SPECIAL REPORT

by Mark Colborn

5th Annual Energy Drone + Robotics Summit 2021

Police Aviation News

The Woodlands, Texas, October 25th – 27th

by Mark Colborn

Unlike public safety agencies, the energy industry has been slower to introduce robots and Unmanned Aircraft Systems (UAS or drones). But, as evidenced by the concentration of hardware solutions on the exhibit room floor at this year's Energy Drone + Robotics Summit in a Houston, Texas suburb, attitudes are changing fast. Energy companies are quickly realizing that drones and robots can do a plethora of mundane tasks that once occupied countless man-hours and exposed their workers to unnecessary dangers. For confined spaces inspection, leak detection, and internal and perimeter security sweeps, the return on investment (ROI) for drones and robots far exceeds conventional methods. For instance, when a company doesn't have to install scaffolding to conduct structural integrity, valve, or piping inspections, they save time and money, plus cut down on employee injuries. Also, sending a robot into a possible radiation zone to detect problems cuts down on employee radiation-absorbed dose or RAD exposure, again saving money and future health issues for workers.

This year's event was held at The Woodlands Waterway Marriott Hotel and Convention Center. The Marriott proved to be a great venue for this four-in-one event, which included for the first time a one-day Drone Responders Emergency Planning and Disaster Response UAV Forum. Other forums included an Industrial Drone Delivery and Unmanned Cargo Forum, Renewable Energy Robotics and Drone Forum, and Methane Tech Forum. Stone Fort Group, the event organizers, claim in their brochure that this is the only event series exclusively focused on the business and technology of unmanned systems, automation, and data/AI in energy operations.

DRONERESPONDERS Emergency Planning & Disaster Response UAV Forum
Christopher Todd, Executive Director of Airborne International Response Team (AIRT – the official home of DRONERESPONDERS) opened the Emergency Planning and Disaster Response UAV Forum on Monday morning. He pointed out that less than 1% of state, county and local law enforcement agencies in the United States have a manned aircraft unit. Actually, the figure is closer to .025%, considering only 435 out of nearly 18,000 agencies in the U.S. have aircraft. Drones are filling that gap and providing public safety entities, which in the past could never afford a manned aircraft, the capability to view their respective jurisdictions from the air and add that needed force multiplier to their operations.

Since the early 1990's, the Texas Department of Public Safety has recognized the benefit of employing drones in various types of operations. Jason Day, UAS Program Manager in Austin, Texas, gave the attendees a short history and current status of the DPS's UAS program. Essentially kick started into full operation after a school shooting incident in 2018, their program in two years grew to 100 trained Remote Pilots in Command (RPICs) and 100 UAS's. In 2021 that number doubled, and by 2022 the agency ex-

COVER IMAGE: Airgility DS-1 Minotaur autonomous drone for GPS-denied exploration and inspection.

#

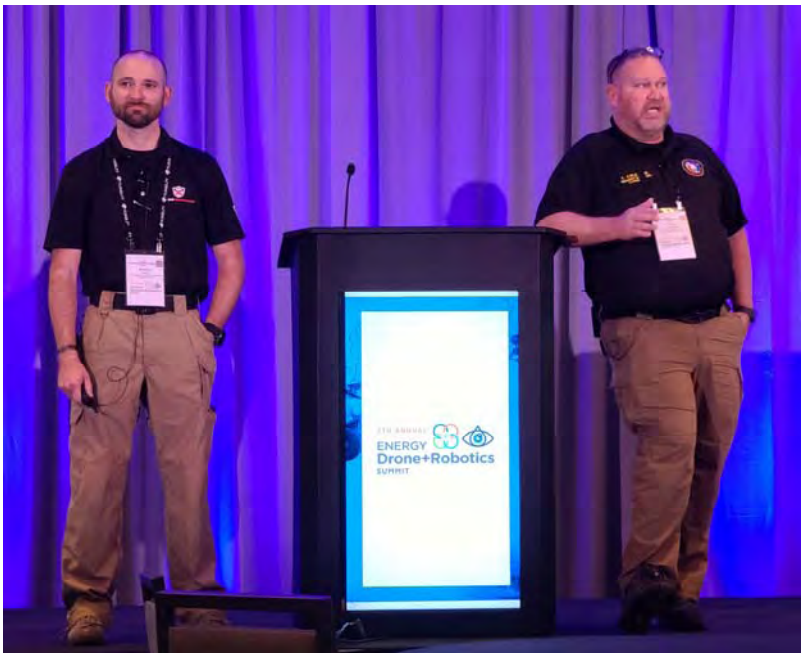
Police Aviation News is published monthly by **POLICE AVIATION RESEARCH,**
7 Windmill Close, Honey Lane, Waltham Abbey, Essex EN9 3BQ UK.
Contacts: **Cell:** +44 7778 296650 **Skype:** BrynElliott or +44 20 8144 1914
E-mail: editor@policeaviationnews.com and policeaviation@hotmail.com

