# Drones and the Fire Service

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**By JOSHUA LARSON**

Small unmanned aircraft systems (UAS), also known as drones or unmanned aerial vehicles, have become one of the fastest growing industries in the world. *Fortune* magazine estimates that from 2015-2025, the drone industry will reach an economic impact of more than $82.1 billion1; this will create more than 100,000 high-paying jobs in the process. Why is the drone industry taking off in the public sector? Having "eyes in the sky" during emergency operations provides protection to citizens and fire crews, which then provides a significant benefit to public safety agencies.

The public safety sector can use drone technology for many emergency scene operations such as for large-area search and rescue of a missing person (photo 1), as long as the pilot in command (PIC) of the drone or an observer maintains visual contact with the aircraft. These aircrafts' speed of search will increase the amount of life-saving time public safety agencies have while they look for a missing person. You can also use drones to create a grid search where the aircraft will search a specific area of land at a certain altitude. Thus, you can create a search pattern that the drone can follow and watch it in real time on a mobile device; this reduces the amount of time drones need to search the land, especially if search crews cannot reach that land. In addition, a drone that features thermal imaging capabilities will make it even easier to spot your person of interest.

**(1) The Wisconsin River during the search for a lost individual. The drone was used to scan a small island to which searchers were not able to gain access in a timely manner. (Photo by Aaron Harris.)**

Drones also aid crews at working fires-both structural and wildland-by helping locate the seat of the fire as well as allowing the pilot to see how the fire is progressing and if crews are getting a

good knockdown (photo 2). This also provides the on-scene safety officer with even more visibility to ensure the safety of his crews at a working structure fire. In photo 2, depending on the safety officer's location, he may not know that flames are visible throughout the west side of the structure. Sending crews into this environment could result in loss of life. Deploying a drone here could help the command staff see the fire from a different perspective, thus preserving lives. With wildland fires, this technology allows individuals to see how the fire is progressing and helps crews work upstream of the fire to find any potential objects or individuals that would need protecting or saving.

Also, with the increase in active shooter incidents, drone technology provides another set of protective eyes while operating at these scenes by deploying them above the scene to survey where and what all on-scene personnel are doing. Another potential use is deploying them inside a structure to search the halls and rooms before any responders enter that building, providing safety to those going in to neutralize the situation as well as providing a more efficient means of finding any potential patients.

Drones can also be used in tandem with fire investigations (photos 3, 4). This device, similar to its uses at a working fire, allows you to see the overall scene damage, ultimately providing better video and photo evidence if it is ever needed in court. You can also use drones in investigations to help determine how the fire spread; where the majority of the damage happened; and, potentially, where the fire may have originated.

**Public Aircraft Operations Certificate of Authorization (PAO COA)**

There are many other ways to use drone technology in the public safety sector-i.e., natural disasters, emergency management, crew resource management, and water rescue operations, to name a few. With such a great tool comes great legal responsibility.

The process to legally fly within the national airspace is a long and tedious process as well as very demanding. Because of this process, many fire departments have not considered or have entirely withdrawn from using drones. And, if your department lacks an aviation background, it will be even more difficult to obtain clearance because of the vocabulary used in the aviation industry. Following is a summary of how to obtain clearance from the Federal Aviation Administration (FAA) to fly within the national airspace.

Definitions. Fire departments operating drones fall under the definition of public aircraft per Title 49 USC 40102. Fire departments operating drones must represent a governmental function. This is defined as follows: "An activity undertaken by the government, such as national defense, intelligence missions, firefighting, search and rescue, law enforcement, aeronautical research, or biological or geological resource management (Title 49 USC 40125)."2 Referring to commercial purposes in the fire service boils down to using your drone as a means of compensation or hire. In other words, your department will not be able to apply for a Public Aircraft Operations Certificate of Authorization (PAO COA) if you will be using the technology for commercial purposes. If your department decides to use this technology for commercial purposes, FAA's 14 CFR Part 107-which went into effect on August 29, 2016-regulates what commercial drone operators can do as well as defines their certification and currency requirements. You can find out more about Part 107 by visiting the FAA's Web site (www.faa.gov/uas). This regulation covers a broad spectrum of commercial uses for drones weighing less than 55 pounds.

