



*International Public Safety Association UAS eBook
October 2018*

ABSTRACT

With increased usage of UAS by public safety agencies, it is expected that new approaches and payloads for UAS will increase to better respond to disasters and emergencies.

International Public Safety Association
www.joinipsa.org



A Message from IPSA Executive Director & Founder

On behalf of the International Public Safety Association, I would like to thank the dedicated Members of our UAS Committee for developing this important work. The IPSA's UAS committee addresses contemporary issues relating to UAS programs and public safety. Specifically, the IPSA UAS committee conducts on-going research to develop papers, policy, position statements and relevant artifacts for the IPSA to share with the global public safety community. Wesley Bull serves as the current IPSA UAS Committee Chair.

The *International Public Safety Association's UAS eBook* is a compendium of thought-leadership articles that shed light on emerging UAS trends as well as legal and policy considerations for all agencies with a UAS program or in the early stages of developing a new UAS program. The articles include:

- ***Aerial swarming threats: Preparing agencies for the next attack***
- ***How public safety agencies leveraged UAS during recent natural disasters***
- ***How UAS can assist during hostage negotiation, barricaded subject situations***
- ***How UAS can help law enforcement, campus public safety manage mass gatherings***
- ***What to consider before starting a new public safety UAS program***

We encourage everyone to download, print and share our eBook within your departments, cities and on social media. Questions? Email me directly at heather@joinipsa.org.

Stay safe,

Heather R. Cotter

Heather R. Cotter
IPSA Executive Director & Founder



*Aerial swarming threats: Preparing agencies for
the next attack*



Aerial swarming threats: Preparing agencies for the next attack

By Wesley Bull, Chair of IPSA's UAS Committee

During a recent U.S. Senate Homeland Security and Governmental Affairs Committee, National Counterterrorism Center Acting Director Russ Travers [testified](#), "We're in the early stages of seeing terrorist use of drones and UASs for swarm attacks, explosive delivery means and even assassination attempts."

Myriad positive use cases for operational deployment of aerial UAS by law enforcement and public safety agencies abound (search and rescue, special operations, investigations, surveillance, crime scene mapping, fire incident size-up, HAZMAT, disaster response and beyond). However, most protection professionals simultaneously recognize the threats and vulnerabilities that aberrant hobbyist UAS operators and criminal and terrorist actors enabled with UAS platforms can bring to a variety of operating environments. Aerial swarm advantages and vulnerabilities are not only strategic, but also operational and tactical, and both offensive and defensive. The notion of aerial swarms, whether deployed with negligence or evil intent is downright terrifying and at present, difficult to mitigate.

Considerations

This in mind, let us consider the emerging threat of aerial swarms and what protective services agencies should begin to contemplate – whether they have a UAS program or not.

Setting a baseline using academic definitions of UAS and swarming can provide a useful framework for the concept of risks associated with aerial swarming threats:

- Swarming, defined by Merriam Webster Dictionary as “a large number of animate or inanimate things massed together and usually in motion.” This technique ostensibly enables a construct for diversified situational awareness, elusiveness, speed, agility and the element of surprise to physically and cognitively overwhelm a target.
- UAS (or drones), as defined by Merriam Webster Dictionary, are “an unmanned aircraft or ship guided by remote control or onboard computers” which by today’s ubiquitous availability means an aerial platform that is relatively cheap, less risky than being proximate to hostile activities, and may provide more flexibility around attack modalities, diversion and situational awareness, among others.

According to a recent National Academies of Sciences, Engineering and Medicine report, “current and near-term (by 2025) capabilities will enable the employment of multiple sUASs in coordinated groups, swarms, and collaborative groups.” This is highly concerning given that swarms pose a significant challenge for counter-UAS efforts to detect, identify and track multiple aerial UAS's. As cited by Seiffert in the NAS report, “as the number of individual sUASs increases in a single swarm, humans lose the ability to track individual sUASs and begin to perceive multiple sUASs as a single entity. While it is not entirely clear at what number of entities this perceptual transition occurs, it is believed that the tipping point is about 40 sUASs.”