Police Aviation Research Airborne Public Safety Association Member since 1994—Corporate Member since 2014

pects to double that number again. They have 114 troopers in the Highway Patrol Section currently trained to map fatal accident scenes. The agency is flying 2000 flights per month, which equates to about 380 hours of flight time. New RPIC's undergo a five-day in-house training program, and the agency uses repeatable metrics (the National Institute of Standards and Training – NIST, specifically the Basic Proficiency Evaluation for Remote Pilots flight evaluation, or BPERP) for pilot proficiency and to build muscle memory (or as I call it; "thumbology"). The department has developed a robust SMS program that among many items uses a 15-step pre-flight checklist and flight risk assessment tool (FRAT) to identify risks and hazards.

They employ a comprehensive maintenance program and take steps to deal with complacency that inevitably creeps into any flight program. A NOTAM is filed for every flight and checked on SkyVector to ensure the notification made it into the Federal Aviation Administration (FAA) system. The department also requires an email containing a flight notification to be sent to pertinent command figures before takeoff, and once in-flight, teams are required to monitor air-band (ATC and Multi/Uni-com) communications with a handheld VHF radio in the vicinity of airports.

Next up on the DRONERESPONDERS' Forum was a panel discussion with Travis Calendine (Little Elm, Texas, Office of Emergency Management), and Brandon Karr (Pearland, Texas, Police Department). Both men are leaders of a Public Safety UAS Response Team (PSURT), one in the Dallas/Fort Worth area and the other in the Houston area. Joining Calendine and Karr were Mike O'Shea and Kerry Flemming from the FAA's UAS Integration Office. The discussion centered around the proper procedures for requesting a Significant Government Interest (SGI) waiver for an emergency flight situation. SGIs are often needed during or immediately after natural disasters, or to fly during an emergency after a Temporary Flight Restriction has been put in place. The FAA has a team of individuals on stand-by 24/7 to handle these requests and in many cases can give the requestor vocal permission to fly in an emergency, pending the issuance of a written authorization.



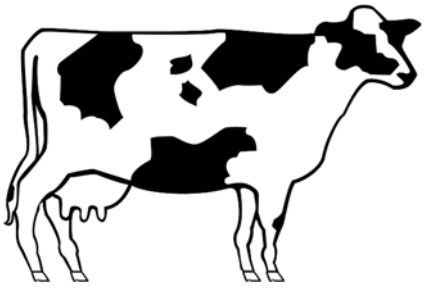
Brandon Karr (L) and Travis Calendine) address the DRONERESPONDERS Emergency Planning and Disaster Response Summit

#

The next panel discussion focused on building public/private UAS partnerships and was followed by a presentation by DRAXXON - a specialty vehicle solution (command/support van) for UAS operations. Next on stage, a new start-up called Paladin Drones based in Houston. Paladin's specialty is an autonomous 911 response drone that is easy to launch and recover. The Paladin quad solution sports a 10X zoom daylight camera and a 640x480 thermal imager. The company claims the quad can fly for 55 minutes, however, when pressed, the representative admitted the flight time is closer to 47 minutes! The company claims they are a full-service solution and can obtain the proper waivers or exemptions from the FAA that are needed for the agency's proposed tailored flight operation.

