. They may not have to undergo radical redesigns, since they are all basically aircraft that have to fly off a carrier. The Navy could choose to stick with the four teams, he said.

Meanwhile, the service continues work on supporting technologies such as modifications to shipboard systems and command-and-control capabilities, the report noted.

The Navy expects CBARS to provide an initial operational capability to the fleet by the mid-2020s, the report said.

The 2017 budget request asks for $89 million, with the development costs ramping up to $349 million in 2018, $544 million in 2019, $646 million in 2020 and $532 million in 2021.

VMU-2 flies RQ-21A in 'Class D' airspace

MARINE CORPS AIR STATION CHERRY POINT, North Carolina -- Marine Unmanned Aerial Vehicle Squadron 2 launched into a new era with its RQ-21A Blackjack flight into Class D airspace, over Marine Corps Air Station Cherry Point, North Carolina, March 21.

Commonly only allowed to fly in restricted airspace, VMU-2 now has the expanded ability to integrate RQ-21A flight operations with manned aircraft over this air station.

Cherry Point’s Class D airspace is defined by a circle around the air station with a 5-mile radius, from the ground up to 2,500 feet above the air station. This is airspace that is constantly under the control of Cherry Point air traffic control, and is frequently busy with military air traffic, as well as contracted commercial flights landing and departing the air station.

“Unmanned aerial systems like the Blackjack are commonly flown from forward sites that sometimes restrict our integration with other air players and events,” explained 1st Lt. Orlando J. Benedict, an unmanned aerial systems officer with the squadron. “Having the RQ-21A at MCAS Cherry Point fosters connections with the rest of the 2nd Marine Aircraft Wing and allows for procedures that integrate manned and unmanned aviation to be solidified for the future.”

The Blackjack is designed to operate off a Marine Expeditionary Unit in support of ground forces deployed worldwide. UAS requirements have evolved and the Marine Corps has refined its concept of operations to incorporate rapidly emerging technologies in its unmanned systems.
The RQ-21A Blackjack can safeguard military bases and activities through a pattern of life identification and explosive device detection. It is equipped with an electro-optic/infrared payload that supports the real-time monitoring to provide indications and threat warnings, and its plug-and-play payloads enable multi-intelligence capability to support a broad range of operations.

“The Blackjack’s main purpose is to support aerial reconnaissance missions,” said Sgt. James E. Burch, a UAV operator with VMU-2. “With the new system, we will now be able to launch and land the UAV on a ship, where with other systems, more space would be required for recovery.”

Before the launch at Cherry Point was possible, VMU-2 traveled to various locations to include Marine Corps Outlying Field Atlantic, Marine Corps Auxiliary Field Bogue in N.C., MCAS Yuma, Ariz., and Marine Air-Ground Combat Center Twentynine Palms, Calif. The ability to conduct flights at Cherry Point assists in a more fluid ability to maintain, test and hone specific skills required to operate the system without the added burden of travel to other sites.

The inaugural flight within Cherry Point’s Class D airspace allowed for another chance to integrate an unmanned aerial system with manned platforms while sharing the same airspace, explained Benedict.

The ability to do so is an intricate process involving FAA requirements that demand UAVs to garner an equivalent level of safety and aircraft separation, comparable to manned aircraft.

“Marine UAS are flown and treated like any other aircraft, the only exception is that the pilot at the controls is not physically located in the plane, but they are very much still in control,” said 1st Lt. Jeremy Eshleman, a UAS officer and weapons and tactics instructor with VMU-2.

With the great accomplishment of being able to operate the RQ-21A aboard MCAS Cherry Point, Eshleman provides one final thought explaining how air traffic controllers and the pilots maintain control of the UAS. “Our UAS flies a standard and predictable route under control of the tower while here at Cherry Point, and the pilot will perform any additional instructions as issued by the tower. In the rare event the pilot loses connection with the UAS and can no longer control it, it will only fly a predetermined route to a known location before landing at our site.”


USN eyes MUM-T while developing unmanned carrier aircraft

The US Navy (USN) plans to create more robust communication networks between manned and unmanned aircraft, including implementation of the burgeoning manned-unmanned teaming (MUM-T) concept used by the US Army, a senior service official said on 22 March.

"That's what we're breaking into now," Rear Admiral Michael Manazir, the navy's air warfare director, said during a briefing at the Air Force Association.
He added that a MUM-T concept for the USN’s and US Marine Corps’ Lockheed Martin F-35 Lightning II Joint Strike Fighters is critical.

"The instantiation that I think about is three [unmanned] wingmen and an F-35," he said.

http://www.janes.com/article/58994/usn-eyes-mum-t-while-developing-unmanned-carrier-aircraft

ARMY:

USAF:

Air Force adds to deal for upgrading Global Hawk UAS

The Air Force is continuing to invest in upgrades to the Global Hawk unmanned aerial system, most recently giving Northrop Grumman a $30.3 million contract modification for retrofits that will help several of the aircraft take over some of the duties carried out by the U-2 spy plane.

The modification, to a maximum $354.9 million contract awarded in August 2014, calls for retrofitting eight of the UAS, converting them from Block 30I aircraft to Block 30M capable aircraft, according to a Defense Department announcement.

The Global Hawk, which is manufactured by Northrop, is the Air Force’s long-range, high-altitude ISR (intelligence, surveillance and reconnaissance) unmanned aircraft. There are several versions of the Global Hawk, which can fly for up to 32 hours at altitudes as high as 60,000 feet, with a range of 12,300 nautical miles, providing imaging and signals intelligence, as well as communications support, to troops around the world.

Congress has pushed for the Global Hawk to entirely replace the U-2, a move the Air Force had resisted for years, saying the manned U-2 was in some ways more capable and maintaining the two systems were complementary. The Air Force relented in early 2014 when the costs of operating the Global Hawk fell below those of the U-2.

Last May, the service announced plans to spend $4 billion over five years on the Global Hawk program. Some of the upgrade work to date has included retrofitting sensors and pods from the U-2 to the Global Hawk. Earlier this year, Northrop announced that a Global Hawk for the first time successfully flew a Senior Year Electro-optical Reconnaissance System-2, known as SYERS.

The Air Force also has been buying more of the UAS, giving Northrop a $240 million deal in August 2014 for three additional Block 30 RQ-4B Global Hawks, each with each with an Enhanced Integrated Sensor Suite and an Airborne Signals Intelligence Payload.

Work on the most recent contract modification is expected to be finished by Dec. 30, 2017.
NASA’s Traveler To Demo ‘Trustworthy’ UAS Autonomy

NASA researchers, together with the U.S. Air Force Research Laboratory (AFRL) are planning demonstrations of an autonomous unmanned aircraft system (UAS) capable of planning, launching, navigating and refueling itself.

Called Traveler, the project is aimed at developing trustworthy autonomy during an initial demonstration flight outside of restricted airspace later this year. If successful, an even more ambitious test in 2017 is targeted at flying a portion of an autonomous mission without a safety pilot. The FAA supports the plan and aims to use data collected during the program to help formulate future standards for UAS operations.

The Traveler vision is a vehicle that would launch independently in response to a medical emergency call to go, for example, to the aid of a victim trapped in an inaccessible location in the wilderness. On receiving a 911 call the vehicle itself would plan the route, file a flight plan, self-launch once medical supplies were loaded, safely navigate to the victim, land and deliver the supplies. En route the vehicle would also organize a location to refuel if necessary. On landing it would also launch and set up communications between the victim and medical personnel.

After proving the technology on quad-copter, NASA will fly the demonstrations using “Elissa,” a commercial, off-the-shelf FireFLY6 VTOL UAV.

The demonstrations will be conducted using a modified commercial BirdsEyeView Aerobotics FireFLY6 vertical-takeoff-and-landing (VTOL) UAV. Dubbed “Elissa,” the flying wing aircraft has a wingspan of 60 in., weighs up to 9 lb. and is configured with three sets of pivoting rotors. The building blocks of the vehicle’s autonomous capability are based on features developed for the auto-ground collision avoidance system (Auto-GCAS) and later auto-air collision avoidance system (Auto-ACAS) created by NASA, AFRL and Lockheed Martin. It also builds on an improved collision avoidance system tested on small UAS and a Cirrus SR22 general aviation aircraft.

Initial development, testing and evaluation of the software and processing system are being undertaken using a smaller quad-copter modified with an expandable variable-autonomy architecture (EVAA) processor. The heart of the system is an Odroid-XU3 processor like that used in the Samsung smartphone, coupled to the flight controls. “This is our piece of hardware which runs all of the logic, it runs everything,” says Mark Skoog, principal investigator of automatic systems at NASA Armstrong Flight Research Center. “Auto-GCAS is in there along with a dynamic inflight route planner and a flight executive that manages the system. Auto-GCAS is also now running an obstacle database as well. We just got to flight test this to understand how it was working. Now this is where our real effort is going to be focused,” he adds.
The EVAA operates with modular software and functionally partitioned modules, each of which is limited to a single safety function. The system also provides a rapid assessment of vehicle situational hazards such as weather, other aircraft, geofences, terrain and obstacles. “EVAA is about all the safety elements, and the ‘moral compass’ elements, Auto-GCAS, air collision avoidance, a forced landing system and geofences. It also has health monitoring and protection from loss-of-control, all managed by a flight executive,” says Skoog.