State-sponsored actors

State-sponsored actors, such as China, are aggressively pursuing aerial swarm technologies to adapt, overwhelm and simultaneously deploy offensive splinter-attack capabilities such as kamikaze drones with explosive warheads, decoys, electronic warfare UAVs, anti-radiation drones, armed UAVs, and communications relay UAVs. All are



designed to overwhelm, exploit and adapt to counter-UAS solutions, along with causing the targeted entity to exhaust its defenses, leaving it vulnerable to the other offensive attack vectors that remain. Of note are the concomitant technology advancements with autonomous flight programming / AI whereby the swarm can even be pre-programmed to mount its attack strategy as a swarm, in autonomous mode with no pilot in command.

However, aerial UAS swarm technology does not exclusively belong to state actors. Although there have been no reports of multiple UAS or swarms used by ISIS as yet, [Geektime](#) reports there are indications that ISIS is becoming more advanced in their ability to maximize multiple drones as part of their terror attack strategies and Russia has reported aerial swarm attacks in theater in the Middle East.

Mitigation planning

So what mitigation solutions are available to counter the threat of aerial swarming by UAS? Regrettably, the most advanced counter-UAS technologies that I've witnessed remain classified and are only available for use by the military and perhaps soon, given recent legislative changes in the U.S., some federal law enforcement agencies. Not surprisingly, several countries outside the U.S., with fewer freedoms, have taken a much stronger posture about protecting their airspace from the UAS threat, making counter-UAS technologies available to law enforcement and their homeland security equivalent organizations.

A recent [Popular Mechanics](#) article recently highlighted that "law enforcement have surprisingly few effective anti-drone tools, and none—that are declassified—to target multiple unmanned aerial vehicles (UAVs), or swarms." Shotgun shells that fire nets to snare the propellers, or frangible projectiles to obliterate the propellers, work only at close range and their utility can vary considering whether the environment is urban, densely populated or remote and unpopulated. Other commercially available options include pure detection, frequency jamming, geo-fencing technologies to barrier an environment, "pursuit drones," which fire nets or projectiles and even falcons have been effectively used to combat the single UAS effectively, but not to counter swarms.

Generally, a counter-sUAS system is used to implement the following kill chain: detect, locate and track potential targets; identify, classify and evaluate targets as sUASs; engage and defeat (neutralize) sUASs; verify the response through damage assessment; and recovery of device(s).

Legislation, regulations

The legal analysts and researchers at Rupperecht Law developed a UAS law specific [blogpost](#) that details the legal and operational problems with many of the counter-UAS technologies in the market today. This site can provide the reader with more insight on the complicated landscape of conflicting laws, regulatory gaps and lack of legal authorities across the counter-UAS domain. It is increasingly apparent that current U.S. legal constructs, authorities and solutions for the public safety domains are ill-prepared to contend with the ever-increasing risks as UAS platforms go mainstream and this technology further advances.

As if the threat of a bad actor in some way weaponizing a UAS wasn't enough of an operational challenge for emergency services to confront, we must now contemplate the potential for a swarm of UAS or micro-drones being deployed for primary and secondary attacks, to interrupt emergency response operations (aerial and ground), conducting pre and post operational surveillance combined with attack modalities, disruption of deployed public safety UAS platforms and beyond.



Notably, included within the FAA Reauthorization Act, was the [Hartzler Provision for Drone Security](#) - that provides Title 18 relief to allow these agencies to use counter drone technology to detect, monitor, and engage with unauthorized drones that pose a reasonable threat to the safety and security of certain facilities and assets, including those related to operations that counter terrorism, narcotics, and transnational criminal organizations.

While it remains unclear specifically what “destroy” means within the language of the Act, it is believed that U.S. Department of Homeland Security, among others, are looking at both kinetic and non-kinetic options based upon a variety of operational and environmental considerations.

This short primer was designed to bring cursory awareness to the emerging threat of aerial swarms using sUAS, and begin to provide some perspective on the preliminary solutions being considered to counter such threats at the time of publication.