Methane Tech Forum

I literally had no knowledge of methane detection methods with a drone so decided to sit in on the Methane Tech Forum afternoon. The line-up of speakers and topics was excellent, and I found the Forum very informative.



Cattle are the focus of animal methane pollution. Blaming them for all the excess methane in the world may be misguided of course. All cud chewing vegetarians tend to emit the gas in quantity. Some more than others!

First, a little about methane, or as it's more commonly known; natural gas. There is an abundance of methane on Earth, making it a common source of fuel for creating electricity, heating homes, running ovens, water heaters, kilns and powering automobiles. When chilled and combined with liquid oxygen, it offers a cleaner rocket fuel that produces small exhaust molecules, which deposits less soot on the internal parts of the motors. Methane is popular because it burns hot and produces less carbon dioxide for each unit of heat released. Methane is mostly found in the ground or under the seabed. But a lot of methane is produced by landfills and livestock. It is harmful to the atmosphere and contributes to climate change when released unburned into the air. Companies that produce and ship methane strive to be in compliance with the law, according to presenters, but also want to assure the public that they care about reducing greenhouse gases (GHGs) and are serious about sustainability. Advancing technology has produced detection hardware that is smaller and weighs less, and many sensors can now be fitted on small UAS and ground based robots, like the agile Boston Dynamics' SPOT (pictured left). The industry is quickly embracing the concept of using drones for this detection mission. The ROI just makes sense and consumers who want low-carbon choices will increasingly embrace inspection methods using this technology.

There are basically three ways to detect vented or leaking methane. The first is with a localized direct measurement device (or point sensor) that takes a reading from the plume of the leak. These devices are generally very sensitive, detecting particles down to the parts-per-billion (PPB). The second category of devices are passive and take readings of the hydrocarbon signatures (Optical Gas Imaging or OGI and Leak Detection and Repair or LDAR). This is done from a safe distance from the leak and generally with some type of thermal imager. And the third detection method uses active remote sensors, either laser reflectivity or ultrasonic imaging technology. For a laser-based system, a reflective surface is needed and used to focus on larger leaks from long distances. These sensors are often used in satellite imaging systems to identify integrated path concentrations in localized areas. Pegram, who makes medium price range ultrasonic imaging devices, claim that one "acoustic" camera can detect all gases in real time. The Pegram Ultra Pro Ultrasonic Imaging Camera is equipped with 124 individual microphones to hear and detect a leak. Pegram claims that optical or OGI cameras are specific to a range of gas and must be calibrated prior to each use, whereas their camera only needs calibration every 4 years. But acoustic cameras have limitations in areas where there is high ambient noise, for instance detecting smaller leaks where large motors or pumps are running.

The most commonly used sensors attached to drones are OGI and utilize thermal imaging technology. Sierra – Olympic Technologies recently introduced the YAYU HD, a light weight (450/520 grams), uncooled long-wave infrared (LWIR) VOx Microbolometer Array thermal camera with an incredible resolution of 1920 x 1200 pixels. This thermal imaging camera not only detects methane like most thermal cameras, but also detects a laundry list of other harmful gases like ammonia, benzene, propylene and sulphur dioxide. The camera comes with either a 25mm or 50mm lens (f 1.2), and the on-board processor outputs video in HDMI (1080p), IP (H.264/H.265), and 16-BIT USB3.0-UVC (raw). Because of price, it may be a while before we see the YAYU HD in widespread use with public safety agencies. The picture quality of this camera is incredible, but it retails between fifty-five thousand and sixty-five thousand US dollars.

