Unmanned Systems Sentinel

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Thanks to Robin Alexander, Mark Rindler and Marcy Huber for providing several of the below articles.
22 MAY 2016

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

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Counter-UAS System in Development

INTERNATIONAL:

COMMENTARY:

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For The Navy, Less Must Be More

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UPCOMING EVENTS:

NAVY/USMC:

AeroVironment details Blackwing UAS

The US Navy plans to deploy a new small tube-launched UAS called Blackwing from its submarines and autonomous underwater vehicles (AUVs), AeroVironment announced on 16 May.

AeroVironment developed Blackwing as part of a 2013 Joint Capabilities Technology Demonstration (JCTD) project called Advanced Weapons Enhanced by Submarine UAS against Mobile Targets sponsored by the navy and United States Special Operations Command (USSOCOM).

According to the company, the JCTD was completed in September 2015 'with a strong recommendation to transition the capability into the fleet'.

Blackwing has been designed to deploy from sub-surface platforms. It consists of a miniature electro-optical and infrared payload packaged with a selective availability anti-spoofing module GPS and AeroVironment's secure Digital Data Link. It has been optimised for operation in anti-access/aerial denial environments.

Kirk Flittie, vice president and general manager of UAS, AeroVironment, said: 'AeroVironment's new Blackwing UAS is a valuable new capability that resulted from our team's close collaboration with, and responsiveness to, the US Navy's undersea warfare community and the special operations community.

'In addition to operating from undersea vehicles, Blackwing can also be integrated with and deployed from a wide variety of surface vessels and mobile ground vehicles to provide rapid response reconnaissance capabilities that help our customers operate more safely and effectively.'

https://www.shephardmedia.com/news/uv-online/aerovironment-details-blackwing-uas/

http://www.nationaldefensemagazine.org/blog/Lists/Posts/Post.aspx?ID=2182

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Navy Researchers to Test UAV Swarming Technology this Summer

In June, Navy researchers plan to shoot as many as 30 small unmanned aerial vehicles (UAVs) into the air to see how well they can conduct wartime operations in a swarm and with little or no human direction.

The flying robots are called LOCUSTs – for Low Cost Unmanned Swarming Technology. They are designed to fly together in relatively tight formations and overwhelm and "saturate a potential adversary," said Rear Adm. Mathias Winter, chief of the Office of Naval Research (ONR). Winter discussed the LOCUST program and other ONR endeavors May 17 at the 2016 Sea-Air-Space Exposition.

The LOCUST drones are designed to be smart enough to operate autonomously – with little human control. They can stay in formation, avoid running into each other and reconfigure their formations automatically to continue on with their mission even if one or more drones in the swarm are lost, said Lee Mastroianni, an ONR scientist.

The Navy envisions swarms of flying drones that can be armed with sensors for gathering intelligence, jammers for disrupting enemy communication or munitions for attacking enemy targets. For now, though, the ONR's focus on refining the software that enables the drones to fly and maneuver together autonomously.

The swarm flights planned for June are to take place over land. In July, the drones will head to sea to swarm over the Gulf of Mexico before returning to shore to land, Mastroianni said.

Swarms of five, 10 and up to 30 LOCUST UAVs can be operated by a single human controller, he said. For the most part, each drone is able to fly itself, controlled by an algorithm – a complex set of computer instructions – that has been modeled after the performance of birds and insects when they swarm, Winter said.

Like the swarming animals they mimic, each individual drone knows where it is in relation to the others in the swarm. Each communicates location information to the other drones around it, and also keeps in contact with its human controller.

LOCUST drones are launched from a compact six-tube launcher. After they are shot into the air, wings and tails pop out and a rear-mounted propeller fires up to drive the drone aloft. The launchers can be mounted on ships, aircraft, vehicles or even on other unmanned platforms.

Although they can fly and maneuver in unison while in close proximity to one another, the drones would probably typically operate in formations in which they are spaced about 50 feet apart, Mastroianni said. For the Navy, though, the big issue is that a swarm of UAVs that can be controlled by a single operator, he said.

Achieving workable, swarming autonomous unmanned vehicles moves the Navy a step further along the road to building unmanned vehicles that can virtually think for themselves and react to changing circumstances in combat and other operations, Winter said.

Robots that smart might be operating in the air, on the sea and under the sea in about 15 years, he said.

http://www.seapowermagazine.org/stories/20160517-onr.html

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USN Expects More Development of Stingray Timeline This Year

Excerpt: The navy is prioritizing deploying the unmanned capability on the carriers as opposed to the stealth element, so redefined the requirements to acquire a refueling ISR asset instead of a stealthy strike one. This is ultimately in line with what the navy's Boeing F/A-18 Super Hornets currently do, and will alleviate the burden on the fighters so that they can carry out the strike role.

Full story:

NEW ORLEANS - A risk-reduction request for proposals (RFP) for the U.S. Navy's MQ-25 Stingray unmanned air vehicle acquisition is expected to be released "this summer," which will help set out the timeline in which the service can realistically expect the tanker system to be deployed on-board its carrier fleet.

Speaking to Flightglobal at the AUVSI Xponential show in New Orleans, Louisiana on 3 May, Rear Adm. Mark Darrah, PEO Unmanned Aviation and Strike Weapons for the navy, said that the move from a stealth intelligence, surveillance and reconnaissance (ISR) strike aircraft to the tanker variant now being proposed has left questions over the availability of the technology and timeframe for its development.

The goal is to release a risk-reduction RFP this summer, which will be followed by an engineering, manufacturing and design RFP in early FY2017, he says.

The intent it still to speak to the same four bidders that were selected for the previous iteration of the program - the unmanned carrier-launched airborne surveillance and strike, or UCLASS - and the risk-reduction RFP will seek information on the technology that the companies currently have, and how much it will cost.

Boeing, General Atomics Aeronautical Systems, Lockheed Martin and Northrop Grumman all have designs they were going to pitch for UCLASS, and are expected to modify them for the Stingray's new role.

"It's giving us the opportunity to incorporate new ideas," Darrah says, and the acquisition timeline will then be set out once this information is garnered from industry.

"We are definitely trying to find that sweet spot in cost and schedule," he says. "Our intent is to get this capability to the carriers as soon as possible."

The navy is prioritizing deploying the unmanned capability on the carriers as opposed to the stealth element, so redefined the requirements to acquire a refueling ISR asset instead of a stealthy strike one. This is ultimately in line with what the navy's Boeing F/A-18 Super Hornets currently do, and will alleviate the burden on the fighters so that they can carry out the strike role.

Elsewhere, the navy is also looking to utilize the capability of its smaller fleet of UAVs more, by "tying together" the assets into a common operational picture to standardize the way that data is communicated to those that need it.

"We continue to see a huge demand from the warfighter for unmanned capabilities at the company level," Darrah says. The navy is targeting more cross-level use of systems such as the AeroVironment Puma and Wasp and Honeywell T-Hawk systems, to be able to deploy the most suitable ISR assets for each job.

This extends to including more payload options in the smaller systems, and Darrah notes that a key priority of the navy is to incorporate scalable technology from the larger platforms to the smaller ones.

He also praised the performance of the Insitu RQ-21 Blackjack UAV that is being deployed from the navy's amphibious assault ships, that are providing "situational awareness that they never had."

"We've learnt a lot about training, sustainment and spares from this," he adds. This includes the logistics of ensuring stable take-off and landing of the UAV from the vessels, and countering the potential loss of GPS when at-sea.

The navy's Northrop MQ-8B Fire Scout rotary-wing UAV is also performing well at sea as it deploys alongside the Lockheed MH-60R helicopter on the Littoral Combat Ships.

The number of people deployed on the ships has been decreased as a result of the unmanned option, which is in line with the navy's desire to utilize these ISR assets more.

The final test of the larger MQ-8C is on track for FY17, and the campaign is "doing very well," Darrah notes. The radar program for the MQ-8C is also underway, and the navy is receiving early demonstrations of options.

A so-called Milestone C decision on the Northrop MQ-4C Triton high-altitude development is expected in June, meanwhile, which will lead on to low-rate initial production and a planned first deployment in FY18.

https://www.flightglobal.com/news/articles/usn-expects-more-development-of-stingray-timeline-th-424923/

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ARMY:

US Army Special Operations Has Big Appetite for ISR - UAS

ATLANTA — US Army Special Operations has a big appetite for intelligence, surveillance and reconnaissance assets and is just scratching the surface on what is possible, according to Maj. Gen. Clayton Hutmacher, its deputy commander.

“ISR and, really, unmanned aerial systems are relatively new for Army special operations aviation,” Hutmacher said at the Army Aviation Association of America Mission Solutions Summit.

At a higher level, the Army Special Operations Aviation Command also has oversight over Shadow “group 3” UAS — bigger than a Raven and smaller than a Gray Eagle.

While Army Special Operations has brought into the fold both Gray Eagle and Shadow, “I believe [ISR] is a growth industry for all of us,” Hutmacher said.

Gen. Raymond “Tony” Thomas, the new leader of US Special Operations Command, who replaced Gen. Joseph Votel, the new US Central Command commander, provided his guidance to the special operations force “a few weeks ago,” Hutmacher said, “and his number one priority was increasing our ISR capacity and capability, so we have to pay attention to that.”

Under the leadership of Brig. Gen. Erik Peterson, the Army Special Operations Aviation Command commander, Gray Eagles are “doing very, very well in combat and proving themselves over and over again and are highly sought after by the commanders forward,” Hutmacher noted.

Yet the Army’s special operations force would really like its UAS to be runway independent, according to Hutmacher

“Right now our Shadow fleet, we are dependent on a runway to recover that aircraft, so if you think about it from a special operations perspective, that is a problem set for us,” Hutmacher said. “One of our key tenets is to operate in denied territory for extended periods of time. If you are tied to a linear terrain feature only, one, you become very predictable for the enemy, it narrows where they are going to look for you. Two, it presents a tactical dilemma to a small ground force to provide security over a linear terrain feature.”

Having to use a runway either for takeoff or landing is “obviously unacceptable,” Hutmacher added.

When it comes to rotary-wing UAS, “the only thing I’m worried about,” Hutmacher said, “is you’ve got a lot of dynamic components up there in the head and so there’s more maintenance, there’s more cost, there’s more weight. So if we can do it with a fixed airplane with less complexity and less cost let’s do it that way.”