Following receipt of a mission request (or distress call in the example of a medical emergency), the UAV will access Google Maps via the Internet. “It will get routing options and put them through EVAA to evaluate if any are appropriate. It will then go through safety systems and assess the risks, the level of those risks and whether they are within acceptable tolerances. If they are, then it will build a flight plan and fill out an electronic flight request,” says Skoog.

For the demonstration the request will go to NASA flight operations. “They will respond back to Elissa with an approved takeoff time. The vehicle will then text us to ask us to set it outside at an appropriate time,” he adds. “It will take all the safety systems that we have been thinking about running in real time and use that for mission planning as well. So we can evaluate the safety of the mission planning in preflight as well as real time in flight. That way as we get into the real challenges of dynamic flight environments such as weather, etc., we can replan; we know if it passes the appropriate risk elements we plan just as a pilot would. It stays within constraints.”

The vehicle will have a forced landing system which activates in the event of an inflight failure. “It will have a full risk map for where the safest place to land is. It will also say, ‘If I don’t have that option I’m going to crash. In that case where’s the safest place to crash?’” adds Skoog.

The FAA is supportive of the pioneering program because it recognizes that NASA’s rigorous experimental approach will generate much-needed hard empirical data. “Some folks argued adamantly that the FAA would never let them do this,” Skoog recalls. “But I was at an FAA headquarters briefing about this and they said, ‘This is what we need. What do you need to do this?’” The FAA is standing up an ASTM (standards) committee “to capture all the lessons learned and best practices to then publish it to the world,” he adds.

NASA and AFRL are building a low-altitude UAS test range at Armstrong “to be able to go to the FAA and make a safety case for this with validated data,” says Skoog. “It is basically an obstacle course and includes the old space shuttle hangar. Nobody cares if we run into it, and it’s got a 140 ft. tower [similar to] a cellphone tower.” The site, which will be “a fake little town,” will also include telephone poles and other obstacles. The area will also be mapped in detail to provide true source data before testing begins.

http://m.aviationweek.com/commercial-aviation/nasa-s-traveler-demo-trustworthy-uas-autonomy

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**NATIONAL AIR SPACE:**
AOPA helps drone operators unravel FAA rules

Drone pilots operating near towered and non-towered airports can get help deciphering FAA guidance and learn more about best practices from a new AOPA fact sheet.

“We get calls every week from drone pilots who want help unraveling FAA requirements for their operations,” said Rune Duke, AOPA director of airspace and air traffic. “The fact sheet is a straightforward, easy-to-use reference that we hope will raise awareness of how to safely conduct unmanned aircraft operations, especially in airspace that’s also used by manned aircraft.”

The fact sheet is designed specifically for hobbyists, and covers topics that include how to get in touch with airport management about planned drone operations, what information to provide, and how to determine whether a planned flight is legal.

AOPA also provides additional fact sheets for drone operators, including registration requirements and information about filing an exemption request to conduct commercial operations.

“Unmanned operators are the fastest-growing segment of the aviation community, and we want to help them fly safely and avoid potential conflicts with manned aircraft,” said Duke. “AOPA will continue to work with the pilots of both manned and unmanned aircraft to make sure we can safely share the skies and enjoy all that aviation has to offer.”

AOPA is actively engaged in working with the FAA and industry to ensure that regulations affecting drone operations protect the pilots of manned aircraft without imposing undue burdens or costs on drone operators. AOPA serves on FAA rulemaking committees for both unmanned aircraft systems and micro UAS.


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FAA Doubles "Blanket" Altitude for Many UAS Flights

After a comprehensive risk analysis, the Federal Aviation Administration (FAA) has raised the unmanned aircraft (UAS) “blanket” altitude authorization for Section 333 exemption holders and government aircraft operators to 400 feet. Previously, the agency had put in place a nationwide Certificate of Waiver or Authorization (COA) for such flights up to 200 feet.

The new COA policy allows small unmanned aircraft—operated as other than model aircraft (i.e. commercial use)—to fly up to 400 feet anywhere in the country except restricted airspace and other areas, such as major cities, where the agency prohibits UAS operations.

“This is another milestone in our effort to change the traditional speed of government,” said FAA Administrator Michael Huerta. “Expanding the authorized airspace for these operations means
government and industry can carry out unmanned aircraft missions more quickly and with less red tape.”

The FAA expects the move will reduce the workload for COA applications for industry UAS operators, government agencies and the FAA's Air Traffic Organization. The agency also estimates the move will lessen the need for individual COAs by 30 to 40 percent. Other provisions of an FAA authorization, such as registering the UAS and making sure pilots have the proper certification, still apply.

Under the blanket COA, the FAA will permit flights at or below 400 feet for UAS operators with a Section 333 exemption for aircraft weighing less than 55 pounds and for government UAS operations. Operators must fly under daytime Visual Flight Rules, keep the UAS within visual line of sight of the pilot and stay certain distances away from airports or heliports:

• Five nautical miles (NM) from an airport having an operational control tower; or

• Three NM from an airport with a published instrument flight procedure, but not an operational tower; or

• Two NM from an airport without a published instrument flight procedure or an operational tower; or

• Two NM from a heliport with a published instrument flight procedure.


UAS Sighting Reports - FAA

Reports of unmanned aircraft (UAS) sightings from pilots, citizens and law enforcement have increased dramatically over the past two years. The FAA now receives more than 100 such reports each month. The agency wants to send out a clear message that operating drones around airplanes, helicopters and airports is dangerous and illegal. Unauthorized operators may be subject to stiff fines and criminal charges, including possible jail time.

The FAA continues to work closely with its industry partners through the "Know Before You Fly" campaign to educate unmanned aircraft users about where they can operate within the rules. The agency also is working closely with the law enforcement community to identify and investigate unauthorized unmanned aircraft operations. The FAA has levied civil penalties for a number of unauthorized flights in various parts of the country, and has many open enforcement cases.

The FAA encourages the public to report unauthorized drone operations to local law enforcement and to help discourage this dangerous, illegal activity.

http://www.faa.gov/uas/law_enforcement/uas_sighting_reports/
Drone legislation passed by Georgia lawmakers

A bill to ban weaponized drones, create a drone commission and clarify privacy protections that apply to drones gained final passage by the Georgia Legislature at the end of the session.

The legislation also includes language to preempt local ordinances regulating the operation or testing of drones that are adopted after April 1, 2016. And it would limit the use of drones by law enforcement for gathering evidence in a private place.

The legislation sponsored by Rep. Kevin Tanner, R-Dawsonville, clarifies privacy protections under laws relating to surveillance.

“We tried to carefully craft the legislation in a way that promotes the industry while at the same time protects privacy,” Tanner said. “If a device is attached to a drone and capturing those images intentionally where someone has a reasonable expectation of privacy [such as in someone’s backyard], then that person would be acting in violation of the law.”

The legislation would create the Georgia Unmanned Vehicle Systems Commission, focused on economic benefits and development of the unmanned vehicle systems industry in Georgia, as well as issues with privacy and safety.

The bill, which passed last week, now goes to Gov. Nathan Deal for his signature.

The state legislation comes as the Federal Aviation Administration more closely regulates drones by requiring registration of recreational drones above a certain weight and regulating commercial use of unmanned aircraft.

The FAA estimates purchases of drones by hobbyists will grow from 1.9 million this year to 4.3 million sold annually by 2020. Sales of drones for commercial use are expected to increase from 600,000 this year to 2.7 million by 2020. Combined, drone sales are estimated at 2.5 million this year, and are expected to grow to 7 million in 2020.

In a recent FAA release of reports of unmanned aircraft sightings, a report from Sept. 13, 2015 said an American Airlines flight departing Atlanta for Charlotte encountered an unmanned aircraft at 3,500 feet. The report said the American Airlines plane “had to take evasive action to avoid collision” with the unmanned aircraft, and that the Fulton County police department was notified of the incident.

There were a total of 13 drone sightings reported in the Atlanta area from Aug. 21, 2015 to Jan. 31, 2016. Here’s an interactive map showing drone sightings around the nation reported to the FAA during that period:

http://airport.blog.ajc.com/2016/03/28/drone-legislation-passed-by-georgia-lawmakers/
PUBLIC SAFETY:

Unmanned Aircraft Systems finds home at LC airport

LAS CRUCES - No where on the Internet can anyone find a map that shows 800 Aerostar Way in Las Cruces.

But, the place does exist, and those who work there want people to know about it.

The New Mexico State University Unmanned Aircraft Systems Flight Test Center (UAS) is at that location, in a large hangar at the southwest corner of Las Cruces International Airport. The flight test center has been there since 1998, when former New Mexico congressional leaders, U.S. Rep. Joe Skeen and retired U.S. Sen. Pete Domenici then realized the day would come that unmanned aircraft would significantly benefit the U.S. military and commercial business. With help from Skeen and Domenici a partnership was formed between the Federal Aviation Administration and New Mexico State University.

The flight test center collects data from test and commercial flights conducted there and shares that information with the FAA, who uses the information in the development of standards and regulations that UAS operators use now and in the future.