#

Industrial Drone Delivery & Unmanned Cargo Forum

Increasingly in my travels, and especially at this conference, I am hearing encouraging talk from leaders in the industry that realize that UAS are aviation assets, not just tools, and must be operated accordingly. They are beginning to realize that the FAA is not going to allow them to just throw their unproven machines into the air and fly whenever and wherever they want. To fly over people, beyond visual line-of-sight (BVLOS), and at night, they must prove to the FAA that their operations will present the least amount of risk possible to manned aircraft operations and to people on the ground. They will have to demonstrate this, as one company representative stated during a presentation, by achieving some form of Type Certification, which "requires producing operational data and artifacts to substantiate a safety case." Several presenters also promoted the introduction of Safety Management Systems as part of their company drone operations.

Unmanned aircraft systems are a disruptive technology. In 1957, two commercial airliners collided over the Grand Canyon. Out of this tragedy grew the FAA and a nationwide air traffic control system. This system has performed admirably over the past 60-years, and pilots are exhaustively trained on how to use it and benefit from it. Also, aviation, from the days of the Wright brothers, has relied on a concept of "see and avoid." If the pilot is taken out of the flight deck, another method is needed to avoid a collision with other aircraft. The FAA has said from the beginning that see-and avoid and steering clear of manned aircraft is primarily the drone operator's responsibility. That is a policy that will not change any time soon, if ever.

In the first decade of the new millennium, the FAA didn't want anything to do with drones. There were pioneers in Hollywood and other areas of the industry who were already building and flying drones for aerial work, but aside from one Administrative Directive (AD) encouraging recreational remote control (RC) aircraft operators to fly at approved fields under the direction of a community-based organization, drones were unregulated, and the FAA was confused about how to handle the "compensation and hire" issue.

There were individuals in the FAA that assumed drones would be a fad that would quickly fade, like the ultralight industry in the early 1980's. But the fad didn't subside, and a frustrated industry who wanted to make money with drones and fed up with the lack of progress by the FAA, went to the United States Congress to get the ball rolling. In 2012, Congress mandated that the FAA would integrate UAS (which essentially the FAA had already classified as "aircraft") into the National Airspace System by 2015. 2015 came and went without any significant integration. The reason, the FAA claimed, was safety. And realistically, most of the remotely piloted "aircraft" being put into the air are untested, not produced to any type of aviation standard, and basically toy grade. And since operators were already essentially self-certifying their machines for flight (which at the time was clearly not allowed by regulation), the FAA crafted a legal alternative to type certification with the Section 333 Exemption process so UAS operators could fly for compensation and hire.

I waited eight months for my exemption, as did many others who wanted to fly UAS's commercially. Then on August 29, 2016, the FAA created Part 107 and the Remote Pilot Certificate for commercial operations,

#

and in 2018 mandated UAS registration. And the most recent action, in 2020, was the creation of a rule on Remote Identification (RID) for UAS. The next step is BVLOS. One speaker at the Summit said (and I agree) that wide-scale BVLOS operations will become the most significant step in the evolution of aviation humanity has ever seen.

I have spoken recently with several experts in the UAS field which hypothesize that the FAA has put all the roadblocks mentioned above into place to give the industry time to mature, and to realize that in order to fly over people or conduct operations in BVLOS, they must prove to the FAA that their machines are dependable and won't consistently fall out of the sky. Must they go through the same or similar processes for certification that manned aircraft manufacturers must endure before they can go into wide scale production? Everyone, including me, is waiting to see which direction the FAA will lead us. But they did make it clear in a Policy Statement published in the Federal Register (dated 18September 2020), that UAS over 55 pounds (25 kg) will be required in the future to obtain a "Special Class" Type Certificate.

A common theme and discussion in the Industrial Drone Delivery and Unmanned Cargo Forum, on the exhibit floor, and at event parties and evening dinners was how much time will pass in the U.S. before we see routine and widespread UAS BVLOS flight without a waiver or exemption? Several individuals I talked with on this subject believe it will happen quickly, but I'm not as optimistic. Currently, all BVLOS operations are being carried out with an FAA waiver or exemption, and in most cases operated under FAR Part 91 or 135 manned aircraft operating rules (Part 107 is too restrictive – doesn't allow air carrier operations and a Part 107 pilot can only operate one drone at a time). As Jonathan Rupprecht, author of the *Drone Law Newsletter* recently stated in an article about the subject of drone delivery, "Most drone delivery news is of operations either overseas, within visual line of sight, or some narrow-scoped operation."