Army Special Operations also wants to get away from the “dog breakfast” of more than 300 air vehicles beyond the standard Army UAS it has acquired, ARSOAC commander Peterson said earlier this year. Special operations wants new UAS that can carry multiple sensors to collect vital intelligence from the battlefield and is working with the Army to achieve this capability, he said.

Special Operations is also using manned-unmanned teaming in its own way, Hutmacher said. While it isn’t deploying the helicopters and UAS in the same way the conventional Army is — filling the gap in the service’s armed scout capability by teaming Apaches and Shadows — “we are doing MUM-T every single night,” he said. “A lot of the formations over a target, there is no one in that cockpit.”

One area Special Operations is less interested in is optionally piloted aircraft. “It’s hard, to me, to envision why we would want that if it’s in direct support of a ground force,” Hutmacher said. “Someone could say, ‘Well, it’s too dangerous, we don’t want to put a person in there,’ but if we are putting people on the ground then it’s a hard argument.”

Special operators are gaining intellectual understanding of how much value UAS add, and Hutmacher said, “my opinion is we are only scratching the surface on different mission equipment packages we can strap on those airplanes from deception to kinetic strike to signals intelligence or imagery intelligence. … We’ve got a long way to on those and I think it’s a very bright future.”

http://www.defensenews.com/story/defense/show-daily/aaaa/2016/05/09/us-army-special-operations-has-big-appetite-isr/83883904/

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Army tests prepare for all-domain warfare

In the future, the real battles in air space will take place in the unseen layers of the electromagnetic spectrum, something the Army has been preparing for in a series of exercises.

The service has conducted a string of experiments that take into account several factors, including that future expeditions will be joint operations involving multiple U.S. military services as well as coalition partners, that adversaries will be well-equipped to operate in the spectrum and that the spectrum will be contested.

The experiments incorporated the cyber and spectrum domains in addition to the traditional domains of air, sea and land, Col. Wayne Grieme, division chief of the Joint & Army Experimentation Division, of the Army’s Training and Doctrine Command’s Capabilities Integration Center, said during a recent round-table in Washington, D.C.

The exercises included low, medium and high-altitude artillery; missiles of various ranges; space-based weaponry; a variety of unmanned aerial vehicles used for both strike and reconnaissance; and fixed-wing and rotary aircraft. One focus was the challenges of dealing with unmanned aircraft, whose growing ubiquity and affordability makes them available even to non-state actors. Another was on dealing with signals that could interfere with operation of UAS and other aircraft.

Although the Army said the details were classified, the exercises, conducted with 11 centers of excellence battle laboratories and the Army Special Operations Command, simulated a hybrid threat from state and non-state actors across all domains.

The Army is planning to continue development of joint, all-domain capabilities with the Unified Challenge 16.2, a simulation exercise planned for the fall, focusing on the force of 2025-2030. Another exercise, Unified Quest, will focus on 2030-2050.

https://defensesystems.com/articles/2016/05/10/army-simlations-contested-spectrum.aspx

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US Army tests GBSAA system

A ground-based radar inputs data to the GBSAA Traffic Display, while on-board aircraft transmitters broadcast position. Data from three different radars are fused and compared to data from the aircraft. A human ground based operator (GBO) monitors the traffic display for aircraft positions, warnings and system health.

The display exhibits concentric rings with distances of two, four and six miles outward, with the UAV at the centre. Aircraft within the four mile ring with a threatening projected trajectory are tagged yellow and prioritised on the alert display. The tag becomes red at the two mile ring if the threat increases, with audio-visual alerts sounded on the alert display.

The alert display notifies the GBO of potential aircraft conflicts monitored by the GBSAA system. The GBO communicates with the aircraft operator directly.

John Innes, test lead, said: 'The warning system allows, at the minimum, one minute to take corrective action. In actual practice, operators would have longer time to take action.'

The new GBSAA removes the need for a chase plane or ground observer to fly UAVs within the NAS. Developers will return to the testing ground in the autumn of 2016 to complete the final part of the last test, and to conduct one full test. Innes expects continued testing at Dugway as changes and issues within the GBSAA are explored or developed.

At present, the GBSAA is solely for military use and there are no plans to extend it to the commercial sector. GBSAA testing has been successful enough so far for the army to decide to field it at five major stateside installations. The air force and marines have also expressed interest in fielding the system at one of their US installations.

https://www.shephardmedia.com/news/uv-online/us-army-tests-gbsaa-system/

https://www.army.mil/article/167610/Dugway_tests_system_for_easier_UAS_transit/

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Army Mulls Hybrid Electric for Next Gen Drones

WEST PALM BEACH, Fla.: Army experts are “extremely excited” by the idea of hybrid electric aircraft, one of the service’s top Unmanned Aerial Systems (UAS) experts revealed Tuesday.

“My team has believed that was the case for some time,” Lars Ericsson, chief of the technical management division in the Army UAS office, said on a panel at the American Helicopter Society International’s annual conference here. “What we’re extremely excited to watch are the number of S&T (science and technology) programs advancing the technology.”

Ericsson cited three experimental hybrid electric aircraft programs now underway:

- DARPA’s Vertical Takeoff and Landing Experimental Aircraft program, known as VTOL X-Plane, in which

Aurora Flight Sciences of Manassas, Va., is building an unmanned hybrid technology demonstrator called LightningStrike. The odd-looking plane will use a conventional turbine engine to power three 1 megawatt electric generators powering 24 electric motor-driven ducted fans in a tilting wing and a tilting canard.

- The Great Horned Owl Program (GHO), an Intelligence Advanced Research Projects Activity (IARPA)

effort to develop, as the IARPA web site describes it, “technologies that significantly extend the operational endurance and payload capabilities of ISR UAVs (intelligence surveillance and reconnaissance unmanned aerial vehicles).” The first phase of the GHO program is developing “a propulsion system that will quietly generate electrical power from liquid hydrocarbon fuel,” the web site explains.

- NASA’s GL-10 Greased Lightning, a technology demonstrator aircraft that uses ten electric propellers

on a 10-foot tilting wing to take off and land vertically and fly like an airplane.

A number of other U.S. and foreign companies are working on such “distributed electric propulsion” and “hybrid electric” aircraft, which are designed to escape the severe limitations of batteries that make pure electric aircraft of any size impractical by using conventional power plants to generate their electricity.

The 2020s drone being discussed wouldn’t replace the Army’s most capable unmanned aircraft, the MQ-1C Gray Eagle, which can carry four AGM-114 Hellfire missiles and fly for 24 hours at altitudes up to 25,000 feet. But Ericsson said the Army wants to get as much capability out of its future drones as it has now in its fixed-wing drones, which include the RQ-7B Shadow. The newest version of the Shadow can fly nine hours at up to 18,000 feet. The Army also wants its future drones to be able to take off and land vertically.

“Efforts like VTOL X-Plane, like Great Horned Owl, like Greased Lightning” are “extraordinarily exciting to us,” Ericsson said, “because if you look at what we are going to ask for in the ‘20s, we want to retain as

much of that payload/endurance combination that we have now out of our great fixed wings…but we want to operate out of those austere areas. Runway independence is the most frequent term you hear."

The Army also wants it 2020s drones to be able to go into more heavily defended areas than today's UAS can, he said.

Potential adversaries know how valuable drones have become to U.S. forces and "have moved out to deny us that capability or degrade that capability," Ericsson said. "I sometimes joke that counter UAS is a growth industry." Beyond that, he said, "The platform we procure in the '20s has to serve in the '40s and '50s. Think of what the world will look like."

Perhaps electric?

http://breakingdefense.com/2016/05/army-mulls-hybrid-electric-for-next-gen-drones/

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USAF:

USAF's Small UAS roadmap calls for swarming 'kamikaze' drones

If the US Air Force needed to break into places like Iran, North Korea, Russia or China, it would overwhelm those countries' integrated air defense systems with tens of thousands of small and relatively cheap small unmanned aircraft acting as jammers, decoys, cameras and "kamikazes".

That is according to Col Travis "Flare" Burdine, the air force's division chief for remotely piloted aircraft operations at the Pentagon, whose office is preparing to unveil the air force's first comprehensive vision statement relating to smaller unmanned aircraft systems (SUAS).

Unlike the army which uses ground-launched devices like the AeroVironment RQ-11 Raven to keep watch over its brigades, peer over hills, identify targets and create communications gateways between hard-to-contact units, the air force would launch its versions from heavy bombers, and whichever ones have not been struck by an expensive surface-to-air missiles (SAM) would be picked up the back of a Lockheed Martin C-130 turboprop transport aircraft.

"I need a stealth bomber that's going to get close, and then it's going to drop a whole bunch of smalls – some are decoys, some are jammers, some are [intelligence, surveillance, and reconnaissance] looking for where the SAMs are. Some of them are kamikaze airplanes that are going to kamikaze into those SAMs, and they're cheap. You have maybe 100 or 1,000 surface-to-air missiles, but we're going to hit you with 10,000 smalls, not 10,000 MQ-9s. That's why we want smalls."

The air force has been preparing its future vision statement for small unmanned aircraft for some time, telling Flightglobal last August that it would be released sometime "this winter".

Burdine acknowledged the delay, and says that the air force has not paid enough attention to the group 3 class of remotely piloted aircraft. He says the air force now wants to take full advantage of the

innovations coming from the commercial unmanned air systems sector, many of which were on display at AUVSI.

Two programs of record that would help the air force achieve its vision of swarming, highly-automated aircraft cheap enough to build in large quantities is the Gremlins project, which seeks to launch low-cost UAS in volleys and recover them in the back of a C-130. The other is the “low-cost attributable strike UAS demonstration” broad agency announcement that was released in June 2015, which seeks aircraft that are high-performance but essentially expendable if needed. The service is also considering launch concepts like the "arsenal plane", which could be based on a Boeing B-1B or some other large, old air platform.

Burdine says these low-cost SUAS could cost anywhere from $1,000 to $10,000, which puts the air force back on the right side of the cost-curve, if one is shot down by a $1 million missile, like from the Russian S-300 and S-400 integrated air defense systems. The S-300 was recently deployed to Iran.

These SUAS will coordinate their flight paths among each other, with some going left, right, high or low and switching between various sensors, payloads or missions en route.