Dennis Zaklan, deputy director of the NMSU UAS Flight Test Center said extensive research, development, testing and evaluation continues there. Technological advancements in safety are becoming reality.

"By 2020 you will start seeing unmanned aircraft without people working on the ground," said Zaklan, at an open house Thursday of the NMSU UAS Flight Test Center. "There are 2,500 different types of unmanned aircraft systems that have been tested or flown here."

The day could come that fighter jets of the future likely won't have pilots aboard, and neither might commercial airlines. Continued unmanned aircraft technologies could lead to that.

"We have been developing the Vanilla aircraft, the VA001 as we call it," Novara said. "It's able to fly for 10 days nonstop. We're doing the research here with the goal of obtaining approval to fly at White Sands Missile Range. With the right technology that's everyone's hope in the company."

Zaklan and Tim Lower, UAS operations manager, emphasized there are major differences between the aircraft tested and flown at the flight test center and drones — which aren't affiliated with the flight test center.

"Drones are guided by remote control, and remote controls are used by people who are flying as a hobby or as commercial ventures," Zaklan said. "When drone goes from being a hobby to a commercial business is when the drone is mounted with a camera, the camera takes pictures, and the pictures are then sold."
Lower said unmanned aircraft have on-the-ground crews that monitor flights and control the aircraft. Unmanned aircraft have transponders on them so crews can maintain the heights they fly at, and safety is a paramount consideration.

"We have been doing this since 2005 and we've had no problems," Lower said.

Zaklan said the flight test center has worked well with many pilots who fly in and out of the Las Cruces airport. The times the flight test center conducts tests and commercial flights of unmanned aircraft are coordinated to minimize potential problems between private and commercial flights and unmanned aircraft.

"More accidents happen within three nautical miles of an airport because they don't see each other," said Zaklan, of unmanned aircraft and private and commercial aircraft using runways at the same times. "We try to be as safe as we can because, simply, that's the name of the game."

As technologies of unmanned aircraft continue to be refined and improved, Zaklan said there are hopes to better educate the public and let them be more involved with the work underway at the flight test center.

"It is our goal to be able to bring in students, the younger students and maybe let them watch test flights," Zaklan said.

"The achievements they continue to have will only prove to be just that much more valuable," Wood said. "The positives of this flight test center are many. There's the potential growth for economic development, the invaluable increases in education and learning our children can get from coming here more frequently. There is obviously some highly sophisticated work going on here that we all can learn, benefit and grow from."


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Assessment of Forest Structure Using Two UAV Techniques

Abstract

This study investigates the potential of unmanned aerial vehicles (UAVs) to measure and monitor structural properties of forests. Two remote sensing techniques, airborne laser scanning (ALS) and structure from motion (SfM) were tested to capture three-dimensional structural information from a small multi-rotor UAV platform. A case study is presented through the analysis of data collected from a 30 × 50 m plot in a dry sclerophyll eucalypti forest with a spatially varying canopy cover. The study provides an insight into the capabilities of both technologies for assessing absolute terrain height, the horizontal and vertical distribution of forest canopy elements, and information related to individual trees. Results indicate that both techniques are capable of providing information that can be used to
describe the terrain surface and canopy properties in areas of relatively low canopy closure. However, the SfM photogrammetric technique under performed ALS in capturing the terrain surface under increasingly denser canopy cover, resulting in point density of less than 1 ground point per m² and mean difference from ALS terrain surface of 0.12 m. This shortcoming caused errors that were propagated into the estimation of canopy properties, including the individual tree height (root mean square error of 0.92 m for ALS and 1.30 m for SfM). Differences were also seen in the estimates of canopy cover derived from the SfM (50%) and ALS (63%) point clouds. Although ALS is capable of providing more accurate estimates of the vertical structure of forests across the larger range of canopy densities found in this study, SfM was still found to be an adequate low-cost alternative for surveying of forest stands.

http://www.mdpi.com/1999-4907/7/3/62

Precision wildlife monitoring using unmanned aerial vehicles

Unmanned aerial vehicles (UAVs) represent a new frontier in environmental research. Their use has the potential to revolutionise the field if they prove capable of improving data quality or the ease with which data are collected beyond traditional methods. We apply UAV technology to wildlife monitoring in tropical and polar environments and demonstrate that UAV-derived counts of colony nesting birds are an order of magnitude more precise than traditional ground counts. The increased count precision afforded by UAVs, along with their ability to survey hard-to-reach populations and places, will likely drive many wildlife monitoring projects that rely on population counts to transition from traditional methods to UAV technology. Careful consideration will be required to ensure the coherence of historic data sets with new UAV-derived data and we propose a method for determining the number of duplicated (concurrent UAV and ground counts) sampling points needed to achieve data compatibility.

http://www.nature.com/articles/srep22574

Woolpert Deploys UAS to Collect Imagery for Rural Roads Project

DAYTON, Ohio - Woolpert has been hired by Michigan Tech Research Institute (MTRI) to collect imagery via unmanned aerial system (UAS), or drone, of haul roads throughout the Midwest.

This project, “Characterization of Unpaved Road Conditions Through the Use of Remote Sensing,” is sponsored by the U.S. Department of Transportation (USDOT), Office of the Assistant Secretary for Research and Technology (OST-R).

The data collected will help test a set of algorithms developed by MTRI, a branch of Michigan Technological University located in central Michigan.
“The contract is to help commercialize computerized analysis and assessment of unpaved roads,” said Aaron Lawrence, Woolpert GIS expert and UAS technology developer. “Michigan Tech has some algorithms to detect potholes, rutting, damage, etc., through high-resolution imagery and 3D point clouds, which would be used to assess and address unstable roads.”

The UAS is intended to provide a fast, safe and cost-effective collection to better understand where road material is lost and what damage there is to these roads.

Woolpert has been employing UAS for multiple industries that require efficient, remote and highly accurate imagery collections.

In addition to roads projects, the national architecture, engineering and geospatial firm is tasking UAS for oil and gas surveying, site design and civil engineering.

“UAS is ideally suited to smaller, rural sites,” Lawrence said. “It’s safer and it’s more cost-effective than flying individual manned aircraft missions, and in many cases we can turn around the imagery in 24 hours or less.”

Lawrence added that gathering imagery and generating 3D models of construction sites and the unpaved roads that provide access to them helps companies monitor construction, inventory material or simulate runoff scenarios to ensure designated retention ponds are collecting material as designed, instead of the surrounding rivers and streams.

“Post-construction UAS imagery can be very useful because it captures significant change to the area after companies clear and level land, install equipment or build haul roads,” Lawrence said.

Woolpert was the first surveying and aerial mapping company to be approved to fly a UAS commercially in designated airspace, earning an FAA Section 333 Exemption in December 2014.

Woolpert is scheduled to fly the MTRI project this spring.


Successful Beyond Line-of-Sight Field Trial of Rescue Drone Technology

OTTAWA, Ontario, March 24th 2016 ---- Ottawa, CA: Kongsberg Geospatial, an Ottawa-based developer of real-time, mission critical, geospatial visualization software, and the County of Renfrew Paramedic Service announced today the successful conclusion of field trials of a new software application developed to improve the safety of operating a search-and-rescue drone beyond visual line-of-sight (BVLOS).
The Country of Renfrew Paramedic Service is one of the first paramedic services in Canada to use a commercial drone, (or UAV) as a first response tool, and gained attention in the media last year when their UAV was used on an active crime scene following a triple homicide in Wilno Ontario.

The biggest limitation that UAV operators face is the fact that for safety and regulatory reasons, civilian UAVs can’t be operated beyond line-of-sight: they have to be within view of the pilot at all times. This is especially problematic in heavily wooded areas where trees typically limit your line of sight to a few tens of meters.

Kongsberg Geospatial has been providing display technology for military UAV platforms for over a decade, and is now actively working with industry and regulatory groups in the United States and Canada to develop a simple, portable unified display for civilian UAV operators that provides them with the necessary spatial awareness to safely operate UAVs beyond line-of-sight.

The display technology integrates and presents a variety of data sources to provide comprehensive information about the UAV along with other aircraft, airspace, obstacles and terrain using a single lightweight tablet. These data sources are not normally available to a UAV operator.

While the test team was restricted from actually operating beyond line-of-sight, they were able to simulate BVLOS conditions by having a second observer shadow the pilot operations and track the progress of the drone.

During repeated exercises over the course of the trial, pilot James Power was able to use the software to successfully navigate the UAV, and to help direct teams of searchers to “casualties” hidden in a heavily forested nature reserve near Cobden, Ontario. The outcome of these trials could have a significant impact on search and rescue operations in the near future. To UAV pilot James Power, the immediate value of the technology is obvious:

“We’re currently really constrained as to how far we can go with a drone – especially in forested areas” explained Mr. Power, “if we can extend the operating range of our drone, we can increase the speed and effectiveness of a search, and help guide rescue teams to casualties in remote areas far more quickly.”

County of Renfrew Paramedic Service chief Michael Nolan believes that their pioneering efforts could eventually help to transform the delivery of paramedic services throughout Canada. “As we continue to develop effective ways to extend the delivery of emergency services, we’re developing a body of knowledge and best practices that could ultimately be applied by other paramedic services throughout Canada” said Mr. Nolan. “The results of these trials are very promising in terms of extending our operating range, and have lead to new ideas about how we can transform and apply this technology.”