Before widespread BVLOS operations without a waiver can take place, the FAA will need to promulgate new regulations. The rule making process is anything but quick and forming a new rule generally takes at least five years. This is certainly true for the Remote ID rule the FAA released in December of 2020.

#

The FAA originally announced in 2018 their intention of creating a Remote ID rule. In December of 2019, they released a Notice of Proposed Rulemaking (NPRM), giving the public 60-days to submit comments on the 319-page proposed rule. Over fifty-three thousand comments were eventually received. A year later, on December 28, 2020, the FAA released the final rule (which didn't become effective for three months because of COVID). It should be noted that the final rule did not include a Network Broadcast (Internet) or strategic deconfliction solution, which was a huge part of the original proposed rule. Because of this omission, Remote ID has become essentially a sophisticated method for law enforcement to identify who is flying a drone at a particular location at a certain time.

We are nearly one year into a three-year implementation of the RID rule and the FAA has yet to release to the public the required specifications for RID beacons. Manufactures can't even start building them yet. Also, the FAA is currently being sued by the first-person view (FPV), or drone racing community (Tyler Brennan and Race Day Quads LLC vs. Steve Dickson, Administrator, FAA – US Court of Appeals for the District of Columbia Circuit - USCA Case #21-1087). Race Day Quads believes the rule violates their reasonable expectation of privacy (especially in shielded areas such as backyards and parks in the unused airspace below trees, buildings or other man-made obstacles), and places an unnecessary extra expense and unreasonable burden on their right to access the national airspace system. Tyler Brennan hired the most knowledgeable drone lawyers in the country, so it will be interesting to see which party prevails. Oral arguments in the case are expected soon.

Regulations aren't the only issue hindering BVLOS. The industry still has to solve the see-and-avoid issue. The drone itself will need a substitute for a pilot sitting in front of a big window and looking outside for other aircraft. On-board tactical deconfliction or detect and avoid (DAA) systems will be a must. Be it radar, electro-optical, acoustic, LIDAR, or some other form of anti-collision sensor, operators will have to prove that their systems will work, day or night, and under all weather conditions.

#

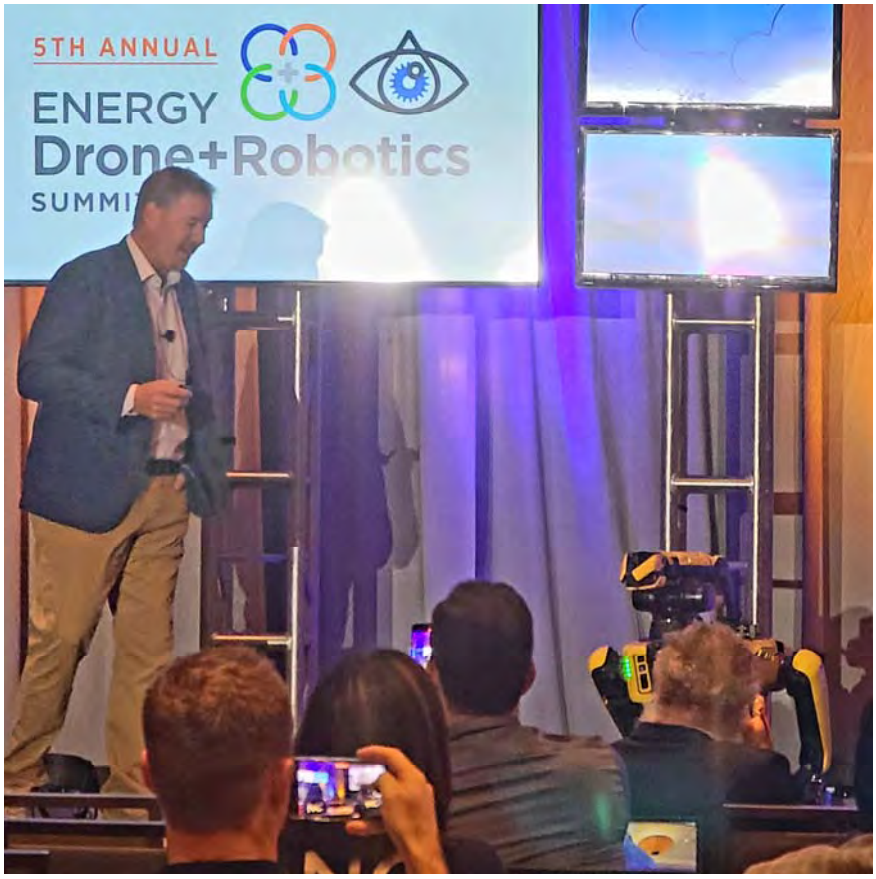
Will on-board DAA be enough, or could a network of ground-based detection systems be needed also to plug the strategic deconfliction gaps? And how will this ground based detection information be transmitted to the UAS or the remote pilot, and to manned aircraft pilots? Will it be through existing 4G cellular networks or the still unproven and maturing 5G Internet of Things, or even more expensive satellite systems? Or will it be a system still in development? Many experts I've spoken with believe a Network (or Internet based) system, similar to what the FAA originally crafted and proposed in the original RID NPRM, will still be needed for a successful and safe UAS Traffic Management System (UTM). There are a lot of companies working on the problem and all of them believe they have the ideal solution. I believe it will take a combination of several or many systems, working in cooperation, to make the skies safe for everyone.