As a fellow protection professional working around the world, I must conclude that there is still much work to be done to better understand and deter this emerging threat. On behalf of the UAS Committee at the IPSA, know we will be vigilant in furthering our knowledge of this threat and provide our members with updates as appropriate. We welcome your comments and insights as we work together to advance IPSA’s mission across the protection disciplines.

About the Author

Wesley Bull is the CEO of Sentinel Resource Group, a consulting and solutions firm helping companies and governments better protect people, places and things from diverse and emerging threats. He is also the Chair of the UAS Committee for IPSA. Prior to SRG Bull’s career included sworn roles in law enforcement and public safety, special task force assignments within the US intelligence community, and as the CSO/CISO/FSO for two major global corporations.



How public safety agencies leveraged UAS during recent natural disasters



How public safety agencies leveraged UAS during recent natural disasters

By Lawrence Nolan Ph.D., Member of IPSA's UAS Committee

The capabilities and missions that an unmanned aircraft system can provide to public safety agencies continues to increase as this emerging technology produces lesson learned and novel approaches to response with increased use in disasters. In a disaster or emergency incident, responders are exposed to hazardous environments or unable to gain timely access to a location to deal with the situations they confront. The UAS, with various types of sensors attached, allows the responders to initially remain clear of the hazards or provide a timely perspective of the incident to gain situational awareness. In a 2015 [report](#) on the use of UAS for disaster response and relief operations, responders to 11 disasters around the world from 2011-2015 used UAS to perform surveillance and mapping, search, structural inspection or estimation of debris.

The use of UAS by emergency response organizations across the nation has increased. A 2017 Bard College article identified that approximately 910 state and local public safety agencies have acquired the technology in the U.S.

Earthquakes, tornadoes, hurricanes, wildfires

Natural hazard incidents such as an earthquake, tornado, hurricane or wildfire may significantly impact a community with a variety of destructive outcomes. They may damage infrastructure in such a way that exposes hazardous materials, explosives or radiation to the environment. Public safety agencies responding to these dangerous conditions could use an UAS to identify the scope of the situation and develop an incident action plan to address the hazardous condition. This would provide public safety officials with critical information to reduce the exposure of first responders to the hazardous environment as the hazards are addressed.

In a March 2018 Vox news [story](#), disasters in the U.S. have included Hurricanes Harvey, Irma and Maria, California Wildfires to include the Thomas Fire, Western Wildfires and tornados in the Midwest. Each of these natural disasters provide an opportunity for expanding the use of a UAS by public safety agencies. The option of various payloads that may be carried by the UAS, provides a range of alternative missions that can be used.

Hurricanes

A September 2017 [post](#) in Drone Life, reported the response use of UAS in Hurricane Harvey for damage assessment and search and rescue, while UAS usage in Hurricane Irma included aerial surveys and damage assessment. This demonstrates the versatility of UAS with its various payloads.

- **Flooding.** The flooding in the Houston area was so vast that searching for victims that needed rescue was an urgent requirement. The use of UAS increased the capability of public safety agencies to efficiently scan large areas and locations that were difficult to access.
- **Damage assessment.** The need for damage assessment after both hurricanes provided another opportunity for the UAS to be well suited to perform this mission. The UAS can provide an overall perspective of an area as well as providing close-up images of damage to critical infrastructure.
- **Infrastructure assessment.** In a February 2018 [Policeone.com](#) article, the Daytona Beach Police Department in Florida used UAS for pre and post Hurricane Irma impact for infrastructure



assessment and route assessment and clearance. For Daytona Beach officials to quickly receive financial compensation from FEMA for the disaster declaration, it had to provide evidence of the status of infrastructure pre and post hurricane impact. The DBPD used UAS to survey the infrastructure prior to Hurricane Irma and after the impact to identify the extent of the damage.

- **Transportation route clearance.** The DBPD also used UAS after the hurricane to identify and prioritize transportation route clearance requirements. Another type of natural hazard incident provided an opportunity for the UAS to be used during the response.