However, there’s still more work to be done before the County of Renfrew Paramedic Service and other similar agencies will be routinely flying UAVs beyond line-of-sight.

Allison Malloy, the program manager for the IRIS UAV platform at Kongsberg Geospatial explained: “We’re pleased at the outcome of these trials, and we’re confident in our technology, but we still have
additional research and development to do before this platform can be applied commercially, and there’s still a lot of regulatory work to do to get the necessary approvals”, she said. “We’re actively engaged with Transport Canada, the FAA, and other regulatory and industry working groups, and we’re hopeful that the necessary regulatory framework to allow licensed drone pilots to work beyond line-of-sight will be put in place in the near future.”


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**Safe Drone Use – BLOS**

The Edison Electric Institute (EEI) and Sharper Shape, a leader in automated Unmanned Aircraft Systems (UAS)-based asset inspection, have formed an innovative partnership to demonstrate and develop commercial UAS beyond visual line of sight (BVLOS) flights for electric companies.

"The safe use of Unmanned Aircraft Systems can help electric power companies improve the reliability, resiliency, and security of the power grid, which ultimately benefits electricity customers," said EEI Director of Government Relations Chris Hickling. "Our innovative partnership with Sharper Shape to safely develop the use of beyond visual line of sight UAS flights will provide crews with yet another tool to quickly and efficiently inspect critical assets during routine maintenance and following a storm or natural disaster. Several electric power companies are already flying UAS under the Federal Aviation Administration’s (FAA’s) Section 333 program for flights within line of sight. We look forward to continuing to work with FAA and other stakeholders to expand these efforts as we work toward regulatory approval of BVLOS flights for our industry."

EEI and Sharper Shape are currently studying the business and regulatory dimensions of BVLOS flights, and intend to apply with the FAA for approval of demonstration flights later this year. Currently, inspections of transmission and distribution lines are done via helicopter or manually from the ground. The use of BVLOS UAS flights could provide significant benefits by enabling a safe, efficient and fast method of inspection.

"We are very excited to be working with EEI to help deliver a new tool that electric power companies can use to improve their operations and enhance the value delivered to all U.S. electricity customers," said Sharper Shape Founder Tero Heinonen. "We believe the EEI - Sharper Shape Consortium will be instrumental in paving the way for the safe use of UAS for inspections. Having spearheaded the adoption of commercial BVLOS UAS flights for energy providers in Europe, we are excited to help develop a framework for large-scale and economic BVLOS UAS flights for all electric power companies in the U.S."

Here's How Amazon Is Fighting for U.S. Drone Deliveries

It spent $10 million in Washington last year

The race is on for Amazon, the company pushing to bring consumers everything just a little faster—from fresh produce to floss picks, fashion, and furniture.

The e-commerce giant is spending more cash than ever on Capitol Hill, in a bid to finally put commercial delivery drones in the skies and longer delivery trucks on the ground.

The big spending jump for Amazon (AMZN 2.32%) makes the company Washington’s fastest-growing tech lobby, as The New York Times reports. The Times says in addition to pushing for delivery drone approval, Amazon is also campaigning for longer trucks, more road improvements, and a closer partnership with the United States Postal Service.

Amazon almost doubled its spending in Washington in 2015, dumping nearly $10 million into lobbying, according to data on OpenSecrets.org. Other tech giants still spend more, though. Google (GOOGL 1.05%) parent company Alphabet pumped over $16.6 million into its own lobbying efforts in 2015.

The lobbying push comes as Amazon tests out its new airborne delivery bots around the world in Canada, the U.K., and the Netherlands. But the company is still eager to unleash its delivery drones in the U.S. Amazon vice president Paul Misener says the Amazon Air Prime program has several types of delivery drones in development. And NASA is developing a drone air traffic control system to help keep the futuristic deliveries flying smoothly.

But before U.S. customers can order up anything to be delivered via drone, the Federal Aviation Administration must give its own verdict on commercial drone regulations. The FAA says those rules will be ready later this spring.

For now, Amazon can only fly its drones in the U.S. as long as the FAA approves each flight, and the drones remain within the operator’s line of site the entire time the gadget is in the air. That, of course, makes the bots less than useful as a delivery tool. So, despite the new push in Washington by the company, it might still be a while before your next Amazon delivery comes flying in.

http://fortune.com/2016/03/21/amazon-drone-lobbying/

SENSORS/APPLICATIONS:

Pedestrian Detection and Tracking from Low-Resolution Unmanned Aerial Vehicle Thermal Imagery

Abstract
Driven by the prominent thermal signature of humans and following the growing availability of unmanned aerial vehicles (UAVs), more and more research efforts have been focusing on the detection and tracking of pedestrians using thermal infrared images recorded from UAVs. However, pedestrian detection and tracking from the thermal images obtained from UAVs pose many challenges due to the low-resolution of imagery, platform motion, image instability and the relatively small size of the objects. This research tackles these challenges by proposing a pedestrian detection and tracking system. A two-stage blob-based approach is first developed for pedestrian detection. This approach first extracts pedestrian blobs using the regional gradient feature and geometric constraints filtering and then classifies the detected blobs by using a linear Support Vector Machine (SVM) with a hybrid descriptor, which sophisticatedly combines Histogram of Oriented Gradient (HOG) and Discrete Cosine Transform (DCT) features in order to achieve accurate detection. This research further proposes an approach for pedestrian tracking. This approach employs the feature tracker with the update of detected pedestrian location to track pedestrian objects from the registered videos and extracts the motion trajectory data. The proposed detection and tracking approaches have been evaluated by multiple different datasets, and the results illustrate the effectiveness of the proposed methods. This research is expected to significantly benefit many transportation applications, such as the multi-modal traffic performance measure, pedestrian behavior study and pedestrian-vehicle crash analysis. Future work will focus on using fused thermal and visual images to further improve the detection efficiency and effectiveness.

http://www.mdpi.com/1424-8220/16/4/446

Environmental protection UAV demonstration

In its quest to prove the commercial appeal of unmanned air vehicles, Qinetiq has carried out a series of demonstrations to show the utilization of small UAVs for environmental monitoring.

Alongside the Welsh Government, Qinetiq carried out the demonstrations at the Snowdonia Aerospace Centre earlier this month, specifically looking at UAVs being utilized for fishery protection and erosion and flooding prevention.

Slovenian manufacturer C-Astral’s 2.5h-endurance Bramor rTK was used to carry out data collection on the Welsh coast’s vulnerability to flooding and erosion, and a high definition camera collected images for layering to develop a 3D model of the topography of the site.

https://www.youtube.com/watch?v=JYDngR7ZiiM#action=share

“The exercise demonstrated how drones could help to spot the warning signs early, enabling better preparedness and timelier response,” Qinetiq says.

A 3h-endurance Bramor C4Eye UAV carrying a video camera was launched from the airfield and flew out over Cardigan Bay, where it collected position data on a Welsh Government fishery patrol vessel in a simulated illegal fishing mission.
“As understanding of unmanned technology grows, sectors such as emergency services, agriculture and communications are beginning to see the possibilities,” Jeremy Howitt, unmanned services campaign manager at Qinetiq, says. “This demonstration is a chance for our guests to see first-hand the role Wales could play in realizing that potential.”

Wales is the home for a number of UAV initiatives, including the Parc Aberporth test site that provides the British Army’s Thales Watchkeeper UAV testing, plus the Snowdonia Aerospace test center at Llanbedr.

“Wales is well placed to take advantage of the growing interest and use of drones for a wide range of civilian uses,” Welsh government economy minister Edwina Hart says. “We have two unique centers in Wales – at Llanbedr and Aberporth – that have benefited from significant infrastructure investment and are in pole position to maximize these emerging opportunities and attract investment as the technology develops.”


A new drone with flexible, bat-inspired wings

Scientists at Southampton and Imperial have completely reframed the design problem of drones by looking to the flight capabilities of bats

This last year has seen the launch of the first passenger drone controlled by a tablet, a prototype of a drone-controlled robot garbage collector, and online retailer Amazon exploring the use of a hybrid drone for delivering packages to customers. One research company estimated that consumer purchases of drones will rise from 4 million in 2015 to 16 million by 2020 driven by decreasing price and the increased functionality of newer drones. However according to Professor Bharathram Ganapathisubramani, Head of Aerodynamics and Flight Mechanics Group at Southampton University such conventional drones are good, ‘but their efficiency level is really poor, the battery life is a problem.’

Professor Ganapathisubramani and his team at Southampton are working with a team from Imperial College, London on a more efficient drone inspired by the aerodynamics of bat wings. The team at Imperial College are working on the computational models for the design and the Southampton team are doing the lab-based work and building the drone. This new machine should be able to fly longer distances than current drones.

Historically Micro-Air Vehicles (MAVs) have been designed and modelled as miniaturized passenger aircraft or imitating helicopters. ‘The helicopter-based ones are all these quadcopters, hexacopters, octocopters,’ says Professor Ganapathisubramani referring to the number of rotors, ‘that’s what you normally see as a drone. They have these multiple rotary wings on top which enable them to lift off, spin
and fly. The bio-inspiration aspect there is very minimal as they are essentially taking a helicopter and scaling it down.’