With this major emphasis on the small unmanned systems space and other funding priorities like the Lockheed Martin F-35, Northrop B-21 and Boeing KC-46 tanker, Burdine does not expect the air force to begin looking for an MQ-X type of system to eventually succeed the General Atomics Aeronautical Systems MQ-9 Reaper, which is currently planned to remain in service into the 2030s. He says the primary focus now is on improving the current MQ-9 inventory. “I wish I could say we have a great plan for that next thing, but right now we’re fixing the things that we have and making them more capable. That’s the emphasis,” he says.

https://www.flightglobal.com/news/articles/usafs-small-uas-roadmap-calls-for-swarming-kamikaz-424973/

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USAF to go small on UAS

Key Points

•The USAF wants to use swarms of SUASs to conduct missions currently allocated to its Predator/Reaper UAS

•Despite the document's specified date, the USAF has not yet set a timeframe for when such operations will be possible using SUASs

The US Air Force (USAF) wants to use swarms of small unmanned aircraft systems (SUASs) to conduct missions currently allocated to its General Atomics MQ-1/9 Predator/Reaper UASs, the service said in a strategic document released at the Pentagon on 17 May.

The 'SUAS Flight Plan: 2016-2036' envisions the use of UASs in 'Group 2', the class of the Insitu ScanEagle UAS, to conduct teaming and swarming intelligence, surveillance, and reconnaissance (ISR), as well as attack operations. The Group 3 MQ-1/9 UASs are currently used by the USAF to conduct ISR and attack operations. Group 2 assets are typically used at a tactical level and are unarmed.

Lieutenant General Robert Otto, USAF deputy chief of staff for ISR, said the envisioned technology is in its early stages but that the service is behind the document's vision. "We do believe that small unmanned aerial systems will be the cornerstone of air force ISR as we look through the next 20 years," he said.

Despite the document's specified date, the USAF has not yet set a timeframe for when such operations will be possible using SUASs, Colonel Brandon Baker, chief of the USAF's remotely piloted aircraft capabilities division, said during a Pentagon press briefing. "We're really at the crawl stage," he said. "We're in the 'prove it' stage, and what I mean by that is [that] we have written a visionary document that discusses concepts of operation in the future and how we may be able to get at certain medium-altitude roles and missions that we currently fly with our MQ-1s and MQ-9s, but we have yet to prove it."

http://www.janes.com/article/60443/usaf-to-go-small-on-uas

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NATIONAL AIR SPACE:

California has the Most Drones in US

FAA releases its database of registered drone users

There are nearly 60,000 registered drone users in California.

California is home to Silicon Valley, Silicon Beach, and now — it appears — Silicon Sky. The state comes in No. 1 for having the most registered drones, both in the commercial and hobby space.

The Federal Aviation Administration on Wednesday released two databases of all registered commercial and hobby drones in the U.S., five months after announcing a rule that all owners of drones greater than 0.55 pounds need to register their aerial vehicles online with the government.

A heat map shows where most of the commercial drone users have registered.

View an interactive version of this map here.

In the commercial drone space, Menlo Park, Calif. takes the cake for having the most registered drone users. Menlo Park, which has 176 registered drone users, is one of the cities that makes up Silicon Valley and is home to Facebook Inc. FB, +0.06% (which is working on drones of its own). It’s also home to startups such as drone delivery company Matternet and Skydio, which was founded by a team of

researchers from MIT and Google's drone team, and creates drones that are smart enough to react to and avoid obstacles like trees

Other areas topping the list include Maxwell Air Force Base in Alabama, as well as Los Angeles and its neighboring city Burbank, where crews are increasingly using drones to shoot Hollywood films.

Cities with the most registered commercial drone users

Ranking City Number of users registered to operate commercial drones

1 Menlo Park, Calif. 176

2 Maxwell Air Force Base, Montgomery, Ala. 138

3 Los Angeles 83

4 San Diego 61

5 Austin, Texas 59

6 Burbank, Calif. 57

7 Houston 53

7 Atlanta 53

9 Miami 50

10 Portland 46

Source: Federal Aviation Adminstration

And if you're looking for drones being used for hobby purposes, look to Houston. The city is No. 1 with 3,061 registered hobby drone users. But Houston also comes in the top 10 for having the most registered commercial drone users.

Dyan Gibbens, founder and CEO of Houston-based drone company Trumbull Unmanned, says she's not at all surprised that Houston ranks so high for commercial drone use, given Houston's strong energy sector.

"Houston is supportive of innovation, and when you look at oil and gas companies, they are really technology companies," she said. "Drones make operations better, faster and safer."

Trumbull Unmanned uses drones for mapping, inspecting and monitoring, primarily in the energy sector, and its clients include Chevron Corp. CVX, -0.21% and BP BP, -0.47% Using a drone for projects like a flare-stack inspection can cost about an order of magnitude less in time and money than using a ladder truck or scaffolding, Gibbens said.

“Particularly in oil and gas, safety is paramount at all times and the cost savings are amplified during a downturn, which we are in currently,” she said.

Cities with the most registered hobby drone users

Ranking City Number of users registered to operate hobby drones

1 Houston 3,061

2 San Diego 2,445

3 Austin 2,111

4 Los Angeles 2,104

5 Miami 2,047

6 Las Vegas 2,028

7 San Jose 1,955

8 Phoenix 1,799

9 San Antonio 1,775

10 Chicago 1,664

Source: Federal Aviation Adminstration

Nearly a half a million drone users have registered for hobby purposes since registration opened in December. And Goldman Sachs says the market is only growing. The consumer drone industry will grow from a $1.6 billion market in 2015 to a $3.3 billion market by 2020, according to a March 2016 Goldman report.

A heat map shows where most of the hobby drone users are registered. While California has the most registered hobby drone users, the eastern half of the U.S. dominates for most hobby drone users. Texas ranks No. 2, followed by Florida, New York, Pennsylvania and Illionois for having the most registered users.

View an interactive version of this map here.

http://www.marketwatch.com/story/this-is-the-no-1-city-where-americas-drones-are-flying-2016-05-18

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FAA Expands Drone Detection Pathfinder Initiative

The Federal Aviation Administration (FAA) is expanding the part of its Pathfinder Program that focuses on detecting and identifying unmanned aircraft systems (UAS) flying too close to airports.

Today the FAA signed Cooperative Research and Development Agreements (CRDAs) with Gryphon Sensors, Liteye Systems Inc. and Sensofusion. The FAA will evaluate procedures and technologies designed to identify unauthorized UAS operations in and around airports. This research effort, part of the FAA's Pathfinder Initiative, addresses one of the significant challenges to safe integration of UAS into the nation's airspace.

"Sometimes people fly drones in an unsafe manner," said Marke "Hoot" Gibson, FAA Senior Advisor on UAS Integration. "Government and industry share responsibility for keeping the skies safe, and we're pleased these three companies have taken on this important challenge."

"Gryphon Sensors, LLC is excited to collaborate with the FAA on utilizing technologies that detect, track and identify errant or hostile UAS in and around our nation's airports and sensitive areas. Detecting these threats is challenging because most of them are very small, fly low to the ground and can be pre-programed to fly autonomously," said Gryphon Sensors President Tony Albanese.

"Our AUDS team is very excited to join the FAA's efforts to counter rogue UAVs," stated Thomas Scott, President of Liteye Systems. He added, "As the legitimate use of unmanned vehicles becomes more prevalent in many industries, unfortunately this large number of aircraft also makes them readily available for illicit use. With the right technologies we can assist the UAV operator to conduct his mission, while protecting against those who wish us harm."

Sensofusion, Inc. CEO Tuomas Rasila said, "We first developed the technology to detect, locate, track, and gain control over UAS three years ago as a military project and operated it with three European armies under NATO. Fast forward to the present time, and AIRFENCE is now protecting various customer sites in Europe, including prisons, high profile government buildings, police, and military sites. Since the technology is software based, it improves with over-the-air updates, ensuring that we are always ahead of the commercial UAS market."

The companies' prototype UAS sensor detection systems will be evaluated at airports selected by the FAA. The agency and its federal government partners – particularly the Department of Homeland Security (DHS) – will work with the companies to study how effective their respective technologies are, while ensuring they do not interfere with the safety and security of normal airport operations.

The CRDAs with Gryphon, Liteye and Sensofusion expand upon collaborative efforts with industry to develop system standards to identify unauthorized UAS flights near airports, which could pose a hazard to manned aircraft. The agency has seen a steep increase in reports of small UAS close to airports over the last two years.

The FAA has also partnered with DHS and CACI International on similar research to explore how that company's prototype detection technology may help detect UAS.

The FAA supports DHS in an inter-agency effort to meet the threat of unauthorized UAS from a “whole of government” perspective. Other participating federal agencies include: the Department of Defense, Department of Energy, U.S. Secret Service and the Federal Bureau of Investigation.

http://www.faa.gov/news/updates/?newsId=85532&omniRss=news_updatesAoc&cid=101_N_U

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FAA Key Initiatives – UAS

Drone Advisory Council (DAC)

The purpose of the FAA's newly announced UAS Advisory Committee is to provide an open venue for FAA and key decision makers supporting the safe introduction of unmanned aircraft systems into the national airspace system. The Advisory Committee will be led by Intel CEO Brian Krzanich and FAA Administrator Michael Huerta will be the Designated Federal Official. Members on the Committee will work in partnership with the FAA to identify and propose actions to the FAA on how best to facilitate resolution of issues affecting the efficiency and safety of integrating UAS into the NAS. Membership will be comprised of a cross-section of UAS stakeholders that represent the wide variety of UAS interests — including industry, government, research and academia, retail, technology, etc. RTCA will assist the FAA with the selection process. Final membership decisions will be made by the FAA. Interested parties should visit www.rtca.org for more details.

Test Sites

After a rigorous 10-month selection process involving 25 proposals from 24 states, the Federal Aviation Administration has chosen six unmanned aircraft systems (UAS) research and test site operators across the country. In selecting the six test site operators, the FAA considered geography, climate, location of ground infrastructure, research needs, airspace use, safety, aviation experience and risk. In totality, these six test applications achieve cross-country geographic and climatic diversity and help the FAA meet its UAS research needs.

Center of Excellence

The use of unmanned aircraft systems (UAS) in civil airspace raises many technical, policy and procedure questions. To better understand how the aircraft can be integrated into the National Airspace System, the FAA has selected Mississippi State University to lead a research team focused on the safe and successful UAS integration.

Section 333

The FAA has been working for several months to implement the provisions of Section 333 of the FAA Modernization and Reform Act of 2012, "Special Rules for Certain Unmanned Aircraft Systems," which will allow for commercial operations in low-risk, controlled environments.