**(2) Attack on an attic fire during a training burn. This positioning gives the incident commander the ability to see that the water is not hitting the seat of the fire and is pouring into the backyard of the home. This becomes a tool to make fireground operations more efficient. (Photo by Aaron Harris.)**

For most fire departments, operating for commercial purposes will not fall under your role as performing governmental functions. [*Author's note:* The following information was reviewed by an individual on the FAA's Unmanned Aircraft Systems Tactical Emerging Technologies Operations Team (AFS-85/AJV-115), who confirmed that the information in this article was accurate and current at the time of publication.]

The FAA recently made changes to its processes regarding PAO for organizations that were defined in the previous paragraph as a "public aircraft." The statute has provisions on aircraft ownership, the entity operating the aircraft, and the purpose of the drone operations to determine whether these operations are considered public or civil.

The process. The first step in the process, and probably one of the most important steps overall, is for your department to develop a Concept of Operation. Throughout this process, you must include your fire and police commission representatives. First, your department needs to understand what the aircraft will be used for and what the cost and savings to the department will be in procuring the system. This will also give you time to determine what the appropriate technology would be for the operations that your department wishes to conduct. Prior to deploying your department's drone program, it may also be appropriate to check with your insurance underwriter or risk management representative to determine the coverage requirements to use this technology within your jurisdiction. The insurance company may require specific certifications on the part of the operator or, as a minimum, appropriate approvals from the FAA to use the aircraft. Once your department has defined its Concept of Operations, you can begin the process of getting access into the national airspace system.

As part of the process of getting your PAO COA, you must register the aircraft. You can complete this step at any time up to the submission of the online COA application.3,4 Recently, the FAA has simplified the registration process for governmental agencies by introducing an online system where you register your department's drone and its manufacturing information. For you to use the online system, the drone must weigh a minimum of 0.55 pounds and a

maximum of 55 pounds; you must register drones weighing more than 55 pounds by paper through AC Form 8050-1. The online registration process takes about five minutes and, when completed, will assign a specific registration number to the craft. Then place the registration number on the front of the craft to which it is registered. Title 49 USC 44101-44104 prohibits the operation of unregistered aircraft in the national airspace. Aircraft being used for public operations are not exempted from the registration requirements.
Your e-mail to the FAA must include the following information:

1. The public agency requesting the COA.
2. A small description of the drone.
3. The Concept of Operation. (3)

You can find the e-mail address on the FAA's Web site (www.faa.gov/uas). With this information, the FAA can direct your e-mail to a UAS Tactical Operations Section (AJV-115) specialist who specifically deals with law enforcement, fire, and first responders. This specialist will be assigned to you throughout the entire COA process and will be there to assist you throughout the process. The specialist will also provide you with a letter of introduction that explains the COA process and the steps necessary to receive FAA approval to operate your drone in the national airspace.
To gain access to the COA online application, your public agency must first declare to the FAA that it is a public safety agency. You can accomplish this through a letter of declaration from your agency's state, county, or city attorney's office. This document assures the FAA that the organization applying for a COA is a political subdivision of the government of the state under Title 49 of the United States Code (USC) section 40102(a) (41) (c) or (d) as well as address Title 49 USC. 40125(b). (2, 4) The latter regulation ensures that the organization will not operate its drone for commercial purposes as defined in said regulation. The legal office of the FAA will then validate this letter prior to granting access to the COA online application. The agency needing the COA cannot certify itself as a public agency.