Wildfires

A December 2017 [Wired.com](http://www.wired.com) article, reported that the Los Angeles Fire Department used UAS to support the response to a California wildfire by determining the advance of the fire and also to identify hot spots that needed to be extinguished. An infrared sensor payload on a UAS would provide the capability to locate hot spots in a wildfire despite the smoke or trees covering the area. This capability provided the LAFD with valuable information to track the advance of the fire and to locate those areas that may not be fully extinguished and require assets to eliminate the hot spots. This is another example of the range of missions that can be performed by an UAS with different payloads.

Disasters caused by natural hazards may also lead to conditions where access to the impacted area is not immediately possible. This situation is another opportunity to use UAS to provide that initial observation of the impacted area and allow for effective planning and response. In the previously cited [report](#), payloads that may be carried by UAS include electro-optical video, infrared sensor to detect heat, mapping sensor, communications relay and sniffers to detect a substance in the air. The payloads on UAS expand the capabilities of public safety agencies to respond in a more informed and safe manner.

The value of the UAS by public safety agencies is supported by the increased usage during disasters. This article focused on natural disasters and the varied mission that could be performed by UAS. In disasters and emergencies developed because of technical accidents or manmade incidents such as terrorism, the use of UAS to respond would be effective as well. With increased usage of UAS by public safety agencies, it is expected that new approaches and payloads for UAS will increase to better respond to disasters and emergencies.

About the Author

Lawrence Nolan retired as a Captain from the U.S. Navy Reserve and served as an Intelligence Officer and Navy Emergency Preparedness Liaison Officer for New Jersey and the Mid-Atlantic Region. He also retired as a Supervisory Logistics Management Specialist from the Department of the Army at Fort Monmouth, NJ. He currently develops Emergency Management Policy for Capstone Corporation supporting the Navy Installations Command.



*How UAS can assist during hostage negotiation,
barricaded subject situations*



How UAS can assist during hostage negotiation, barricaded subject situations

By Thomas Margetta, Member of IPSA's UAS Committee

The use of unmanned aerial systems in law enforcement and public safety applications is quickly gaining in adoption and will continue far into the foreseeable future. According to the [Center for the Study of the Drone at Bard College](#) estimates, as of May 2018, there were at least 910 state and local police, sheriff and emergency services agencies in the U.S. that have already acquired UAS. Initial applications of the use of UAS range from search and rescue, suspect pursuit and traffic accident investigations to SWAT operations. Key benefits, including tactical aerial support and situational awareness, provide agencies with many operational advantages like manned aircraft, but with greater maneuverability and safety without the associated high costs. While most UAS law enforcement applications generally refer to overhead tactical support use outdoors, one lesser known operational benefit is how UAS can assist during hostage negotiation and/or barricaded subject situations.

UAS equipment

Law enforcement personnel who are experienced in working with UAS understand how critical it is to match the UAS and associated equipment with the right operation. This may include inherent capabilities of the UAS such as flight time, wind rating, weather, imaging payload, battery change capabilities, communication and control software. For example, UAS equipment required for a search and rescue operation over expansive, rugged terrain at night may be quite different than one used to take detailed aerial photography over a traffic homicide scene. Similarly, UAS used for hostage and/or barricaded subject situations also requires forethought in selecting the proper equipment for proper tactical support.

One example of this occurred in 2013, when a suspect shot a school bus driver and held a 5-year-old boy captive for nearly a week in an underground bunker in Midland City, Alabama. The [FBI's elite Hostage Rescue Team](#) flew UAS over the scene to provide aerial intelligence while they snuck a camera into the bunker to build a replica to practice their assault for entry. In what Clint Van Zandt, former FBI negotiator, described as, "A classic, textbook situation," the team exchanged gunfire with the suspect and killed him before rescuing the child.

Tactical UAS considerations

Some general requirements of tactical UAS to be considered may include:

- The capability to operate both outdoors and inside GPS-denied environments.
- A smaller size to navigate through windows, breach points or tight interiors.
- Two-way communications.
- Night vision or thermal imaging capabilities.
- Lighter weight for increased flight times.
- Ruggedness/durability to withstand impacts.
- Most importantly, officer/pilot and team safety features.



To prepare for a multitude of variables that can occur during a hostage and/or barricaded subject situation, a law enforcement agency must ensure they have the right UAS and associated features and communications capabilities for the operations they will be called to respond to.