Pathfinder Focus Areas

The UAS Pathfinder initiative with industry will explore the next steps in UAS integration beyond the scope of the FAA's proposed Small UAS Rule.

UAS in the Arctic

Section 332 of the FAA Modernization and Reform Act of 2012 tasked the FAA with developing a plan to designate permanent areas in the Arctic where small unmanned aircraft could perform research and commercial operations.

June 10, 2014 – FAA Approves First Commercial UAS Flights over Land

September 23, 2013 – FAA Opens the Arctic to Commercial Small Unmanned Aircraft

AFS-80 will provide white paper on second Arctic operation

Arctic Implementation Plan (PDF)

UAS Roadmap

The first annual UAS Roadmap addresses current and future policies, regulations, technologies and procedures that will be required as UAS operations increase in the nation's airspace. Integration of Civil UAS in the NAS Roadmap (PDF).

http://www.faa.gov/uas/legislative_programs/

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FAA Releases Drone Registration Location Data

The Federal Aviation Administration (FAA) has just posted a large database showing the city, state and zip code of each registered drone owner. Release of the database responds to a number of Freedom of Information Act (FOIA) requests submitted since the new unmanned aircraft registration system began operating on December 21, 2015.

The FAA is not posting the names and street addresses of registered owners because the data is exempt from disclosure under a FOIA exemption that protects information in agency files from a clearly unwarranted invasion of personal privacy.

The FAA based its determination to post only city, state and zip code on several factors, including, in part, that many of the registrants are minors and only hobbyists or recreational users. In addition, when the FAA published its Federal Register notice pertaining to the new unmanned aircraft registration system it specifically advised the public that name and addresses would only be available by the registration number issued to the registrant. For these reasons, the FAA believes the privacy interest in such data outweighs any public interest.

Anyone who owns a drone weighing more than 0.55 lbs. but less than 55 lbs. must register before flying the aircraft outdoors for hobby or recreation. All owners of small unmanned aircraft used for other purposes must also register as one of the requirements associated with a Section 333 exemption.

You can view and search the registration data here.

http://www.faa.gov/foia/electronic_reading_room/media/Reg-by-City-State-Zip-12May2016.xlsx

http://www.uasvision.com/2016/05/19/faa-releases-drone-registration-location-data/?utm_source=Newsletter&utm_campaign=52554a414a-RSS_EMAIL_CAMPAIGN&utm_medium=email&utm_term=0_799756aeb7-52554a414a-297540877

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FAA and FBI Test Drone Detection

Before the first drone hits an airplane, the FAA wants to be ready. Small unmanned flying objects can damage a plane, like in the tragic case where a bald eagle crashed into a small plane and caused an accident that killed everyone on board. Reports of drones flown near airplanes are increasingly common, even if the drones in question sometimes turn out to instead be plastic bags. Still, the FAA wants to be ready, so to make sure they can spot a drone flying at an airport, earlier this month they flew a bunch of drones at New York's John F. Kennedy International Airport.

Beginning May 2, the FAA conducted evaluations at JFK to study the effectiveness of a Federal Bureau of Investigation (FBI) UAS detection system in a commercial airport environment. Five different rotorcraft and fixed wing UAS participated in the evaluations, and about 40 separate tests took place.

Besides the FAA and the FBI, other federal and local agencies were involved in the tests, including the Department of Homeland Security, Department of Justice, Queens District Attorney's Office, and the Port Authority of New York and New Jersey. We won't know yet what the FAA learned from the tests, and because the tests were about finding security flaws, it's unlikely the agencies involved want to publicize any weaknesses they found. It's also not clear what kind of detection system they're using, since drones are too small for radar to confirm. Our money's on some kind of audio or visual system.

The test likely missed the more obvious danger to airplanes: birds and other wildlife, which are more common than small civilian drones, and have a long record of unintentional plane collisions.

http://www.popsci.com/faa-tests-drone-detection-at-jfk-airport?dom=rss-default&src=syn

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A Look Back at April Drone Law Developments: the Micro UAS Report

This past month, a FAA committee tasked with providing recommendations on a regulatory framework for the classification and operation of micro unmanned aircraft systems ("UAS" or "drones"), submitted its official report to the FAA.

The Micro UAS Aviation Rulemaking Committee ("ARC") was directed to develop "recommendations for a performance-based standard that would allow for micro UAS to be operated over people who are not directly participating in the operation of the UAS." On April 6, the FAA accepted those recommendations. Moreover, the FAA has already started the process of developing a notice of proposed rulemaking based on the ARC's recommendations.

While trying to balance the twin goals of ensuring safety and encouraging innovation, the ARC identified four small UAS categories defined primarily by level of risk of injury posed by operations over people. For each category, the ARC recommended a risk threshold that is based on either weight or an impact energy equivalent.

Category 1 includes small drones weighing .55 lbs (250 grams) or less, including accessories and payload (e.g., cameras). The ARC considers the level of risk of injury posed by this category of UAS to be very low. Consequently, the ARC recommended that no performance standards and no operational restrictions beyond those imposed by the proposed part 107 of Chapter 14 of the Code of Federal Regulations ("part 107") are necessary.

Based on the risk that a UAS could strike a person on the ground causing serious injury, the standards and restrictions in categories 2, 3, and 4 are "scaled up" to mitigate the increased risks.

Category 2 includes drones that weigh more than .55 lbs (250 grams) but still present a 1% or less chance of serious injury to a person in the event of impact. Depending on its design characteristics and operating instructions, a 4 to 5 pound drone would qualify. On the other hand, category 3 and 4 drones would have a 30% or lower chance of causing a serious injury upon impact with a person.

The ARC recommended that category 2 drones must, among other things, be operated at a minimum distance of 20 feet above people's heads, or 10 feet laterally away from people. Even with these minimum distance requirements, the small UAS must always maintain a safe distance from people so as not to create an "undue hazard" to those people.

Under the ARC's recommendations, category 3 operational restrictions "do not allow flight over crowds or dense gatherings of people." But category 4 differs because it allows sustained flight over crowds or dense gatherings of people beyond what is permitted in category 3. Since an increased number of people on the ground may be subjected to overhead flight of longer duration, category 4 prescribes additional standards and restrictions for drone operations over people that present the same level of risk of serious injury as category 3 (i.e. 30% or less).

Accordingly, the ARC recommends that category 4 drones (1) require the drone operator to have a risk mitigation plan in place for conducting sustained operations over people and (2) take into account

materials and components of the drones to determine if the materials pose additional potential risk of collateral serious injury to people on the ground, in addition to injury caused by initial impact.

In each case, extensive testing would be required to determine that the drone meets the weight or impact energy threshold for its category. Additionally, to demonstrate that a small UAS qualifies for categories 2, 3, or 4 operations over people, the manufacturer of the drone must: (1) declare that the small drone meets industry consensus standards applicable to the category; (2) submit that declaration to the FAA in a form and manner acceptable to the FAA; (3) label the product or product retail packaging in accordance with industry consensus standards;[1] and (4) provide an operating manual to the operator that includes operator instructions for flight over people. Lastly, drone operators would be responsible for knowing what category of operations his or her drone qualifies for, and what operational limitations he or she must follow.

The ARC's recommendations illustrate an effort by drone manufacturers to put drones on the path to everyday commercial and recreational use in populated areas by lessening the operational restrictions and requirements set forth by the FAA in the proposed rules in part 107 announced in February, 2015. But hurdles remain, including creating tests to determine which drones meet the various thresholds of the performance standards. As noted above, the FAA will use the information in the ARC's report to develop a flexible, performance-based proposed rule and the public will have the opportunity to comment.

It is difficult to predict how long it will take for the FAA to work out the details or how long before companies manufacture drones which meet the standards enumerated above. But what is clear is that this is progress and the application of the ARC's recommendations would allow businesses to use drones for many commercial applications. Indeed, the FAA's ban on flying drones over crowds or in towns and cities could soon be modified further.

[1] For category 1 operations over people, the ARC recommended that the manufacturer of the drone be required to: (1) label the retail product packaging of the small UAS with either the actual weight of the small unmanned aircraft or a general statement that the small UAS weighs .55 lbs (250 grams) or less; or (2) declare that the small unmanned aircraft weighs .55 lbs (250 grams) or less and submit that declaration to the FAA in a form and manner acceptable to the FAA.

http://ontheradar.foxrothschild.com/2016/04/articles/general-uas-news-and-developments/a-look-back-at-april-drone-law-developments-the-micro-uas-report/

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PUBLIC SAFETY:

Unmanned Aircraft Systems Applications in the Solid Waste Industry

His presentation with Terry Pallotto of Tukuh Technologies, a tribally owned 8(a) firm, was entitled "Unmanned Aircraft Systems (UAS) Applications in the Solid Waste Industry." Bill and Terry explained

how UAS, also known as UAVs, provide a cost-effective platform for a wide variety of remote sensing applications for landfill and solid waste management. UAS can be outfitted with live streaming video and terrain mapping cameras to perform tasks such as automated site inspection, orthophotography, 3D mapping and modeling, and small sensor deployment.

http://www.geosyntec.com/news-and-events/item/4992-bill-harris-co-presented-on-unmanned-aircraft-systems-applications-in-the-solid-waste-industry

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NSF grant to help NAU grow and share drone technology

Wildlife biologists and ecologists are data starved because current technologies for tracking small animals are time intensive and produce low sample sizes, said Paul Flikkema, professor of electrical engineering.

NAU researchers are using a National Science Foundation grant to produce an unmanned aerial vehicle to find animals in the wild that are carrying tiny transmitting tags. The technology has potential to vastly improve the ability to track wildlife.

Carol Chambers, a forestry professor and wildlife biologist, has spent years tracking bats. After a small radio transmitter is glued to a bat and it flies away, the researchers track the transmitter's signal, often through rugged terrain.

"It could make our work more efficient because people won't have to drive around for days searching for transmitters, often hiking long distances and up to the tops of hills and mountains to find bat roosts," said Chambers, who primarily works to protect maternity bat roost habitats.

"We will help these wildlife trackers do their jobs and improve information gathering. Instead of using a 20-foot pole, we will basically put an antenna on a UAV that can go up hundreds of feet and better locate the radio tag signals," Shafer said.

NAU's drone technology capabilities for tracking wildlife will turn the UAV into a virtual pole that can fly hundreds of feet in the air and replace or augment handheld poles currently used to pick up radio tag signals.