In September of last year, Bell Textron Inc., in conjunction with NASA, successfully test flew their Autonomous Pod Transport 70 (APT 70) equipped with a multi-sensing DAA system, which included radars, ADS-B and visual systems. The Systems Integration and Operationalization (SIO) demonstration test flight transitioned in and out of the Dallas/Fort Worth International Airport's Class Bravo surface area over a 10-mile circuit following the Trinity River. Bell eventually submitted a final report to NASA on the two-year trial and admitted they experienced gaps with their Command and Control (C2) system and said the following about their chosen radar system for DAA; "Additional testing for optimizing the filtering and/or the inclusion of additional technologies to aid in the removal of ground clutter is needed for this radar system to provide adequate reliable detections while flying at low altitudes." Bell also admitted that their electro-optical cameras would need further testing to evaluate them as an independent technology for detecting non-cooperative manned aircraft.

#

This brings us to another issue that is relatively unique to America, non-cooperative manned aircraft. These are manned aircraft that are not equipped with ADS-B Out or an ATC Transponder. In America, this type of strategic deconfliction equipment is only required in certain types of controlled airspace, but not in uncontrolled Class G (and Class G encompasses the majority of airspace in America). This presents a huge see-and-avoid and strategic deconfliction issue in America because only about 50% of the general aviation fleet is equipped with ADS-B Out. This is why, I believe, an extensive ground-based detection system (in addition to on-board tactical deconfliction or DAA systems) will eventually be needed in order to allow UAS to fly BVLOS.

I would like to extend a special thanks to Julien DuPont, Director of Partnerships at Stone Fort Group and Sean Guerre, Partner at InnovateEnergy and Stone Fort Group, the event organizers, for inviting me to participate in this very informative and well-organized three-day event. It was definitely worth attending.



Patrick Campbell – Director of Energy and Natural Resources @ Boston Dynamics shows off SPOT the Agile Mobile Robot (see also image on page 5)

Many of the sessions were recorded and can be accessed on line at the event website
https://www.edrcoalition.com/edr-summit-2021

The Author, **Mark Colborn** is a recently retired pilot from the Dallas Police Department.
His current status is that he is now a Retired Reserve Senior Corporal with experience of Dallas Police Department Air Support Unit and the UAS Squad.
FAA's Advance Aviation Advisory Committee (formally the Drone Advisory Committee) Member & FAASTeam Representative
USHST Safety Analysis Team Member
HAI's UAS Working Group Secretary

5TH ANNUAL
ENERGY
Drone+Robotics
SUMMIT

#