Once the right equipment with associated features and communications are selected, examples of how a UAS may be used include:

- **Breaches/primary entry and room clearing.** Officer safety and operational efficiency is critical. Once a breach is made, the UAS can act as a room clearing device leading the way for team clearing operations. For example, the pilot position may be 2nd in a stack, while the team leader may wear a wrist worn device to view video from the UAS. Safety is greatly enhanced while clearing fatal funnels such as stairwells or tight long hallways or when visually inspecting for bombs and traps. A qualified indoor pilot can clear an entire 10,000 square foot office space in approximately 10 minutes. Clearing offices, office cubicles, bathroom stalls and visually looking under and over furniture or around corners is much faster and safer than traditional methods such as when using mirrors.
- **Mapping, monitoring and observation.** Once an area is cleared, one or more UAS can be used to monitor cleared areas. Armed with the right software, the UAS may also be utilized to map the layout or perch silently under furniture or on a high vantage point to look for and/or monitor suspects and their movements.
- **Two-way communications.** Two-way communications may be in the form of two-way voice between the negotiator and the suspect. Instead of using a telephone thrown to the suspect at a distance away, a UAS equipped with two-way voice and mic/speaker can be flown near and used for safer communications with the suspect(s). At the same time, the camera on the UAS can gain potential valuable intelligence such as the number of suspects, health of any hostages, weapons or other crucial information.
- **Greenlight go tactical weapon.** Depending on state and local laws, UAS may also be utilized to deploy concussion grenades or chemical irritants, providing the advantage of surprise while increasing officer safety. Additionally, several UAS may operate in a coordinated attack on multiple suspects. Soon, evolving UAS swarm technology and micro-UAS may be utilized as tactical weapons.

In summary, UAS are gaining in adoption and use for law enforcement. It is critical to understand that matching the right UAS and associated equipment, communications and software with the right objectives and tactical operations will help ensure successful outcomes. For hostage negotiation and/or barricaded subject situations, specialized indoor UAS, associated equipment, two-way communications and software should be considered to ensure law enforcement is prepared to handle these situations while providing greater officer and hostage safety and increasing operational efficiency.



About the Author

Thomas Margetta is the Director of Client Services for STRAX Intelligence Group, who's STRAX® Platform provides aerial intelligence and real-time situational awareness solutions for public safety. The Florida-based company manufactures the SABER® Close Quarters Tactical Indoor UAS. He is in the 27th year of his 9-1-1 career supporting law enforcement. An inaugural IPSA UAS Committee member, he may be contacted at tmargetta@straxintelligence.com.



*How UAS can help law enforcement, campus
public safety manage mass gatherings*



How UAS can help law enforcement, campus public safety manage mass gatherings

By Mark Wesley, Member of IPSA's UAS Committee

University and college campuses have traditionally been venues used by students and others to protest, demonstrate and engage in other activities under their First Amendment rights. Managing the security and safety during these large gatherings is primarily a function of law enforcement officers and campus public safety personnel. However, these events can quickly evolve, the size of the crowd can increase rapidly, and the peaceful mood can swing to civil disturbance, which will ultimately stress the limited resources available to most campus public safety departments.

UAS offers a cost-effective and safe force multiplier. A bird's eye view live stream of the situation can quickly provide information on crowd size, movement, access path, and other elements that can assist campus public safety make decisions on how to manage the event.

Mass gatherings and UAS

UAS are deployed at many events to help with security and management. The 2018 [Coachella Music Festival](#) organizers and local law enforcement utilized surveillance UAS as part of the security measures for the event. Indio, California police officers used the UAS to monitor security and traffic.

Following the Route 91 Harvest Music festival shooting in October 2017, [Las Vegas police used UAS](#) to monitor crowds, identify suspicious packages and track any unusual activity on the Strip during New Year's Eve celebrations.

The Air Support Unit of the [Contra Costa County Sheriff's Department](#) used UAS to monitor an immigrant rights rally at the Contra County West County Detention Facility.