Wildlife biologists have an easier time studying larger animals because they use GPS-enabled trackers. Those sensors are usually too heavy for bats, birds and other small animals, which need small, specialized radio-transmitting tags.

"We are developing a new UAV that is not available anywhere commercially," said Flikkema. "We think the technology is a great synthesis of a mobile platform with sophisticated electronics and software that together can help find and track small animals."

The NSF grant of $160,000 is applied to instrument development for biological research. Instead of funding new science, NSF is funding NAU's new tool development with the goal of quick distribution to the scientific community.

http://news.nau.edu/nsf-grant-help-nau-grow-share-drone-technology/#.VzNhguSOJnA

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Robotic Lifeguard Named 'Emily'

The U.S. Navy funded research on the development of a fast-swimming "robot lifeguard" that saved Syrian refugees from drowning but has no immediate plans to acquire the EMILY system for the military.

"That's my mission in life, to win them over," Tony Mulligan, the inventor of the system and CEO and president of Arizona-based Hydronalix Inc., said Tuesday of his hopes to see EMILYs aboard U.S. Navy ships. "Other navies and coast guards around the world are using it."

The four-foot, 25-pound EMILYs, for Emergency Integrated Lifesaving Lanyard, were on display at the Navy booth this week at the Navy League's Sea Air Space exposition at National Harbor, and several of them were also zipping about in the Potomac outside the exhibition halls.

Fernando Boiteux, an assistant chief and 30-year veteran of the Los Angeles Fire Department, described EMILY as a "self-propelled life jacket" as he guided two of the maritime robots across a river inlet Monday with a hand-held remote.

Boiteux said his department began experimenting with EMILYs in 2012 and now has four of them that they use off the beach for rescues. He said they were especially useful when rip tides take a group of swimmers away from shore, since the robots can get to them much quicker than a human swimmer.

Boiteux had no estimate for how many people may have been saved by EMILYs operating off the Los Angeles-area beaches, but guessed that it was "quite a few." The same systems used by a Texas A&M research team in coordination with the Greek coast guard also recently helped save an estimated 300 refugees who were in the water off the Greek island of Lesbos.

The Navy's Office of Naval Research, and the Navy's Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs began working with Mulligan in 2001 on the concept for a self-propelled flotation device and funded research on its development.

Mulligan said the finished product was 98% made in the U.S., including the composite hull made on the Tohono O'odham Indian reservation in Arizona. He said the EMILY goes for about $10,000 in the U.S. but the costs can balloon for overseas sales because of taxes.

The bright orange and yellow cylindrical devices are powered by an electric motor that shoots out a water jet stream for propulsion, operating much like a mini-jet ski. EMILYs are made of Kevlar and aircraft-grade composites and "can be thrown off a helicopter or bridge and then driven by remote control to whoever needs to be rescued," Mulligan said in a phone interview.

The latest versions of the devices are equipped with two-way communication radios, a video camera with live feed to smart phones and lighting for night rescues. The motors have also been upgraded to push through strong currents.

About eight people can grab on to EMILY at a time, and they can be reeled back to shore or a rescue boat by a 200-foot line that EMILY can carry to the rescue area.

Hydronalix has sold EMILYs to navies, coast guards and search-and-rescue units in South Korea, Indonesia, Singapore, Japan, Britain, France, Mongolia, Brazil, Mexico, Greece and the Hong Kong harbor police.

http://www.military.com/daily-news/2016/05/18/meet-the-us-navys-robotic-lifeguard-named-emily.html

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Saab delivers Sea Wasp prototypes

The EOD agencies are the South Carolina Law Enforcement Division's Counter-Terrorist Operations Maritime Response Unit, the FBI Counter-IED Unit and the US Navy Explosive Ordnance Disposal Group 2. The agencies will carry out testing and evaluation of the Sea Wasp for the next ten to 12 months.

The Sea Wasp is an underwater C-IED system designed to be operated by a two-man team. It is piloted from a control vehicle ashore using a power-supplying, fibre optic tether, or from the surface using a control console on-board a support vessel.

The system's five-function manipulator arm positions a disruptor beside the target. The vehicle then returns to the surface for recovery, and the disruptor is fired from the surface to neutralise the target.

Saab provided a four-day training session to representatives of the agencies in January 2016 at the Charleston Law Enforcement Training Center in South Carolina. Personnel were trained in how to operate the various tools and sensors of the Sea Wasp, how to pilot the vehicle, and how to fault find and conduct routine maintenance.

https://www.shephardmedia.com/news/uv-online/saab-delivers-sea-wasp-prototypes/

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SENSORS/APPLICATIONS:

Flight Technique of Long-Eared Bats May Offer Insights That Could Improve Drones

Drone designers may take a cue from bats and how they fly slowly to improve aerodynamic controls of their technology, says a new study.

Over the past few years, there has been a growing interest in drones and what they can do. While these unmanned aircraft were used heavily for surveillance, today they figure themselves in forward-looking businesses that wish to use them for quick delivery.

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

But before they can do that, they have to improve their aerodynamic control first to make them more energy efficient. This is where bats come in.

Lund University researchers studied the flight techniques of long-eared bats by making them fly in a wind tunnel, at the end of which is a worm meal. The tunnel was surrounded with smoke while a laser was used behind the bats to measure the force generated by each wing movement.

Based on the data, the researchers learned two crucial things. One, their large ears are actually not a bane but a boon in terms of sustaining their flight.

It's long been believed that echolocation, or the ability to measure distances of objects within a space through the bouncing off of sound-waves, and their ears have allowed the bats to evolve successfully in their 65 million years of existence. They can fly in good height when foraging at night. However, their ears can also be a detriment as they can potentially slow them down. The Swedish study proves otherwise.

"We show how the air behind the body of a long-eared bat accelerates downwards, which means that the body and ears provide lift," said Christoffer Johansson Westheim, senior lecturer for evolutionary biology in the university and one of the study's authors.

This means that the big ears allow the bats to stay aloft while creating a strong resistance.

The second discovery is how these bats propel themselves forward when they fly slowly. It turns out that they generate the needed thrust force by lifting their wings high and away from their body.

"This specific way of generating power could lead to new aerodynamic control mechanisms for drones in the future, inspired by flying animals," Westheim said.

http://www.techtimes.com/articles/156432/20160506/flight-technique-long-eared-bats-offer-insights-improve-drones.htm

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Zero Zero Hover Camera drone uses face tracking tech to follow you

Camera-toting drones that can follow a subject while they're recording aren't a new thing, but a company called Zero Zero is putting a very different spin on them. It's all about how they track what's being filmed.

Zero Zero's new Hover Camera doesn't require you to wear a special wristband like AirDog. There's no "pod" to stuff in your pocket like the one that comes with Lily, and it doesn't rely on GPS either. Instead, the Hover Camera uses its "eyes" to follow along.

https://www.youtube.com/watch?v=aOn-BG4h0pQ#action=share

Unlike some drones that use visual sensors to lock on to a moving subject, the Hover Camera uses them in conjunction with face and body recognition algorithms to ensure that it's actually following the person you want it to follow.

For now, it can only track the person you initially select. By the time the Hover Camera goes up for sale, however, Zero Zero says it will be able to scan the entire surrounding area for faces. They'll then be presented to you on their mobile app, and you'll be able to tell the drone who you want to follow by tapping their picture. That same mobile app will also allow you to control the Hover Camera's movements manually when the situation calls for it.

Another cool feature of the Hover Drone: it folds up for easy storage and transport. Flip down the two "wings" and you're left with something roughly the size of a VHS tape. Unfold them, power it on, and let go, and it hovers in place until you tell it what to do.

http://www.geek.com/news/zero-zero-hover-camera-drone-uses-face-tracking-tech-to-follow-you-1653409/

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Stanford Researchers made a drone that can land on walls like an insect

Researchers at Stanford are trying to give drones another of insects' useful traits: the ability to land on vertical walls, and even upside down. They've already gotten pretty far on a system that lets drones do that. As one of the researchers writes at IEEE Spectrum, the setup has two parts: a rigid tail, and a pair of "micro-spines." The tail allows the drone to correctly position itself while landing; the two micro-spines, which are really just small textured pads, are then dragged along the wall, where they catch on microscopic grooves in the surface.

https://www.youtube.com/watch?v=7cKlbmfY6cQ#action=share

An earlier version of the tech was shown this time last year, but a new video demonstrates the researchers' progress. They have it set up on a modified commercial drone and are able to use it outdoors, seemingly with ease. "While it's still not as foolproof as landing on a level surface, we are closer than ever to making perching accessible outside of a research environment," writes Morgan Pope, a researcher involved with the project. The video compares what they're doing to "mosquitoes and spiders," saying that the drone's micro-spines latch onto walls in much the same way those insects do.

As for why you'd want to land a drone on a wall: it looks cool, for one; but more importantly, it could allow a drone to rest for hours while recording video or capturing data with on-board sensors and then

fly back down to safety. Drones are already revolutionizing how we capture video, but right now that's usually measured in minutes at a time. By letting drones stick to many surfaces, it opens up far more opportunities for researchers and filmmakers. There are, of course, some concerning downsides to drones potentially being able to hide almost anywhere. For now, at least, they're still stuck in and around the lab.

http://www.theverge.com/circuitbreaker/2016/5/12/11668046/drone-wall-landing-tech

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Bee model could be breakthrough for autonomous drone development

A computer model of how bees use vision to avoid hitting walls could be a breakthrough in the development of autonomous drones.

Bees control their flight using the speed of motion (optic flow) of the visual world around them. A study by Scientists at the University of Sheffield Department of Computer Science suggests how motion-direction detecting circuits could be wired together to also detect motion-speed, which is crucial for controlling bees' flight.

"Honeybees are excellent navigators and explorers, using vision extensively in these tasks, despite having a brain of only one million neurons," said Alex Cope, PhD., lead researcher on the paper. "Understanding how bees avoid walls, and what information they can use to navigate, moves us closer to the development of efficient algorithms for navigation and routing, which would greatly enhance the performance of autonomous flying robotics," he added.

"Experimental evidence shows that they use an estimate of the speed that patterns move across their compound eyes (angular velocity) to control their behavior and avoid obstacles; however, the brain circuitry used to extract this information is not understood, " the researchers note. "We have created a model that uses a small number of assumptions to demonstrate a plausible set of circuitry. Since bees only extract an estimate of angular velocity, they show differences from the expected behavior for perfect angular velocity detection, and our model reproduces these differences."