Wings and artificial muscles

The starting point for this project completely reframes the design problem. About five or six years ago Professor Ganapathisubramani and Professor Rafael Palacios, his lead collaborator from Imperial College, went to a talk on the flight of bats and the aerodynamics of bat wings, ‘the fact the wings are flexible gives it a better aerodynamic performance,’ he explains. ‘Then doing some research into this we discovered these things called artificial muscles. When you apply a certain voltage across them they kind of relax and become more flexible.’

These artificial muscles would normally be used in robotics where if tendons need to be made, electroactive polymers are used as artificial muscles. But they’re used mostly on mechanical systems not aerodynamic systems. The lack of mechanical parts would also make the MAV easier to maintain. In the MAV an electric voltage will be applied across the wings that either stiffen or relax the wings.

‘Our idea was that if you make something flexible you get a good performance,’ says Professor Ganapathisubramani. ‘What we are proposing is not going to work for commercial aircraft. It will have to be contained to small-sized vehicles because the kind of loads experienced are just the right level for the flexibility to have a positive effect.’

Sails of a ship

They have replaced what would normally be a composite material wing with latex wings, and the shape of these wings, depending on the speed of the plane and the elasticity of the rubber membrane, respond to the environment. Professor Ganapathisubramani makes an analogy with the sails of a ship. ‘It’s why they use a cloth sail because they wouldn’t know which direction the wind would come from,’ he says, ‘so they used a cloth and once the wind blows the sail will balloon up in the direction of the wind and give you the propulsion. We are kind of using the same concept but for Micro-Air Vehicles.’ In this way, the latex wings also respond to the environment which makes them more efficient.

But using the information from the numerical modelling provided by Imperial College, they can design the active wings so the drone isn’t relying on the wind only, it’s proactive, rather than just adapting to the environment reactively. ‘Suppose we have to make a left turn or a right turn, you can actually relax the material properties on a wing and make maneuvers rather than just relying on gusts or the environment to change the wing shape,’ he explains. The modelling means they know what kinds of voltage will be needed to change wing shape and direction with a certain force of wind. This functionality of the wing explains why an excited media doing stories on the project have compared it to Batman’s memory cloak.

Some of this technology has been incorporated in a 0.5m-wide vehicle tested in the laboratory and on the water. The next step explains Professor Ganapathisubramani would be to take the electroactive material they have studied extensively in lab settings and make it part of the vehicle and use the active
part of this in maneuvers. ‘The practical applications are that anywhere you see these scaled down versions of aircraft, these planes will be more efficient at doing those jobs,’ he says. ‘It is a different way of thinking about designing these vehicles.’

https://www.britishcouncil.org/cubed/future-technology/bat-winged-drone

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UAV Factory launches new division

UAV Factory recently launched the Octopus ISR Systems division and released the Epsilon 140, a dual-sensor gyro-stabilized gimbal.

The new division offers ISR solutions that consist of Epsilon gimbals, IP datalinks, tracking antennas and ground control stations, according to a news release. The Epsilon 140 is the division’s first release and features an automatic moving target indication function, a nighttime surveillance range of up to 2,000 m with its 60-mm IR lens, and other critical functions for surveillance and observation.

“After the development of our flagship system Penguin C, we realized that there was a lack of advanced imaging payloads for small UAVs that were capable of delivering well-stabilized images on high-vibration platforms,” UAV Factory CEO Konstantins Popiks said, according to the release. “As a result, we decided to take the challenge and develop a working solution ourselves, and from mid-2013, we invested in engineering efforts to see if it was possible to develop better products than those that were available on the market.”

Epsilon gimbals like the 140 are known for their extensive use of the onboard processing unit to help make the operator more efficient while reducing costs and saving time. Using onboard processing makes a variety of functions possible, such as target tracking, scene steering and moving target indication. It also reduces the bandwidth required.

http://insideunmannedsystems.com/uav-factory-launches-new-division/

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Underwater optical remote sensing can be used as a precise positioning system for Unmanned Underwater Vehicle (UUV) navigation. Using a hemispherical optical detector array mounted on a UUV, it is possible to detect the platform’s relative position (translation and rotation in 3-D space) with respect to a guiding light beacon that is mounted either on a docking station. In this study, simulations were conducted to test the performance of the positioning detection algorithms obtained from the optical detector array during underwater navigation. Image processing algorithms used to guide the UUV based on input remote sensing information received from the optical detector array include: 1) Phase Correlation and Log-Polar Transform (PC-LPT), 2) Spectral Angle Mapper (SAM), and 3) Image
Moment Invariants (IMI). In addition, simulated control scenarios evaluated the positioning performance of a static-dynamic system in which the UUV autonomously positions itself with four degrees-of-freedom (DOF) that include translational axes and yaw/heading. The environmental conditions (water turbidity and background noise) and the hardware characteristics contribution to the performance of the position detection algorithms were also taken into account. Simulation results show the potential use of a cost-efficient optical-based positioning system in an acoustically noisy environment, such as a port or harbor.


**How full-motion video is changing ISR**

Full motion video has been a game changer in the world of tactical information. FMV, largely from airborne sources, provides the military with “pattern of life” imagery of the battle scene, tracking high value targets in real time while reducing collateral damage.

Demand has increased exponentially over the past 15 years, to the point where the presence of FMV capability is virtually assumed. Navy Deputy Program Manager for the Common Systems Integration program office Paul Weinstein predicts that it won’t be long before almost all unmanned aircraft will have FMV capability.

Recent military requests to industry show the steady pace of demand. For instance, one research solicitation seeking technologies to ease the workload on Army pilots specifies that “each individual sensor will provide full-motion video as well as accompanying metadata describing the geospatial position and orientation of the sensor.”

A Navy solicitation for Small Tactical Unmanned Aircraft System ISR takes a similar approach, including in its requirements a call for FMV capabilities.

Lately there has been a new twist in the ongoing effort to bring value to FMV assets. Vendors today are bringing to the table not just full motion video capabilities, but FMV tools designed expressly to mesh video data into information generated by other sensor systems, in order to create a fuller picture of the situation on the ground.

Layers of meaning

Commanders have faced an ongoing challenge in getting FMV to the battle space or to personnel in other supporting roles. With evolving technologies, “collaboration is the key capability change,” said Steve Coffey, systems analyst for intelligence & information systems, SRC Inc.

To this end, SRC has developed capabilities to fuse FMV footage with Google Earth data, as well as electronic warfare input. The resulting picture gives a more complete sense of the operational
landscape, making it possible to put FMV into a more meaningful context. “Users can now understand what is happening in the FMV and provide additional operational or intelligence value,” Coffey said.

The Army has been moving in the same direction — melding FMV into other data sources — by integrating video feeds into Nett Warrior, a smartphone-based device that supports advanced navigation, friendly-force tracking, command and control communications, and other sensor-fed information portrayals to soldiers on the ground. With an additional Digital Data Link wave form radio integrated into Nett Warrior, soldiers can draw FMV data directly from any source, “from an F-16 down to a small drone like the Raven and the Puma,” said David Darkow, a mission information team leader at U.S. Army Natick Soldier Research, Development and Engineering Center, or NSRDEC.

Integration into Nett Warrior significantly extends the usefulness of FMV data. “It’s about making tiers of situational awareness for the ground soldier,” Darkow said. “First you have a radio voice link, then you have dots-on-a-map capability which tells you where people are, and now with FMV you can have real-time details about what is going on in a hot zone.”

In these examples, FMV data is extended either by combining signal with other sensor data, or by combining FMV intelligence with an existing war fighter platform. Army also is working to extend FMV usefulness through novel forms of functionality designed to help operators assimilate FMV data more efficiently alongside other sensor input.

In the past, soldiers on the move had to look at stovepiped data coming from FMV, ground imaging sensors, weapons systems and other inputs. With its newly developed Multifunction Video Display (MVD), the service makes it possible for any crewmember to view FMV and other sensor feeds simultaneously and in real time.

U.S. Navy Naval Air Systems Command (NAVAIR) also has been working to broaden the effectiveness of FMV, by making video data more readily accessible to multiple end users, as demonstrated in last summer’s Trident Warrior sea trials. In that case, NAVAIR set out to overcome a longstanding problem in FMV: That is, the challenge of sharing large quantities of FMV data across carrier strike groups using limited bandwidth.

Researchers modified an existing Unified Video Portal (UVP) currently located at multiple intelligence agencies and integrated the system aboard the ship, in order to disseminate both ISR data and real-time viewing of FMV streams and metadata. “During a portion of the exercise, we streamed video from a battlegroup DDG [guided missile destroyer] back to an intelligence center ashore for 48 hours with no issues,” said Space and Naval Warfare Systems Command (SPAWAR) support engineer Garret Hart in a NAVAIR press release.

The common theme in all these scenarios: The more FMV can be shared among war fighters and combined with other sensor data, the more value it brings to the tactical edge.