While UAS may seem an efficient and easy application, there are many considerations that need to be addressed prior to flight operations in support of law enforcement. A few of these basic considerations include regulatory compliance, integration with incident command, and privacy issues.

Policy considerations

Campus law enforcement needs to be familiar with applicable federal, state and local laws and policies to determine if UAS can be used. Has the agency met FAA requirements for operation under a Certificate of Waiver/Authorization (COA) or under Part 107?

[According to the FAA](#), federal, state and local government offices can fly UAS to support specific missions, under either the FAA's Part 107 rule or by obtaining a COA. Be aware that some states have legislation restricting the use of UAS by law enforcement agencies. Can the operation be warrantless?

Before any deployment, agency leadership needs to decide if the use of UAS is the best way to fulfill the mission. If the decision is to use UAS to support the mission, then the specific details of the operation need to be identified prior to deployment and captured in an incident action plan. Adherence to incident command protocols is essential for successful UAS flight operations during events. Setting the conditions for flight operations, establishing the chain of command for authorization of flights and



ensuring notification to ground elements of the operation are just some of the elements that need to be planned out prior to deployment.

UAS operation can also impact the campus community's perception of the agency's transparency and trust. Some people will view the use of UAS as a violation of their privacy and a restriction on their First Amendment rights. The agency needs to be prepared to proactively explain the need for improved safety and why UAS supports that effort. One way to accomplish this is to engage the campus community in the process as the program is being developed and to publicize the agency's policies regarding UAS use, collection and storage of information. It will be an on-going debate over when and how law enforcement uses UAS.

However, UAS can be an incredibly effective tool in conducting situational assessment and providing valuable information to help protect both law enforcement personnel and participants during mass gathering events.

About the Author

Mark Wesley has more than 30 years of progressive experience as an emergency management professional, with a focus on program development, policy analysis, training and exercises. He is currently the Emergency Management Director at Eastern Michigan University and previously spent 22 years with the Michigan State Police Emergency Management and Homeland Security Division. He is the principal manager of MHW Consulting LLC, founded in 2011, a veteran-owned consultancy company that provides comprehensive emergency management services.



What to consider before starting a new public safety UAS program



What to consider before starting a new public safety UAS program

By Bill Pritchett, Member of IPSA's UAS Committee

The use of aerial support is not a new concept in public safety. Helicopters have proven to be a successful tool to aid emergency response personnel with aerial policing and search and rescue operations. Many law enforcement agencies, such as the Los Angeles Police Department, have had air support divisions for more than 60 years. Unfortunately, the price makes it unattainable for smaller public safety departments to utilize.

UAS benefits

Unmanned aircraft systems are changing that. Technological advancements and the relatively low cost of these aircraft has made offering aerial support a reality in many communities. UAS are a less expensive alternative to a full-scale helicopter, and they can quickly be deployed from nearly any site. This capability makes them crucial in providing real-time situational awareness to commanding officers at a scene.

Cameras currently used on UAS can stream live 4K video footage to the ground, as well as take high-resolution pictures at a scene. Thermal imaging and GPS are also available and frequently used to aid crews in search and rescue and firefighting operations.

As UAS technology evolves, so will its use in public safety. Larger emergency agencies, such as the New York Fire Department, now deploy UAS to large, four-alarm fires. They clearly offer public safety departments the option to protect their communities in ways that they previously could not.

UAS applications

Using a UAS during an emergency provides incredibly helpful live data to incident command, which can lead to better, faster and safer decisions—ultimately saving lives and property and keeping first responders out of harm's way. Perhaps the most critical domain for UAS use is in areas in which the assignment poses a significant risk to human life.

Explosive ordnance disposal is a prime example. According to the 2007 U.S. Department of Defense *Unmanned Systems Roadmap* report, coalition forces in Iraq neutralized more than 11,100 improvised explosive devices from 2003 to 2007. From 2004 to 2007, the number of EOD unmanned vehicles deployed in Iraq rose from 162 to more than 4,000. They were, without doubt, responsible for saving thousands of lives.