We present a novel neurally based model for estimating angular velocity (AV) in the bee brain, capable of quantitatively reproducing experimental observations of visual odometry and corridor-centering in free-flying honeybees, including previously unaccounted for manipulations of behavior. The model is fitted using electrophysiological data, and tested using behavioral data. Based on our model we suggest that the AV response can be considered as an evolutionary extension to the optomotor response. The detector is tested behaviorally in silico with the corridor-centering paradigm, where bees navigate down a corridor with gratings (square wave or sinusoidal) on the walls. When combined with an existing flight control algorithm the detector reproduces the in-variance of the average flight path to the spatial frequency and contrast of the gratings, including deviations from perfect centering behavior as found in the real bee's behavior. In addition, the summed response of the detector to a unit distance movement

along the corridor is constant for a large range of grating spatial frequencies, demonstrating that the detector can be used as a visual odometer.

http://www.kurzweilai.net/bee-model-could-be-breakthrough-for-autonomous-drone-development

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Crowdsourcing App Detects Drones

A new free smart phone app that tracks drone signals close to airports or crowded events could help prevent unmanned aerial vehicles being used for nefarious purposes such as terrorism.

With terror attacks gripping the world in recent years, security experts are seeking new ways of ramping up defense systems. And now, they're calling on you to help. By downloading a new, free, phone app, users are being encouraged to help keep people at stadiums or airports safe from potential attacks.

DroneWatcher uses a smart phone's wifi receiver to monitor for radio signals of unmanned aerial vehicles (UAVs). The data collected from multiple users' phones is sent automatically to security officials for them to act on. So as Edward Zakrajsek at the developing company DeTect Global puts it – all you really have to do is download it.

"The application is really crowdsourcing, where if we have a hundred users in an area using the app all of their data from detecting that drone gives us much better information, and instead of knowing that the drone is near one phone we can now locate that drone and the controller and essentially plot that drone on a map now with good accuracy and track its movements."

Although the Android-based app is free, developers will be paid by organizers of concerts, sporting venues and airports to access the crowdsourced data. Last October Turkish warplanes shot down an unidentified drone in Turkish air space near the Syrian border after repeated warnings for it to be diverted were ignored. And a year earlier an international soccer match in Belgrade between Serbia and Albania was abandoned after a drone carrying a flag depicting so-called Greater Albania, was flown above the pitch and grabbed by a Serbian player. British security consultant Matthew Finn, managing director of Augmentiq, puts the potential of these drones into perspective.

"If you've now got control of a device that you could put into a sensitive area you could weaponise it, you could do something with that drone that could cause untold damage in a particular area that you as an individual wouldn't be able to get to … You can get into that football stadium, you can get into that shopping mall, you can get into these other areas."

Finn says law enforcement and security organizations need to think carefully about how to deal with the threat. With enough users, DroneWatcher could be a step in the right direction**.**

http://www.uasvision.com/2016/05/10/crowdsourcing-app-detects-drones/?utm_source=Newsletter&utm_campaign=bf49f02d5f-

RSS_EMAIL_CAMPAIGN&utm_medium=email&utm_term=0_799756aeb7-bf49f02d5f-297560805

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COUNTER UAS:

Unmanned Experts Support FAA Program to Counter Rogue Drones

The Federal Aviation Administration (FAA) this week announced an expansion of their Counter-UAS Pathfinder Initiative (Pathfinder 4) with the addition of two new 'drone detection' companies and the first complete Detect-Track-Identify-Defeat system in the form of the Liteye Anti-UAS Defense System, or AUDS. Under its new Cooperative Research & Development Agreement (CRADA) with the FAA, Colorado-based Liteye will deploy its AUDS platform to various airports across the country over the summer, and trials will be run to test its effectiveness in 'defending' controlled airspace from rogue small unmanned aircraft systems (SUAS). To support the trials, Liteye has engaged Unmanned Experts, Inc., to provide supporting SUAS flights and system integration.

Liteye's AUDS (pictured above in set-up trials last year) combines world-leading radar, thermal and electro-optical sensor technologies to detect, track and identify SUAS out to 8km from the control console. Its two-person crew is able to coordinate responses with air traffic control agencies, law enforcement ground parties and 'friendly' UAS to negate any threat posed by the unauthorized drone / drones. Should it be deemed necessary, and if certain Rules of Engagement (ROE) have been met, AUDS has a number of 'non-kinetic' defeat options that can be activated to return the factor SUAS to a safe area or land it in place. Although this CRADA is part of a research program, AUDS is considered fully operational, or TRL9, and is already deployed to protect critical infrastructure in Europe and South East Asia.

Deploying a system to interact with potential SUAS threats requires expertise in the UAS environment. Thus Liteye has partnered with fellow Colorado company Unmanned Experts, Inc. (UMEX), a field-leading team of SUAS subject matter experts and flight crews (details below). UMEX has worked with Liteye over the past year to develop AUDS Concepts of Operations (CONOPS) and training packages. UMEX is also providing a 'Red Team' capability to the group, with their FAA-approved SUAS operators flying numerous fixed and rotary-wing SUAS types at the AUDS test facility to trial the counter-drone solution. An ongoing program of Red Team trials are scheduled to ensure that AUDS is able to keep pace with rapid technology advances in commercial drone capabilities.

"Knowing the characteristics and performance of typical SUAS models," said UMEX CEO Keven Gambold, "we can quickly plan and execute a variety of flight profiles in the AUDS environment, providing a very challenging but efficient trial opportunity for Liteye as they demonstrate their technology."

Another example of applying SUAS technology to the AUDS trials is the recent addition of the Aeryon Labs SkyRanger multi-rotor aircraft as a 'friendly' intelligence gathering asset to AUDS. UMEX, as a SkyRanger operator and Aeryon Labs training partner, has helped Aeryon integrate its hardware and

software into the AUDS system, such that the SkyRanger can be deployed from the AUDS platform (currently only within VLOS, but BVLOS being studied) to investigate suspicious ground and air activity and assist ground teams in locating unauthorized SUAS operators and their aircraft. Field trials are ongoing.

“The concept of interfering with, inhibiting or even ‘knocking down’ airborne devices stirs many visceral emotions, but the increasing threat posed by this new technology cannot be ignored,” said UMEX CGO Bill Cossoff. “With this CRADA, the FAA and its partner agencies are being pro-active in exploring the technical, regulatory, legal and even ethical aspects of a ‘counter-drone’ system operating in U.S. National airspace.”

Unmanned Experts Inc. (unmannedexperts.com) is a Colorado corporation providing world class UAS Managed Services, Consultancy, and Training. Our team of professionals has over 25,000 flying hours on UAS platforms and over 35,000 flying hours on manned aircraft. Unmanned Experts is staffed by UAS and Remotely Piloted Aircraft System (RPAS) pilots, operators and maintainers, as well as specialists with expertise in all areas of unmanned operations, providing dependable; approachable and affordable mentorship in the UAS sector. UMEX is FAA-approved for numerous Section 333 exemptions, allowing for commercial operations of more than 10 different aircraft types within a growing fleet. UMEX has highly trained and experienced operations teams available for tasking and travel at very short notice. Ops crews are OSHA-10 trained, and the company has undergone ISNetWorld Certification.

http://www.unmannedexperts.com/umex-in-faa-c-uas/

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Counter-UAS System in Development

With the proliferation of consumer UAS, the threat of collisions between drones and manned aircraft is a growing concern, particularly to operators of rotorcraft, which tend to fly at lower altitudes than fixed-wing aircraft. To combat this potential hazard, Virginia-based Alion Science and Technology (a $billion-revenue government contractor) is developing a device to take control of encroaching drones and move them out of harm’s way.

“We had talked to a few people in the [rotorcraft] business and they said, ‘We’re really concerned about this because if I get one of these in my tail rotor I’m going to have a problem,’” said Bill Senich, the company’s vice president. Using its existing signal analysis and processing technology, Alion began to design a counter-unmanned aerial system (C-UAS) system that would detect and override control signals sent to unmanned devices. “Some drone operators are good companies, and they are doing good things with UAVs,” Senich toldAIN. “It’s the stuff under the Christmas tree that is causing all the problems. At no time should anybody consider an autonomous drone to be more important than an aircraft carrying people or a lifesaving aeromedical flight departing, unscheduled, from an accident location, for example.”

While the system is currently effective against 87 percent of the 444,000 registered commercially available drones in the U.S., says the company, with a patent pending it is loath to discuss exactly how the equipment functions. Senich did say that the C-UAS system does not use radar, relying instead on signal detection to indicate when a UAV could be close enough to be a threat, and then forcing the offending device to the ground, until control is returned to its operator, either through the C-UAS system being turned off or by it moving out of range.

The technology, which was first publicly displayed this March at Heli-Expo in Louisville, Ky., is still young, and while the company says the basic functionality is sound, it is working on operator interfaces to make it user-friendly. Also to be determined is what shape the eventual consumer product will take. Senich envisions a portable "backpack device that velcros in" and can be moved from aircraft to aircraft. Another choice would be for a hard-wired installation, with at least one rotorcraft manufacturer considering adding it as a factory option, a route that would likely require an STC from the FAA. Another version attracting interest is for fixed, ground-based units to protect airports, heliports and other locations. "A lower-power version might have a range of several hundred feet, or you might need a higher power version with a range of half a mile," said Senich. "These are feasible."

The company anticipates it could have the system in production in six to 12 months.

http://www.uasvision.com/2016/05/19/counter-uas-system-in-development/?utm_source=Newsletter&utm_campaign=52554a414a-RSS_EMAIL_CAMPAIGN&utm_medium=email&utm_term=0_799756aeb7-52554a414a-297560805

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INTERNATIONAL:

COMMENTARY:

Civil Liberties Debate Coming On Drone, Sat Photos

GEOINT: Small satellites — thousands of them, spinning round the Earth, taking endless photos from low earth and sun-synchronous orbits. Drones flying round neighborhoods or sitting on your windowsill and taking photos or relaying imagery.

And you thought the NSA program that scooped up your phone's metadata was intrusive? When most Americans think of privacy and the intelligence community, they think of the National Security Agency. That is likely to change in coming years, as drones and satellites take photos and videos 24 hours a day, seven days a week, sometimes in the service of the government's intelligence agency that provides geospatial information, the National Geospatial Intelligence Agency (NGA) . Companies such as Google-owned Terra Bella, Planet Labs and others hope to build and launch many satellites and find a major market with NGA.