Adding analysis
Lately these capabilities have been given added firepower with the evolution of high definition (HD) full motion video. The move from analog to digital architectures has allowed for the development of FMV imagery as clear as any home HDTV might produce. The heightened accuracy of this high-quality imagery affords a tactical advantage, especially when shared readily among different elements and combined with data from other sensors.

But HD FMV can be a mixed blessing, especially in terms of the sheer volume of information it produces. In a report on The Future of Air Force Motion Imagery Exploitation, RAND predicted the need for advanced analytics in the face of a vast flow of FMV. While storage issues may be manageable given current costs and storage capabilities, “making this vast trove of information searchable and accessible to all authorized users who need it presents a far more challenging problem,” the report notes.

Keeping in mind the need to balance the sheer volume of data and with the need for tactical information, the military has been looking to bring further added value to FMV through the use of sophisticated analytics. Some say there is a critical need to analyze video data and ferret out its meaning in context.

Until fairly recently imagery analysts would sit in front of screens, sometimes working 12-hour shifts, watching for any activity that might appear suspicious. The process was laborious and often ineffective, relying as it did on limited human perception and judgment. Automated analysis tools now on the rise promise to make the process more efficient and also more accurate.

“It’s about getting rid of the video that is not useful, the videos full of cloud cover. Then you get into things like ‘this is moving here,’” said Ron Krakower, director of business development at SRI International. With sophisticated analytics, operators can engage in event query: “In these six hours of video, find me the stuff where someone is getting out a car.”

Among other emerging tools is the rewind-and-search function. A number of vendors already have come to market with FMV systems that enable an operator to scroll back in time and review events as they unfold. This may give strategists a considerable edge, for instance as they seek the source of an event or the escape routes of adversaries in the wake of an attack.

Taken together, the push for shared data and the rise of advanced analytic tools promise to bring FMV even more into the tactical limelight in the near future.


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**COUNTER UAS:**

Hacker Says He Can Hijack a $35K Police Drone a Mile Away
As the rise of hobbyists’ cheap quad-copter drones freaks out the FAA and the Secret Service, it’s easy to forget that the government itself is putting another tier of much-less-cheap UAVs into service for first responders, cops, and the military. And now a security researcher has shown that at least one model of those government-ready flying machines has serious security vulnerabilities that could allow it to be hacked from more than a mile away, taken over by a rogue operator, or knocked out of the sky with a keystroke.

At the RSA security conference in San Francisco on Wednesday, IBM researcher Nils Rodday will show how flaws in the security of a $30,000 to $35,000 drone’s radio connection allow him to take full control over the quad-copter with just a laptop and a cheap radio chip connected via USB. By exploiting a lack of encryption between the drone and its controller module known as a “telemetry box,” any hacker who’s able to reverse engineer the drone’s flight software can impersonate that controller to send navigation commands, meanwhile blocking all commands from the drone’s legitimate operator. “You can inject packets and alter way-points, change data on the flight computer, set a different coming home position,” Rodday says. “Everything the original operator can do, you can do as well.”

Rodday, who began his drone research while working as a graduate researcher at the University of Twente in the Netherlands, won’t reveal the specific drone he tested or who sells it. The unnamed UAV manufacturer had him sign a non-disclosure agreement in return for loaning him the pricey quad-copter for testing. He hinted, however, that the three-foot wide quad-copter has a flying time of around 40 minutes and has been deployed by police and fire departments, though it’s also marketed for use in industrial applications like inspecting power lines and windmills and aerial photography.

But the specific make and model of the quad-copter he tested don’t matter as much as the actual security flaws his work spotlights, Rodday argues. He believes the vulnerabilities may apply to a broad swathe of high-end drones. Rodday found that the UAV he studied has two serious security oversights: First, the WI-Fi connection between its telemetry module and a user’s tablet uses weak “WEP” or “wired-equivalent privacy” encryption, a protocol long known to be crackable in seconds. That would allow any attacker in WI-Fi range to break into that connection and send a so-called “deauth” command that kick the drone’s owner off the network.

Worse, the connection between that telemetry module and the drone itself uses an even less-secured radio protocol. The module and drone communicate using so-called Xbee chips created by the Minnesota-based chip-maker Digi International. Those chips, often used in mesh networking, do have built-in encryption capabilities. But in order to avoid latency between the user’s commands and the drone, Rodday says, the quad-copter doesn’t implement that encryption function, leaving the drone open to a man-in-the-middle attack in which another malicious machine could join the same network. That interloper, whom Rodday says could be farther than a mile away, could then send commands to the module and drone that reroute packets on the network, establishing communications between the drone and the intruder and intercepting or dropping any commands from the drone’s operator. (Rodday based that attack distance on the range listed in the drone’s manual. He tested his attack at only around 30 feet in his own lab.)
In a proof-of-concept exploit he plans to show in his RSA talk and which he demonstrated for WIRED, Rodday can inject a command to turn on the drone’s motors without touching the tablet or telemetry box meant to control it. But in a more malicious attack, he says an unseen hijacker could just as easily control the quad-copter to make it unresponsive, or worse, to crash it into a building—or to simply fly it away and steal it. “If you think as an attacker, someone could do this only for fun, or also to cause harm or to make a mess out of a daily surveillance procedure,” says Rodday. “You can send a command to the camera, to turn it to the wrong side so they don’t receive the desired information…or you can steal the drone, all the equipment attached to it, and its information.”

Rodday says he’s alerted the drone’s manufacturer to the security flaws he’s found, and the company plans to fix the issue in the next version of the quad-copter that it sells. But there’s no easy fix for the UAVs already in customers’ hands, Rodday says. The quad-copters aren’t connected to the internet, so they can’t download a security update. Even if the company did release new firmware that could be downloaded to a PC or tablet and installed on the flying machines to enable the encryption on the drones’ Xbee chips, Rodday says that update would slow down the drone’s responsiveness to commands, which the quad-copter’s manufacturer may be reluctant to do. Instead, he says that enabling encryption without adding latency would require adding another chip dedicated specifically to those security functions. “A patch over the internet isn’t sufficient,” says Ricardo Schmidt, Rodday’s former advisor at the University of Twente. “The product needs to be recalled.”

The radio connection problems Rodday found may not be confined to the single, unnamed drone that he tested. He says he contacted other drone sellers that use the Xbee radio protocol to ask for information about how they secure their UAVs’ communications, but he didn’t get a response. “I think this vulnerability exists in a lot of other setups,” he speculates. “The impact of the whole thing is bigger than this manufacturer.”

But Rodday’s research proves that problem for what’s likely the most expensive drone yet—and one that’s used for more serious applications than high-altitude selfies. “What if a massive, expensive drone like this gets taken over?” Kamkar asks. “It’s an interesting attack. And there will be others out there.”

http://www.wired.com/2016/03/hacker-says-can-hijack-35k-police-drone-mile-away/

**Dedrone Releases Next Generation of Anti-Drone Technology**

San Francisco, CA - March 21, 2016 - Dedrone, the global leader in drone detection technology, announced today the next generation of its drone warning system. The DroneTracker 2.0 detects unmanned aerial vehicles based on their WLAN signals, allowing for identification of drone models and even individual devices.

"Only through safe and immediate detection can an individual or corporation effectively protect against unwanted drone surveillance,” states Dedrone CEO, Joerg Lamprecht. "As drone sales reach an all-time high and the technology and sophistication behind drones is amplified, it is imperative that drone
detection meets the rapid changes in the industry. DroneTracker 2.0 is the next wave in technology to meet that demand."

Dedrone’s DroneTracker system, which currently utilizes cameras, sonic and ultrasonic sensors, has been updated with WI-Fi sensors, making it the most effective drone detection tool in the marketplace. These WI-Fi sensors detect UAVs through their Wi-Fi signals that are either emitted when a drone is controlled with a smartphone or when an on-board camera is sending video signals to the pilot. The new sensor also reads the MAC- addresses of the emitting device, thus allowing to identify both drone models and even individual devices.

"When a drone returns or is tracked to a different location, it is recognized as the identical device," Lamprecht explains. "This information is crucial in order to evaluate the threat potential and to trace the pilot."

Efficient Airspace Monitoring 24/7

In addition, Dedrone announced the ability to connect any number of DroneTrackers and manage them through one user interface, ultimately providing around the clock monitoring of the airspace with very few resources. Once a drone enters the secured airspace, an alert is triggered, allowing for immediate action by security teams. The drone's position is shown in real time on a digital sitemap. Evidence videos are automatically saved and easily forwarded to law enforcement.

Worldwide sales in the emerging anti-drone market

More than 100 partners already distribute DroneTracker worldwide, including international corporations such as Securitas and Bosch Security Systems. And the demand for safe, efficient and effective tracking systems continues to grow.

This February, the market research institute Markets & Markets published, for the first time, a report on the anti-drone market. The analysts are forecasting an annual growth of around 24 percent in between 2017 and 2022 and a volume of 1.14 billion dollars by the year 2022. The United States investment research firm Morningstar lists Dedrone as a leader in this field.