Dangerous job assignments are not limited to the military. The inspection of structures such as bridges, radio towers, wind turbines and oil rigs depend heavily on visual assessments from experienced field inspectors. Visual inspections of bridges and high-mast structures often require inspectors to be placed in high-risk settings, working at altitudes greater than 1,700 feet, or being suspended beneath bridges. This technology is ideal for taking the inspector out of danger and gaining new perspective on otherwise dangerous places to reach.



In the event of an emergency, UAS are an important tool for first responders. Every day, firefighters, law enforcement officers, SWAT teams and many others use UAS to survey areas that would be difficult or dangerous to survey on foot.

Getting started with UAS

Under the small Unmanned Aircraft Systems (sUAS) Rule (Part 107), pilots must pass an aeronautical knowledge test to obtain a Remote Pilot Certificate. FAA knowledge testing centers charge approximately \$150 to take the initial aeronautical knowledge test. Keeping your license current requires testing every two years from the last day of the month of the initial test. It's a difficult test. Someone with no aviation background will likely need to enroll in a course to prepare for the test.

Federal law requires that all aircraft (which includes sUAS and radio/remote-controlled aircraft) flown outdoors be registered with the FAA and marked with a registration number. Any sUAS weighing more than 0.55 pound and less than 55 pounds can be registered online at <https://faadronezone.faa.gov>.

UAS flown for work or business (commercially) must be registered individually by the owner. Each registration costs \$5. Each registrant must supply his or her name, address and email address, in addition to the make, model and serial number (if available) for each sUAS that the pilot wants to fly.

UAS and safety

Once the pilot takes the course, passes the test, and has everything registered this makes him or her legal, but not safe. Executing a successful (safe) commercial operation for public safety, building inspection, aerial photography, videography or other flight mission requires actual flying skills. Just because a pilot has figured out how to take off, fly around a parking lot and land does not give him or her the necessary skills to fly commercially.

Flying publicly means flying near other people, over someone else's property and/or under the ever-watchful eye of the FAA and the public. Flying skills such as these require training from professionals who have done it thousands of times without incident. There is an initial and continual need for UAS hands-on training for all pilots.

UAS programmatic planning, cost

All agencies must plan for success by budgeting for great equipment and training. Ask around because there are but a handful of manufacturers' products universally recommended for use in public safety. Budget for training. Be proactive in the development of your department's deployment procedure, training recurrence and equipment maintenance and management.

One item to be aware of is cost. There is no question that a single UAS is substantially less expensive than deploying a full-scale helicopter at a rate of \$1,000 per hour. However, do not try to compare a real public safety UAS deployment budget with what anyone can buy a single UAS for at any local retail store. Anticipate several other line items in the UAS programmatic budget – not just the cost of the technology – and plan for those items accordingly.



About the Author

Bill Pritchett is the Director of Education for the Academy of Model Aeronautics. He has 40 years of experience as an educator. A graduate of Ball State University in Muncie, Indiana, he received his undergraduate degree in education in 1976 and a master's degree in 1981. Bill is an RC Precision Aerobatics national champion and continues to fly and participate in competitive model aviation Precision Aerobatics events. Bill, AMA, and its employees have accomplished the following:

- Created AMA Flight School, an online resource that answers the question, "How Do I?"
- Developed a partnership with Fly Robotics, one of the nation's leading providers of sUAS education.
- Created Learn sUAS
- Assisted in developing the sUAS Fly Robotics Ground School. This program is an E-Learning sUAS Center of Excellence, designed for self-paced and asynchronous learning.
- Received the Frank G. Brewer Award for Education. This award is given annually by the National Aeronautic Association for significant contributions of enduring value to aerospace education in the US.
- Helped produce *Wings Over Indiana*, a 60-minute PBS documentary and winner of three Emmy awards.
- Received an Alcoa Grant for Aviation in Education four times.
- Generated Model Aviation Student Clubs (MASC) and University Model Aviation Student Clubs (UMASC).
- Developed educational multirotor kits that include a building instructional video series and a national competition (UAS4STEM) using a search-and-rescue challenge for high school and college teams.
- Created AMA partnerships with Embry-Riddle Aeronautical University, the Experimental Aircraft Association, the FAA, the Civil Air Patrol, NASA and others.



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