Terra Bella LogoMeanwhile, small drones like the flying beetle in the Eye in the Sky movie also will proliferate, The Army already has a prototype like it, said Collin Agee, senior advisor at the Army's G-2 (intelligence) on the Intelligence Community, speaking at a panel discussion here on small satellites and open source analytics. "The little things can land in the window and have persistence," Agee said. "When we think of privacy concerns we think NSA, but imagery is much more intrusive."

"The civil liberties discussion is coming," Gary Dunow, the National Geospatial Intelligence Agency's director of analysis, said simply. NGA works with the Department of Homeland Security and other law enforcement agencies in the United States to provide geospatial support. In addition to helping DHS with major events such as the Democratic and Republican conventions, the Super Bowl and such, NGA helps domestic authorities with a wide array of support for terrorist and law enforcement threats.

Because of the fact that NGA uses imagery and data from commercial satellites in time of war, the government created something called shutter control. It grants the government the power to stop the satellite companies from providing data or imagery to anyone but the US government for a period of time. The restriction is imposed in the license granted by the Commerce Department to the companies. I asked the panel if shutter control, which has never been used as far as I or anyone on the panel has heard, was obsolete.

Dunow was keenly aware of the need to ensure the quality of data, the safety of data and the availability of data from the new commercial providers. When I asked if shutter control was still needed, he offered this careful reply: "It's not an obsolete issue. However, I think we may have to think about it differently in the future." He didn't elaborate.

http://breakingdefense.com/2016/05/civil-liberties-debate-coming-on-drone-sat-photos/

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Drones and the Future of Aerial Combined Arms

Today, fighter pilots approach warfare like a questing medieval knight. They search for opponents with similar capabilities and defeat them by using technologically superior equipment or better application of individual tactics and techniques. For decades, leading air forces nurtured this dynamic by developing expensive, manned air superiority fighters. This will all soon change. Advances in unmanned combat aerial vehicles (UCAVs) will turn fighter pilots from noble combatants to small-unit leaders and drive the development of new aerial combined arms tactics.

Since ancient times, commanders have dealt with diverse threats by integrating combat arms to achieve complementary effect. Macedonian hoplites were protected by a screen of javelin-throwing skirmishers, medieval pikemen cooperated with primitive musketeers, and modern U.S. Army brigade combat teams integrate artillery, armor, and infantry elements into a unified force. Fighter pilots of the future will not be the individualistic warriors of today, but rather commanders of small combined arms forces largely consisting of UCAVs. As in modern ground forces, these integrated groups of manned fighters and UCAVs will possess a mix of specialized capabilities ranging from direct combat to electronic warfare.

A future fighter aircraft with advanced communications will control semi-autonomous UCAV systems from dozens or hundreds of miles behind the line of battle, well outside the range of most enemy missiles and radars. From this vantage point, the fighter commander will guide drones in a myriad of tasks, locating enemy fighters with advanced radar and infrared sensors, engaging them with UCAV-carried missiles, and blinding the enemy through electronic jamming and attack. While opponents are tied up dogfighting drones, future fighter commanders will seize advantageous positions or engage distracted enemy aircraft with their own missiles.

Future-Aerial-Lines-of-Battle

If a fighter commander is task-saturated or destroyed, aircraft such as the E-3 airborne early warning control center (AWACS) will be able to assume control of the UCAVs through communications links. Pilots onboard the AWACs will fly additional drones in support of fighter elements and take control of UCAVs as friendly manned fighters are lost to the enemy. As the E-3's embedded pilots engage the enemy, other crewmen will feed information to higher headquarters and sync intelligence inputs from friendly aircraft in theater.

Even further from the front lines, legacy bombers such as the B-1 and B-52 will loiter hundreds of miles away and sling long-range missiles at enemy targets painted by UCAV radars and infrared sensors, greatly expanding the number of munitions in the fight. This "aerial artillery" will be especially useful against foes fielding large numbers of fourth-generation fighters.

Dispersing the capabilities of a fifth-generation fighter aircraft like the F-35 across a team of UCAVs also allows for individual weapon systems to be used in the best manner possible. The integration of these functions into a single fighter forces the pilot to employ his systems sub-optimally; theoretically, a stealth fighter conducting an electronic attack could expose its location by repeatedly broadcasting signals traceable by enemy aircraft. Distributing these capabilities among UCAVs allows the controlling fighter to achieve complementary effects by placing UCAVs into the best position to employ their particular weapon system or intelligence-collection capability. Imagine a forward-positioned UCAV jamming an enemy fighter's radar moments before the impact of its wingman's missile.

Combined arms tactics on the ground have evolved for over 2,000 years, but aerial combined arms tactics remain in infancy. The modest integration of unmanned assets with manned fighters and bombers over the last decade has been impressive, but remains nascent.

http://warontherocks.com/2016/05/drones-and-the-future-of-aerial-combined-arms/

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For The Navy, Less Must Be More

The Navy's future depends on what isn't there. Research and development for both vessels and weapons seems predicated on the absence of matter.

Here's what I mean.

In weapons, one of the top priorities is development of hypersonic weapons. In tests, they fling a projectile at many times the speed of sound, such that the energy from impact along can wreck a target. They work on the absence of an explosive inside, like regular ordnance.

The idea of less goes further. Also on the list of research and development priorities: directed energy, according to Dr. John Burrow, the deputy assistant Navy secretary for research and development, science and technology. I spoke to him at the Sea Air Space conference earlier this week at National Harbor. Directed energy used to be seen mainly in bad horror movies. But it's basically a death ray made of microwave or laser beams. They don't shoot shells or other projectiles. They work on an absence of ordnance as we usually think of it altogether.

To do real damage, these still-experimental devices need hundreds of kilowatts of power, a capability few ships have at this point.

Lesser also extends to the size of the Navy itself. The U.S. Navy is big – the biggest in the world. But not as big as it was. It's down to less than 300 deployable ships from a post-war peak of more than 600. Yet, as the current Chief of Naval Operations, Adm. John Richardson, points out, the high seas undergo more and more varied traffic than ever. U.S. economic interests extend everywhere. And, as he and others have pointed out, including in this interview, the U.S. faces a resurgence of "great power" rivals, if not outright adversaries, in China and Russia. Both countries have ambitious navy-building plans, including nuclear subs and carriers.

If you've got a king sized bed to cover, a double-sized blanket won't cover it. But the Navy won't get an embroidered, quilted, king-sized blanket in the foreseeable future.

But unmanned and autonomous – vessels with the absence of sailors – can extend the reach of manned ships and even of ashore intelligence officers and planners. Unmanned refers to vessels operated by a remote person with a joystick somewhere. Autonomous means the vessel sets its own course from point A to point B, with the ability to make adjustments along the way. The Navy – all the armed forces for that matter – pursue both. Absent all of the systems required to support human life, surface and submarine vessels are cheaper to build and operate. The Navy could, under certain circumstances, deploy them in swarms.

As Richardson's Design for Maintaining Maritime Superiority points out, to meet new and still-changing conditions the Navy will "explore alternative fleet designs, including kinetic and non-kinetic payloads and both manned and unmanned systems." All in a "highly 'informationalized' environment..." That is, an information-rich network enables autonomy.

Autonomy, Richard told me, "is coming on fast, right? This role of artificial intelligence, the role of unmanned vehicles – we ignore that development at our peril." He adds, "I'm very interested in finding what is the final correct balance between those types of systems."

Still, Richardson says, "At the end of the day this is a human endeavor." It's also an endeavor that has shown remarkable restraint in repeated provocations by Russia and Iran.

http://federalnewsradio.com/tom-temin-commentary/2016/05/navy-less-must/

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A Categorical Error: Rethinking 'Drones' as an Analytical Category for Security Policy

Editor's Note: What is a drone? Some do surveillance, others hunt terrorists, and some models likely to enter air forces are more akin to sophisticated fighter aircraft. Dave Blair, badass warrior intellectual, argues that lumping these many different systems together under the label "drone" confuses more than it enlightens. It makes more sense, he contends, to focus on the mission set rather than the engineering behind it.

"All models are wrong, but some are useful."

Poor categorization yields poor understanding, which yields poor policies. A good typology keeps like with like, and distinguishes like from unlike, at least for the purposes of the question you're asking. In policy, well-built categories help decision-makers appropriately task issues to the most appropriate agency or process, whereas a poorly-constructed typology potentially condemns a complex issue to interagency hell. In the realm of military strategy, the uncertain nature of emerging technologies makes this all the more critical – without placing poorly- understood new platforms alongside well-understood analogs, we risk venturing into the fantastical. And nowhere is this more apparent than in the NatSec debates about 'drones.'

It is difficult to make coherent policy for the Remotely Piloted Aircraft (RPA) force, because it isn't a united force in any strategically meaningful sense. Whether you call them Drones, RPAs, or Unmanned Aerial Vehicles (UAVs), we've built a category around the remote control system of the RQ-4 Global Hawk, MQ-9 Reaper,* and X-47 aircraft. This is a clumsy and strange category. The three aircraft have radically different levels of automation. Their missions have little-to-no overlap, and they face entirely different operational and tactical challenges. At best, these planes are cousins; more likely, they are strangers. The differences between these aircraft well exceed their commonalities, and we would do better to place them in boxes with other craft that do the same sorts of things that they do.

I recommend that we therefore greatly diminish our reliance on the concept of 'Drones' or 'RPAs,' and instead lump like with like in terms of mission sets. MQ-9 crews, for example, have much more in common with tactical intelligence, surveillance, and reconnaissance (ISR) aircraft in terms of mission familiarity and skills than they do with more strategic ISR aircraft, such as the RQ-4; RQ-4 crews are fluent in U-2-style surveillance, and vice versa, but know little more than the average pilot about how to fly the MQ-9. Therefore, I propose that we consider RQ-4s as Strategic ISR aircraft, in a (somewhat dysfunctional) family with the U-2, and possibly reconnaissance satellites. In another example, MQ-9s and AC-130s both spend hours orbiting over a target, staring through advanced sensors and engaging with off-boresight weapons. Accordingly, we should think of both as 'Persistent Attack' aircraft. Finally, X-47s and future Unmanned Combat Attack Vehicles (UCAVs) have more in common with advanced fighters, such as the F-35, than they do with unmanned aircraft like the RQ-4s or MQ-9s. Because of similarities in performance, stealth technology, and mission set, a true UCAV should be considered kin

with fighters. These three mission-based categories serve far better than control-system categories for answering questions of strategy and policy for these communities.