**(3) Pictures of a barn fire that was concluded to be a total loss. These pictures were taken for investigation purposes and helped diagram where on the property the barn was. These images also helped show where the most damage to the barn was sustained, which could**

**ultimately help find the origin and cause of the fire. (Photos by Gary Acker.)**

Once the FAA's legal offices clear the letter of declaration, the agency will be granted permission to access the COA application through the FAA's online portal. Note that the COA online application process was designed to accommodate all public agencies including public universities and federal agencies for all different types of drones. Some of the questions asked throughout the process may seem technical or may not apply to your aircraft, so consult your FAA specialist if you have any questions.

The latest program released by the FAA allows for a more rapid process in approving drone operations while expanding the access into the national airspace system for public agencies. This Blanket Area Public Safety COA approval will allow small drones (55 pounds or less) to operate during daytime visual meteorological conditions under the following limitations:

1. At or below 400 feet above ground level (AGL).
2. That which will take place beyond the following distances from the airport reference point of a public use airport, heliport, gliderport, or water landing port listed in the airport/facility directory, the Alaska Supplement, or the Pacific Chart Supplement of the U.S. Government Flight Information Publications.
    a. Five nautical miles (NM) from an airport having an operational control tower,
    b. Three NM from an airport having a published instrument flight procedure but not having an operational control tower,
    c. Two NM from an airport not having a published instrument flight procedure or an operational control tower, or
    d. Two NM from a heliport.

Under this Blanket Area program, the public agency will conduct initial training at a specific training site that will remain well clear of housing areas, roads, persons, and watercraft. This also allows the agency to conduct the necessary ground and flight training to bring pilots, observers, and ground crew members to a high level of drone flight proficiency while enabling them to develop and conduct training exercises to ensure efficient, standardized coordination among other supporting/responding emergency elements (e.g., coordination for operational missions including search and rescue, disaster control, forensic photography, fire missions, law enforcement, and so on), similar to that of the training COA.

Once this training is complete, the organization will be authorized under the COA to conduct drone public safety operations in compliance with Title 49 USC 40125B at any location within the national airspace under the provisions stated above. The FAA believes that using this COA will allow most public agencies to meet 75 percent of their mission objectives.

The current COA process typically takes 60 business days to complete because of the time it takes for the review of the organization's documentation by several entities within the FAA. It is projected that, under this blanket area COA program, feasibility and safety assessments as well as the coordination at the air traffic control facility level are not required. This should result in a processing time of approximately 15 business days of receipt of the application. (3) However, if the organization requesting access to the national airspace does not fall within the guidelines above, it must apply for a traditional COA.

The FAA believes that the most effective and safest deployment of drone technology for public safety agencies does not fall under a Blanket Area COA; that would instead be the traditional

COA application, which is accomplished through a two-phase process. Phase I-the initial application-is restricted to an area of airspace known as Class G airspace. This airspace is usually well clear of housing areas, roads, persons, and watercraft at or below 400 feet AGL. This restriction permits agencies to conduct the necessary ground and flight training to bring the organization's pilots, observers, and ground crew members to a high level of proficiency with drone operations. (3) In Phase I of this COA, the department must submit the following documents online with the COA application:

- *Airworthiness Release Statement.* The agency's account executive must write this document, which acknowledges that the organization will accept all responsibility to ensure that the drone is airworthy and that it will be operated and maintained per the manufacturer's recommendations.
- *Lost-Link Procedures.* This document provides a detailed outline of the procedures to follow in case there is a loss of communication between the control station and the drone.
- *Lost Communication Procedures.* This document provides procedures in case there is any lost communication between the PIC and the air traffic controllers (ATCs) or loss of communication between the PIC and the visual observers (VOs).
- *Emergency Procedures.* This document provides procedures that will be executed in the event of an emergency while operating the drone.
- *Drone Operating System Description.* A detailed description of your operating system and its capabilities.

Along with this documentation, the agency must also submit information regarding the type of mission; the operational altitudes; flight procedures; the PIC, flight crew, and VO qualifications; and training requirements. Once the FAA clears all the documentation and information provided (which typically takes 60 business days, provided there are no submission errors, missing information, or safety/airspace issues), the organization can begin training within the designated area outlined in the COA.