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DHS to Demonstrate Acoustic Counter-UAS

New Jersey-based Stevens Institute of Technology has received a $2.75 million award from the Department of Homeland Security (DHS) to support a multi-year program to develop and deploy a system of sensors to defeat small and medium unmanned aircraft systems. The DHS Science &Technology Directorate’s Center of Excellence for Maritime Security at Stevens will develop a test bed
and demonstrate an acoustic sensor solution for the protection of critical infrastructure and public events.

http://aviationweek.com/awin-only/dhs-demonstrate-acoustic-counter-uas

COMMENTARY:

Drone Operator Claims Government’s Registry is Illegal

As a heat wave swept across California this past summer, a fire broke out on the parched hills of northeastern Los Angeles and roasted several vehicles along a major highway. Firefighters initially struggled to contain the blaze, and peeved U.S. forestry officers said their efforts lagged because people kept flying drones nearby, which interfered with their planes. “You’ve got people in areas where they think it is cool,” California Department of Forestry and Fire Protection spokesman Daniel Berlant told The New York Times. “But they don’t realize the implication of what they are doing.”

They’re not the only ones. Over the past five years, drones have become not only cheap and easy to fly, but also a public nuisance—slamming into infants, drifting close to airports and crashing onto the White House lawn. Now, after years of leaving the industry alone, the Federal Aviation Administration (FAA) is trying to force owners to register their aircraft.

Late last year, the FAA and the Department of Transportation—with the drone industry’s support—quickly created an online registry for hobbyists. Its goal is to track down law-breaking owners and hold them accountable. The penalty for not registering: up to three years in prison and a $250,000 fine. There’s no way to know what percentage of drone hobbyists have followed the new rules. But as of February 8, the FAA says 329,954 owners have signed up for the registry. “Make no mistake: Unmanned aircraft enthusiast[s] are aviators,” U.S. Transportation Secretary Anthony Foxx said in a statement in December, “and with that title comes a great deal of responsibility.”

Not everyone is pleased about the requirement. Some drone owners say it’s illegal, and they’re challenging the FAA in court. Leading the fight: John Taylor, an insurance attorney and drone hobbyist in Silver Spring, Maryland. When the registry launched in December, Taylor says he waited for an appropriate lawyer to file a suit. When that didn’t happen, he did it himself. “I truly believe,” he says, “the FAA has no real defense.”

Taylor bases his argument on a half-page clause in the FAA’s Modernization and Reform Act, which explicitly prohibits the agency from making new rules and regulations regarding model aircraft. In launching the registry, Taylor claims, the FAA has technically created a regulation as well.

The FAA disagrees. It argues the registry isn’t new, but rather an extension of a paper-based program for regular aircraft that was codified during the Eisenhower era.
Either way, drone registration may have another problem. Under a separate piece of legislation, signed in 1946, all regulations from federal agencies need to go through a public notice period so nongovernment entities can offer feedback. The FAA circumvented this process, however, saying the registry was too important to wait.

Drone enthusiasts have other concerns as well—namely, privacy. The FAA says it will make the registration numbers in its database open to the public. But as Taylor cites in his lawsuit, several drone owners claim they’ve received other people’s information after completing an application. A spokesperson for the agency declined to comment on the matter because of the pending litigation.

It’s unclear when there will be a ruling on the lawsuit, but the FAA doesn’t seem to have a backup plan. If a judge declares the registry illegal, the agency may be forced to wait on a fractious Congress to establish drone regulations.

Taylor is optimistic and eager to stop what he calls federal overreach. So is Rupprecht, who seems to be enjoying the fight. “I’m here,” he says, “to blow the registry up.”

An earlier version of this article referred to the Federal Aviation Administration as the Federal Aviation Authority.


Report Cites Dangers of Autonomous Weapons

A new report written by a former Pentagon official who helped establish United States policy on autonomous weapons argues that such weapons could be uncontrollable in real-world environments where they are subject to design failure as well as hacking, spoofing and manipulation by adversaries.

In recent years, low-cost sensors and new artificial intelligence technologies have made it increasingly practical to design weapons systems that make killing decisions without human intervention. The specter of so-called killer robots has touched off an international protest movement and a debate within the United Nations about limiting the development and deployment of such systems.

The new report was written by Paul Scharre, who directs a program on the future of warfare at the Center for a New American Security, a policy research group in Washington, D.C. From 2008 to 2013, Scharre worked in the office of the Secretary of Defense, where he helped establish U.S. policy on unmanned and autonomous weapons. He was one of the authors of a 2013 Defense Department directive that set military policy on the use of such systems.

In the report, titled “Autonomous Weapons and Operational Risk,” set to be published on Monday, Scharre warns about a range of real-world risks associated with weapons systems that are completely autonomous.
The report contrasts these completely automated systems, which have the ability to target and kill without human intervention, to weapons that keep humans “in the loop” in the process of selecting and engaging targets.

Scharre, who served as an Army Ranger in Iraq and Afghanistan, focuses on the potential types of failures that might occur in completely automated systems, as opposed to the way such weapons are intended to work. To underscore the military consequences of technological failures, the report enumerates a history of the types of failures that have occurred in military and commercial systems that are highly automated.

“Anyone who has ever been frustrated with an automated telephone call support helpline, an alarm clock mistakenly set to ‘p.m.’ instead of ‘a.m.,’ or any of the countless frustrations that come with interacting with computers, has experienced the problem of ‘brittleness’ that plagues automated systems,” Scharre writes.

His underlying point is that autonomous weapons systems will inevitably lack the flexibility that humans have to adapt to novel circumstances and that as a result killing machines will make mistakes that humans would presumably avoid.

Completely autonomous weapons are beginning to appear in military arsenals. For example, South Korea has deployed an automated sentry gun along the demilitarized zone with North Korea, and Israel operates a drone aircraft that will attack enemy radar systems when they are detected.

The U.S. military does not have advanced autonomous weapons in its arsenal. However, this year the Defense Department requested almost $1 billion to manufacture Lockheed Martin’s Long Range Anti-Ship Missile, which is described as a “semiautonomous” weapon by the definitions established by the Pentagon’s 2013 memorandum.

The missile is controversial because, although a human operator will initially select a target, it is designed to fly for several hundred miles while out of contact with the controller and then automatically identify and attack an enemy ship in an opposing fleet.

The Center for a New American Security report focuses on a range of unexpected behavior in highly computerized systems like system failures and bugs, as well as unanticipated interactions with the environment.

The lack of transparency in artificial intelligence technologies that are associated with most recent advances in machine vision and speech recognition systems is also cited as a source of potential catastrophic failures.

As an alternative to completely autonomous weapons, the report advocates what it describes as “Centaur Warfighting.” The term “centaur” has recently come to describe systems that tightly integrate humans and computers.
However, in a telephone interview Scharre acknowledged that simply having a human push the buttons in a weapons system is not enough.

“Having a person in the loop is not enough,” he said. “They can’t be just a cog in the loop. The human has to be actively engaged.”

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Here’s how the U.S. government can accelerate drone deliveries

This story was delivered to BI Intelligence IoT Industry Insider subscribers.

The federal government recently announced that it would create regulations for delivery drones by 2018, but the U.S. still lags behind the rest of the world in this regard.

European regulators created a framework for delivery drones last year, while China already allows drone deliveries and plans to create official regulations soon.

This slow adoption by the U.S. government has led companies such as Amazon to test their drones in other nations. U.S. regulators have restricted enterprise use of drones to only a few industries and cases, such as aerial photography and land surveying.

But a recent column in WIRED argued that the federal government could accelerate its approval of commercial drone deliveries and other enterprise drone usage.

For example, the Obama administration could order an interagency review of drone technology development to create a broad strategy at the federal level.

It could also enhance its export control policy, which insists that buyers who import drones from U.S. manufacturers use them according to international law. But it's not clear how these rules apply to commercial drones, so clarification could help U.S. drone manufacturers make sales to international companies.

Finally, the FAA could accelerate the creation of policies that safely allow drones to share airspace with other aircraft. The FAA is expected to announce drone regulations within a few months, but the organization could consider Amazon's proposal of reserving airspace less than 400 feet above the ground specifically for unmanned drones that are traveling great distances.

Drones turned the corner in 2015 to become a popular consumer device, while a framework for regulation that legitimizes drones in the US began to take shape. Technological and regulatory barriers still exist to further drone adoption.

Drone manufacturers and software providers are quickly developing technologies like geo-fencing and collision avoidance that will make flying drones safer. The accelerating pace of drone adoption is also pushing governments to create new regulations that balance safety and innovation.
Safer technology and better regulation will open up new applications for drones in the commercial sector, including drone delivery programs like Amazon’s Prime Air and Google’s Project Wing initiatives.

Jonathan Camhi, research analyst for BI Intelligence, Business Insider’s premium research service, has compiled a detailed drones report that forecasts sales revenues for consumer, enterprise, and military drones. It also projects the growth of drone shipments for consumers and enterprises.

The report details several of world’s major drone suppliers and examines trends in drone adoption among several leading industries. Finally, it examines the regulatory landscape in several markets and explains how technologies like obstacle avoidance and drone-to-drone communications will impact drone adoption.


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Upstate New York Seeks Economic Boost from Drones

Officials hope test site in Rome, N.Y., will help establish industry in region and boost the economy

The National Aeronautics and Space Administration has a contract with Oneida County, which owns the test site, for up to $5 million over five years. A nonprofit known as NUAIR Alliance, which manages the test site, will research unmanned and autonomous flight technologies.