Mission-Based vs. Control-System-Based Typologies

The category 'Drones' focuses on the control system as if it were the most important aspect of the aircraft. This is essentially tantamount to lumping fighter jets and transport aircraft together because both aircraft use similar electronic control systems or considering transport aircraft like the C-130 and ground attack aircraft like the A-10 as kin because their electro-hydraulic controls. Control systems are one design element amongst many and do not serve as useful analytical categories for most long-term acquisitions or personnel questions. While a control-system-based typology might be useful for technical purposes, it does not help us come to terms with questions of policy or strategy. Accordingly, with the exception of RPAs, the U.S. military does not use control systems, propulsion systems, or crew complement as governing categories for aircraft. Unfortunately, quite a few self-proclaimed 'drone experts' unflinchingly accept the 'drone' categorization, but lack the technical or operational fluency to cash out the vastly different implications of the vastly dissimilar aircraft and mission sets contained therein. The resulting pronouncements are confusing at best to those of us who actually fly these 'fly-by-wireless' planes.

In fact, outside of RPAs, the Air Force classifies aircraft according to mission set. (The schema for naming aircraft is itself called "Mission Design Series.") The B-1, B-2 and B-52 bomber aircraft are very different, but they share the bomber mission, and accordingly we placed them into a shared category. C-17s and C-130s transport aircraft have different capabilities, but they share the concept of airlift, and hence, we classify them as cargo aircraft. F-15s, F-16s, and F-22s are likewise differentiable, but they share 'fighter-ness' and hence we consider them kin.

The differences between these aircraft well exceed their commonalities, and we would do better to place them in boxes with other craft that do the same sorts of things that they do.

By placing remotely piloted platforms under a control-system-based exception to this taxonomy, we've made it very difficult to think about all of these platforms. The MQ-9 dominates the discussion with ubiquitous lethal strikes, but this is not the reality of the RQ-4 world, which primarily consists of strategic ISR. The 'drone' chip-out from the mission-based typology confusingly conflates concepts between these largely disjointed worlds; by decoupling these discussions, we can engage each with far more analytical precision. This conflation also confuses the MQ-9 discussion by overly focusing on the control system and thereby neglecting commonalities with manned aircraft of similar mission sets. While 'Remotely Piloted Aircraft' is a more accurate and precise term than 'drone,' it still makes the same categorical mistake. I propose we rectify this mistake by leaving the control system category to the electrical and computer engineers, and instead, looking toward categories based on mission sets.

How We Got Here

Perhaps more than anyone else, the current category owes its coherence to the superb work of Dr. Tom Ehrhard, who described the history of UAVs in a story arc from the remote-controlled B-24s of the

Second World War to the modern Predator. However, we are victims of his well-earned success – the discussion, especially inside the Air Force, has heretofore taken his lineage and typology of our current RPAs as writ. This provenance places the high-performance, jet-powered, Vietnam-era RPAs, such as the BQM-34 Firebee, as progenitors to the well-known MQ-1 Predator, a claim that has generally gone unchallenged despite the differences in performance and mission between the two craft.

While this lineage was helpful for a time, it has outlived its usefulness. What was once an incubator is now a straitjacket, and the rapidly-maturing MQ-1/MQ-9 and RQ-4 communities are increasingly in a position to chart a course well beyond these initial concepts, which will likely chart courses largely independent of each other.

Now that we have overcome the novelty of 'fly-by-wireless' aircraft, it is time to re-focus on what it is they do. And they do many different things, some of which they do very similarly to their manned counterparts, and sometimes, very differently from each other. Three extant mission categories capture the spectrum of capabilities that we currently, clumsily discuss as 'drones': Persistent Attack, Strategic Reconnaissance, and Air Dominance.

By placing remotely piloted platforms under a control-system-based exception to this taxonomy, we've made it very difficult to think about all of these platforms.

Persistent Attack: Gunships, Tactical ISR, Predators and Reapers

Aviation pioneer Abe Karem gave the Predator wings, but airpower pioneer Colonel Ron Terry gave it claws. Colonel Terry developed persistent attack airpower in order to suppress the Ho Chi Minh trail during the conflict in Vietnam. His basic theory held that an aircraft that could loiter – and look and shoot from that loiter – could exert vertical dominance over the ground so long as one could hold the air. His theories took form in the AC-47 and the AC-130 Gunships, which fused three characteristics: the ability to park over a target, observe it with a sensor package, and engage from that perch with off-boresight weapons. This combination proved devastating in conflicts from Desert Storm to Iraqi Freedom.

Colonel Terry's vision was expansive: he imagined swarming remote aircraft partnering with manned gunships in a persistent cloud over that battlespace. He built an early version of that cloud over the Ho Chi Minh trail, with early versions of that vision realized in the partnership between early AC-130s, OV-10 spotter planes, and QU-22 unmanned intelligence gathering aircraft. This vision bears a striking resemblance to the partnership of persistent ISR/attack aircraft overhead modern battlefields.

These aircraft share bloodlines. The camera ball on the MQ-1 and the camera on the U-28 were both developed out of an effort to develop a new targeting camera for the AC-130 Gunship during the 1990s. Many of the people who founded the modern tactical ISR community, both manned and remote, came from the Gunship circa 2005. Enlisted sensor operators hailing from the AC-130 Gunship community transformed the culture of the early Predator community from an ISR collection community to a tactical raid support and strike platform. All three of these communities share far more DNA with each other than any of them share with the RQ-4 or a future UCAV. Moreover, the aspects of the MQ-1/MQ-9 that

have reshaped the spectrum of policy options – endurance, precision strike, and sensor fidelity – are about persistent attack, not about robotics. Therefore, the concept of persistent attack should guide us toward better manpower and acquisitions choices and ultimately, a better future for the community.

Strategic ISR: Global Hawk & U-2

The dominance of the MQ-1/MQ-9 in the 'Drones' discussion has, unfortunately, drowned out the voice of the RQ-4 Global Hawk community. Their story is distinct and better understood if we consider them as siblings with the reconnaissance U-2. The RQ-4 and the U-2 have broadly similar sensors and mission payloads, performance profiles, and mission sets. They both work closely with intelligence ground stations that direct and analyze their payloads of exotic sensors. They face many of the same challenges and meet those challenges in many of the same ways. They should be considered as kin. The friction between the two communities is then a sibling rivalry, with each focusing on how their particular concept of operations outdoes the other. Future acquisitions choices will eventually put this rivalry to rest, but as interesting as that story will be, it is orthogonal to the issues faced by MQ-1 Predators and MQ-9 Reapers.

Air Dominance: F-22, F-35, X-47

Lastly, the X-47 fills a very different role than either the RQ-4 or the MQ-1/MQ-9. A UCAV is best understood as a remotely-piloted or autonomous strike fighter aircraft. With high performance, long-range sensors, stealth technology and so on, these craft are built with the hallmarks of advanced fifth-generation jet fighters and should be considered as such. While this technology is still maturing, and while we await a synthesis between the current crop of manned fighters and the possibilities of these new technologies, the UCAV seems on track to become kin, partner, or rival to manned fighters. This drama will certainly be fascinating for aviation aficionados, but it once again has little to do with the future of persistent attack or strategic ISR.

Next Steps: Quad-Copters and Small, Swarming Unmanned Aircraft Systems (UAS)

The contemporary discussion generally distinguishes between Small UAS (sUAS) and larger, military-grade UAS. These are two different creatures: in a mission-set category realignment, we should retain the instinct to separate out the sUAS and Quadcopters, store-bought mini-UAVs and their kin, as something new and different from their military counterparts. The Department of Defense explicitly differentiates these classes, as does the very helpful typology from the Center for a New American Security. Given size and cost, Small UAS has no manned counterpart and can have no manned counterpart. As these technologies link with better swarming algorithms and more efficient datalinks, we should expect to see even more disruptive and fascinating applications come from these aircraft.

I recommend referring to any automated craft too small to have a manned equivalent as a 'drone." By this standard, the word 'drone' actually suits these aircraft well – they fly through simple algorithms, they mostly take care of themselves, they can accomplish simple tasks on their own. Similarly, the emerging class of indefinite-duration, high-altitude, solar-powered flying wings seems to be carving a novel niche as 'surrogate satellites.' Since there is no manned equivalent of a craft with one-month or

longer endurance (except perhaps the International Space Station), these would be something new as well and might rightly be called 'drones' or something else entirely. Either way, that discussion is largely uncoupled from the fates of the other three categories of aircraft discussed here.

Conclusion: Electrical Engineering is not Foreign Policy

The technologies that supposedly create the 'drone revolution' animate all of the next generation of tactical aircraft, both manned and remote. The F-22 blows the MQ-1/MQ-9 away in terms of processor speed. The F-35 is no slouch in the realm of datalinks and networking. And frankly, the automation that goes into both of those aircraft puts the MQ-1 Predator and MQ-9 Reaper to shame. We make an analytical error when we overly focus on computers and datalinks in remote aircraft, but overlook them in manned craft. Therefore, the term 'RPA' has a place in technical aeronautical and electrical engineering discussions, but much less so in foreign policy circles. Just as someone who cannot explain feedback loops has no business opining about 'fly-by-wire' aircraft, a working understanding of latency should be a prerequisite for those who wish to publish serious works about remote aviation. Fortunately, mission-based categories require much less of a technical preamble, and they draw upon operational concepts familiar to students of foreign policy.

We clarify our thinking about policy and strategy when we focus on the capabilities and mission sets of aircraft. For instance, we could easily speak about shared future sensor and weapon acquisition equities between the MQ-9 Reaper and the AC-130 Gunship. For almost all questions that spark policy debates, "persistent attack" or "strategic ISR" bins these questions correctly and focuses on the most important feature: operational employment. And this is much of what we, as a community, have been saying all along: what you do should matter more than from where you do it.

*For the purposes of this paper, I consider the iconic MQ-1B Predator as subsumed by the MQ-9A Reaper, because they share deep similarities and were at one point considered two variants of the same craft. In fact, some of the sub-menus in the MQ-9 refer to the aircraft as a 'Predator B' rather than a 'Reaper.'

The views expressed in this article are those of the author and do not necessarily reflect the official policy or position of the U.S. Air Force, the Department of Defense, or the U.S. Government.

https://www.lawfareblog.com/categorical-error-rethinking-drones-analytical-category-security-policy

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