**(4) Pictures of a barn fire that was concluded to be a total loss. These pictures were taken for investigation purposes and helped diagram where on the property the barn was. These images also helped show where the most damage to the barn was sustained, which could**

**ultimately help find the origin and cause of the fire. (Photos by Gary Acker.)**

When the organization has completed the training, the FAA will have the organization apply for the Phase II (Jurisdictional) COA. This part of the COA typically incorporates the organization's entire jurisdiction. If there are mutual-aid agreements within a county or state, this COA will also allow for operations within those areas. As part of the Phase II process, the FAA may conduct an onsite program review and evaluation, including the following:

- A review of the agency's drone training and proficiency program with all training records.
- A review of the agency's standard operating procedures (SOPs) for drone operations. These SOPs must contain a holistic overview of the drone operations including preflight procedures, launch, recovery, and postflight and mission record keeping. At a minimum, these SOPs must contain emergency procedures and SOPs for expected scenarios, crew resource management, ground control station protocols, PIC and VO communications, and any special circumstances.
- A review of the agency's Safety Risk Analysis Plan, which identifies jurisdictional boundaries as well as all unique operational areas within the jurisdiction and their attendant hazards.
- An evaluation by the FAA of an actual drone exercise to demonstrate the competency and safety of the organization's program.

As imagined, it is not logistically possible for the FAA to make onsite visits to every COA applicant, so it will visit only those sites that have a unique operating airspace or environment that the FAA has not seen in previous site visits.

The FAA does recognize that some fire departments and public safety agencies cannot accommodate either of the COAs previously discussed. Thus, it has developed a program known as the Emergency COA (eCOA). The eCOA acts as a waiver, and the public safety agency must already be approved for a COA to request an eCOA. This process allows the organization to operate within the national airspace system during emergency situations only.

**Training**

Through the PAO, fire departments may exercise their own internal processes regarding aircraft certification, airworthiness, pilot, air crew, and maintenance personnel certification and training. (2, 4) This new program allows first responders to establish their own training and certification program for their pilots (operators), observers, and aircraft maintenance personnel as long as it is done under an acceptable level of safety. Although the FAA has limited oversight of the PAO, such operations must continue to comply with the regulations applicable to all aircraft operating in the national airspace. The governmental agency will assume all responsibility for oversight of the PAO.

With that said, there is a great amount of responsibility put on the fire department to ensure that drone flights are safe and operate under the same regulations with which all aircraft must comply while operating in the national airspace. I recommend that fire departments train their operators and observers to understand the following regulations at a minimum:5

- 14 CFR Section 61.111-*Operating Near Other Aircraft.*

- 14 CFR Section 61.113-*Right-of-Way Rules: Except Water Operations.*
- 14 CFR Section 61.115-*Right-of-Way Rules: Water Operations.*
- 14 CFR Section 61.119-*Minimum Safe Altitudes: General.*
- 14 CFR Section 61.155-*Basic VFR Weather Minimums.*

Knowledge of these regulations will ensure a safe flight with other manned aircraft in the vicinity of the drone flight. The above regulations are followed by all aircraft in the national airspace; thus, knowledge of these regulations is pertinent for communicating with ATCs. I recommend that your department create an agreement with your local airport that discusses procedures to follow when conducting drone operations. This communication will be key in keeping the airspace in which you are flying safe for all air traffic operating within it.
The above information seems like is a lot to take in; this is why doing your research and communicating all of this information to your fire and police commission are so important. During the process of applying for your PAO COA, your FAA specialist will be available to answer any questions that may come up. This PAO COA application process, in the eyes of the FAA, is the safest and most successful jurisdictionwide deployment of drone technology supporting public safety agencies.
The training of public agency drone operators should be consistent with that of commercial drone operators. Commercial operators are required by FAA regulation to obtain a remote pilot certification; all public safety agencies should develop their curriculum around this. Below is an outline of the requirements and steps to obtain that certification:

1. Requirements.

- Be at least 16 years old.
- Be able to read, speak, write, and understand English.
- Be in proper physical and mental condition to safely operate a drone.
- Pass the initial aeronautical knowledge exam.