Beyond the test site, many companies involved focus on technology that will allow drones to detect and avoid each other aloft, and the eventual air-traffic control system that will be needed.

“To be able to allow the Domino’s pizza delivery drone to keep from hitting the Amazon package drone at the corner still has to be developed,” said Larry Brinker, executive director and general counsel of NUAIR, which coordinates about 90 business, government and academic institutions collaborating on regional drone efforts.

In December 2015, the plan got a further boost when the central New York region was awarded $250 million for drone initiatives through the Upstate Revitalization Initiative.

The state funding will go toward building an indoor testing and certification facility, developing an air-traffic management system and policy research.

The management system essentially creates “highways in the sky for UAS,” said Oneida County Commissioner of Aviation Russell Stark, using the acronym for unmanned aircraft systems.

The big need and challenge in developing a traffic-management system is to help drones fly safely beyond the line of sight, said Parimal Kopardekar, principal investigator for NASA’s UAS Traffic Management.
Among other things, the indoor facility would replicate environmental conditions, such as wind, dust, fog or snow, said Craig Marcinkowski, director of strategy and business development at Gryphon Sensors LLC, a detection and surveillance company.

In December 2013, the FAA named Griffiss International Airport in Rome, a decommissioned air base dating to the 1940s, as one of the six test sites nationwide. The designation came with no major funding, but it provided a morale boost for the region, said Robert Simpson, president of CenterState CEO. The area has been hard hit by the loss of manufacturing jobs that once offered reliable employment.

Not everyone is on board. “We have a serious poverty problem, and this industry is not too accessible to people who are making low wages and are poor,” said Howie Hawkins, a longtime Green Party politician who ran for governor in 2014. “There are opportunity costs when you put all your eggs in that basket.”

But economic development is never an exact science, noted Oneida County Executive Anthony Picente. “In order to grow you have to have a broad vision and have to be bold,” he said.

The initiative is still in its early stages. One company has moved to the area, Pro Drones USA LLC. Local officials say they are in talks with others.

In the coming weeks at the Rome test site, a group called Project Lifesaver is scheduled to use a modified version of the Indago to test finding patients with dementia. A separate trial will involve the first flight at the site with multiple aircraft in the air simultaneously. The goal is simple: no crashes.


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Military Beefs up Research into Swarming Drones

The concept sounds hard to defeat: dispatch a horde of flying, thinking armed robots that can autonomously coordinate amongst themselves an attack against a target.

If an anti-aircraft weapon takes down one drone, the others change direction, push through and destroy the target kamikaze style.

Senior Air Force officers and Defense Secretary Ashton Carter are among the military leaders who have touted “swarming” robots lately, although the Air Force Research Laboratory doesn’t like that term. It prefers “distributed collaborative systems.”

Swarming fish and birds don’t collaborate much, she said in an interview. “That collaboration is where we anticipate where you would be able to gain capability as opposed to blindly following or staying out of the way of everything else in the team.”
Distributed collaborative systems for the Air Force is “about putting that next level of decision making and capability on the platform. Not only can it maintain itself, but it can work other parts of the team, whether those be airmen, or whether those be other machines to perform a mission task.”

Also working on the concept is the Pentagon’s Strategic Technology Office.

One project uses “swarming autonomous vehicles in all sorts of ways and in multiple domains,” he said. “In the air, they develop micro-drones that are really fast, really resistant. They can fly through heavy winds and be kicked out the back of a fighter jet moving at Mach 0.9, like they did during an operational exercise in Alaska last year, or they can be thrown into the air by a soldier in the middle of the Iraqi desert.”

Peter W. Singer, a strategist at the New America Foundation, said, “Swarming has several potential benefits. It is a way to gain the effect of greater intelligence without each individual unit needing to be intelligent. Think how ants can perform incredibly complex tasks, even though each ant is not all that smart.”

Gen. Ellen Pawlikowski, commander of the Air Force Material Command in a speech last year, said swarming drones “can be very much a game-changing reality for our Air Force in the future.”

Today, once a missile is launched at a target, the human is out of the decision-making loop. He has no control over it. “When we separate the weapon from the aircraft, we separate the weapon from the human,” she said. A swarm of thinking, flying munitions could be commanded in mid-flight to change direction.

Before that happens AFRL has many technological hurdles to overcome, Kearns said. It will require a lot of collaboration and data sharing between the weapon systems, she added.

Machine perception, what the robot sees, is a relatively mature technology. They can identify a large object such as a tank. But the swarming concept poses some difficulties. “The challenge becomes what happens when it can only see half of that object. How can that machine identify what it is when it needs to do some inferencing?” Kearns asked.

And given that missiles move rapidly, the data stream becomes vital — not only maintaining connections between the robots, but managing what is passed between them, she said.

“What is the amount of information that needs to be shared between the systems to be able to do that collaboration?” she asked.

“Sending a lot of data would be easy but the problem is because of the time and the speed, you have to know exactly the data that needs to be sent in order to have that coordinated interaction,” she said.

A consultant familiar with the Defense Department autonomy programs, who declined to be named, said the human operator may not be able to compete with a fully autonomous system that identifies, analyzes and geolocates a target, especially in such a scenario where the swarm is moving rapidly.
There is a fundamental debate in the armed services about the correct amount of human and autonomous operators, he said.

“Getting the right blend of autonomous, semi-autonomous and autonomous systems, which related to drones or robotics or other physical or virtual capabilities, is an evolving debate, but that’s where the future is going,” he said.

When targeting, it’s important to remember that humans are moral creatures. Machines are not, he said.

“The ultimate safeguards on the use of lethality are driven by humans and will be driven by humans until such time as we have sufficient capabilities in moral, smart machines,” he said.

Singer said, “Just like with past human ‘swarms’ in war, like German U-boat wolf packs, it is a lot easier for them to operate if they can easily communicate. But that may not always be possible. So you then have to pack in more and more intelligence, and give them greater and greater autonomy.”

Kearns said: One of the major challenges with any autonomous system is verifying and validating that the decisions it is making are correct. “And that is the case across the Department of Defense, when we work with the Army and the Navy, that is a challenge that we all have.”

Trust, or “verification and validation,” becomes paramount with what is essentially artificial intelligence, Kearns added. “How do we assure safe and effective operations when we put decision making in the platforms?”

Some of the technologies needed to advance the field of distributed collaborative systems will be developed before the problem of verification and validation is solved, she said.

Arati Prabhakar, director of the Defense Advanced Research Projects Agency, said in a briefing with reporters, that there is a powerful new wave of research happening with artificial intelligence but “one of the biggest issues is trust and confidence in what [machines] tell us what they think is happening and what course of action to take.” The field needs more of a rigorous theoretical foundation, she added.

That case, a remotely piloted aircraft would follow a jet fighter. It could serve as a “bomb truck” and carry extra ordnance, or be another set of eyes with its sensors. It could be directed to go to a hazardous area where the pilot doesn’t want to go, she said.

While this is a step toward distributed collaborative systems, it has its own questions and challenges.

What is the airman’s job today, and what can researchers do that enhances and allows him to do that more effectively? How can they efficiently and effectively help pilots to make decisions and support them so there is a fluid operational team of both this intelligent system and airmen working together? she asked.

“What we don’t want to do is hand them a tool ... and actually make their jobs harder,” Kearns said.
The question becomes how to manage the workload of that pilot as you add a robotic wingman, she said. “What work does that pilot need to do and how much workload can you give them before you start impacting performance?” she asked.

“It is critical that your pilot isn’t up there flying his plane and another plane,” she said.

Steve Walker, deputy director of DARPA, said his agency has been working on developing battle management systems with a blend of manned and unmanned vehicles.

“You have humans and unmanned systems and you need data fused together quickly and things are happening fast and you don’t want to overload the human with all that information. … You want to give him or her exactly what he needs to make a decision and have all these distributed effects work together,” he said.

Singer said swarming is “a more resilient approach. Rather than having one single system or single point of failure, it can take losses and still function. This also means it complicates an enemy’s job by having so many more targets to have to take out. And it might also be cheaper than trying to put all your capability in one exquisite system that tries to do it all, that is ‘too big to fail.’”

Hordes of autonomous robots attacking a target or performing other tasks are still a number of years in the future, Kearns said. AFRL is looking to conduct experiments on the loyal wingman concept by fiscal year 2022. Expanding the distributed collaborative system concept would come later.

There is a lot of ongoing work in autonomy across the Defense Department, and AFRL will leverage some of it. For example, there is no need to do a lot of research into autonomous landing when the Navy has already demonstrated this on an aircraft carrier with its UCLASS unmanned aerial vehicle. Landing on a moving ship is a lot harder than landing on the ground, she noted.

Singer said, “Some things are possible today if we were willing to pull the trigger, budget-wise, and some are several years off.” Meanwhile, there are many videos on YouTube showing some amazing advances with robots flying, sailing or moving in formation, he said.

“But one thing to note about the YouTube aspect: it’s also a good illustration of how so much”.

http://www.nationaldefensemagazine.org/archive/2016/March/Pages/MilitaryBeefsUpResearchIntoSwarmingDrones.aspx

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