1. Application process.

- Schedule an appointment with a knowledge testing center. Applicant must bring a government-issued photo ID to the exam.
- Pass the initial aeronautical knowledge test. Topics include the following:
    a. Applicable regulations relating to drone rating privileges, limitations, and flight operation.
    b. Airspace classification and operating requirements and flight restrictions affecting drone operation.
    c. Aviation weather sources and the effects of weather on drone performance.
    d. Drone loading and performance.
    e. Emergency procedures.
    f. Crew resource management.
    g. Radio communication procedures.
    h. Determining the performance of drones.
    i. Physiological effects of drugs and alcohol.
    j. Aeronautical decision making and judgment.

k. Airport operations.
l. Maintenance and preflight inspection procedures.

- Complete FAA Form 8710-13 for a remote pilot certificate using the online FAA Integrated Airman Certificate and/or Rating Application System.
- The Transportation Security Administration will do a background check on you. Once that has been completed, you will receive an e-mail with a temporary remote pilot certificate.
- A permanent remote pilot certificate will be sent in the mail once the FAA is finished processing it.

1. This certification is valid for two years. Certificate holders must pass a recurrent knowledge test every two years.

Existing pilots should follow these processes:

1. Requirements.
    - Hold a pilot certificate issued under 14 CFR Part 61.
    - Have completed a flight review within the previous 24 months.
2. Application process.
    - Complete the online training course *Part 107: Small Unmanned Aircraft Systems (sUAS) ALC-451*, available on the FAA FAASTeam Web site. Course topics include the following:
        1. Applicable regulations relating to drone rating privileges, limitations, and flight operation.
        2. Effects of weather on drone performance.
        3. Drone loading and performance.
        4. Emergency procedures.
        5. Crew resource management.
        6. Determining the performance of drones.
        7. Maintenance and preflight inspection procedures.
    - Complete FAA Form 8710-13.
    - Validate applicant identity.

        a. Make an appointment with a flight standards district office, a pilot examiner, an airman certification representative, or a certified flight instructor (CFI).
        b. Present FAA Form 8710-13 and proof of current flight review.
        c. The application will then be signed once the FAA representative verifies your identity. Acceptable forms of identification include the following:

United States driver's license.
Government identification card.
Passport.
Military identification card.

The FAA representative will issue the applicant a temporary airman certificate. CFIs are not authorized to issue a temporary certificate.

A permanent remote pilot certificate will be sent in the mail after the FAA is done processing the information.

Certification is valid for two years. Certificate holders must pass either a recurrent online training course or recurrent knowledge test every two years.

Individuals assigned to your drone team can also take classes in their free time; when they finish the course, they will have adequate knowledge to operate within the national airspace. (A qualified individual within your organization should test these individuals to ensure that they have obtained that knowledge.)

When training operators and observers, make sure your requirements remain current. The FAA has a regulation that states pilots must, at a minimum, have three takeoffs and landings in a 90-day period (14 CFR Part 61). (5) This ensures that your operators' skills and knowledge stay proficient. In addition, keep a log of all training and fireground operations for reporting purposes.

The above regulations are current and set forth by the FAA to legally fly within the national airspace. These regulations are subject to change at any time, and it is the department's responsibility to stay on top of those regulations through the FAA's Web site. Public safety agencies have different regulations than commercial and hobbyist operators. The FAA is currently working on putting forth regulations for those sectors of drone operations. Through the processes outlined above, your fire department will be on its way to becoming a safer and more effective firefighting force.

Drone technology provides a great tool for any public safety agency looking to make its operations more effective and efficient. Although this process may take a long time to complete, the training and time put into the drone program will end up paying for itself because of its multiuse functionality. This technology is not going away, so take advantage of drone capabilities.

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**JOSHUA LARSON** is a firefighter with the Middleton (WI) Fire Department and the founder of Breakover Services, a consulting firm for commercial and public safety sector drone operators.

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