A Perspective From on High

New FAA Rules Will Make Unmanned Aerial Systems (UAS) More Accessible to Consulting Arborists and Safer for Air Travel.

By Marty Shaw, RCA #470

Background

A few years ago, I took on an assignment to appraise the value of some nursery stock where a nurseryman had accused a crop duster of chemical trespass. The assignment included calculating damages for acres of plant material. The focus of my investigation quickly turned to the damage at the nursery and what may have caused it. While seeing the trees and other plants from the ground gave me an up-close and personal perspective of the site, it did very little to show any patterns of damage from a wider perspective. Since there were no public domain images of the nurseryman's fields after the alleged damage occurred, I had no way to discern if the damage I was seeing up close might fit into any patterns that one might expect to see if a nonselective pesticide had drifted some distance onto the site from a crop duster's aircraft. At that time, I wondered how one might obtain images from a much higher altitude using a wide angle lens. The simple answer to that question was to hire an aerial photographer and have them provide the photos I needed. I was shocked when I looked into the cost of farming out such a job. The site was remote and the nearest aerial photographer wanted over $1,000. Plus, I would have to make another trip all the way out to the site again at the cost of an entire day just to make sure that my pilot took all the photos I needed to fulfill the assignment.

In another case, the US Army Corp of Engineers (USACE) owned a large parcel of land near a waterway that had been set aside for multiple-use purposes. Part of the land was a wildlife refuge, and another part was reserved for recreation. A local municipality leased the property from USACE, which would permit the city to utilize the land as part of the city's park system. One stipulation of the lease agreement was that the city would abide by all the guidelines in the USACE Master Plan, which had originally been developed years earlier with public support and input. Included in the Master Plan were detailed specifications for the land's functions and uses. Unfortunately for the city, a new mayor was elected who knew nothing about the USACE'S Master Plan. The mayor unwittingly gave permission to a local charity group to clear nearly 15 acres of the site with heavy land-clearing equipment under the guise of making the land more useful to the public. In reality though, all trees and understory that existed at the site were blocking a waterfront view of a commercial land development for sale—right next to the site. The land-clearing event caused extensive damage to trees, shrubs, and another wildlife habitat. Nearly everything that was growing there was wiped out. Once again, I needed aerial photographs to give the users of my report a sense of scope and extent of the damage.

Fred Barnard originally coined the phrase "One Picture is Worth a Thousand Words." In these cases, an image showing pesticide damage from a crop duster could have been worth a million dollars in nursery damages! In USACE's case, a picture might be worth $1.2 million of wildlife habitat and parkland trees. The value of aerial photography became crystal clear to me. I needed a means to gather my own images from hundreds of feet in the air. If only I had my own camera-equipped aircraft and the credentials to use it. Then I could fly right to where I needed, click a button a few times, and have all of the video footage and imagery to develop a well-reasoned, substantive opinion. I could gather the wider details

that I needed to convey to the users of my report, and I could do it for a fraction of the cost of hiring someone else to do it. And, if I needed that type of information often enough, I might be able to make a healthy profit for myself.

So, I did my homework, and in January 2015, I bought a DJI Phantom 3 advanced drone. As I began to explore this new and exciting world of hobby model aircraft flying, I also learned that there are some rules that must be followed if you want to fly your aircraft within the bounds of our federal laws. It turns out that in the United States, if you want to fly your aircraft commercially (i.e., for money), you need to have a pilot's license. There is one notable exception: you may apply for Title 14 Part 107 Section 333 exemption. This exemption permits the use of UAS for fee without the rigors of needing a pilot's license. Traditionally, the application process is a Section 333 exemption and is fraught with bureaucratic hurdles, paperwork, lengthy delays, and the exercise of one's frustration threshold.

The FAA

To understand how we arrived to such a seemingly insurmountable dilemma, to something that should be quite simple, it may be worthwhile to take a look at the origins of the FAA and how the current rules and regulations regarding drones came to be. On May 21, 1958, Democratic Senator Mike Monroney introduced a bill to create the Federal Aviation Agency to provide safe and efficient use of our national airspace. An August 23, 1958, Republican President Dwight D. Eisenhower signed the Federal Aviation Act, which transferred the Civil Aeronautics Authority's functions to this new, independent federal agency, making it solely responsible for civil aviation safety throughout the country. President Eisenhower appointed retired Air Force General Elwood "Pete" Quesada the first Federal Aviation Agency Administrator, and just 60 days later, on December 31, 1958, the Federal Aviation Agency began operations in Washington, D.C. On April 1, 1967, the Federal Aviation Agency became the Federal Aviation Administration (FAA) to reflect the agency's more active role in regulating the safety of our airways and to reflect the broad authorities it was given to govern air transportation.

Between 1959 and 1969, the number of aircraft operations at the FAA's air traffic control (ATC) towers had increased by 112 percent. The increases in air travel caused capacity to become a real safety concern; the lack of clear standards and regulations became a threat to the flying public. Schedule delays cost the air carriers millions of dollars annually; not to mention the cost to passengers over and above inconvenience and discomfort they experienced while traveling by air. Capacity had to be increased to prevent system delays, and safety had to improve. In 1968, Congress gave even greater and broader powers to the FAA administrator to prescribe a variety of rigorous standards throughout all national airspace.

Along the way, the FAA has increasingly been granted more money and greater powers to keep air travel, civil and civil/military mixed-use airports, civil aircraft, and equipment operating safely and efficiently. (Federal Aviation Administration, 2015)

National Airspace System

The National Airspace System (NAS) is all of the airspace, navigation facilities, and airports of the United States, along with their associated information, services, rules, regulations, policies, procedures, personnel, and equipment. It also includes all of these components that are shared jointly by both civil and military aviation.

As part of the FAA's evolving and growing mandate to keep our airways safe and free from bottlenecks, the FAA organized

all types of airspace into various classes, depending on the type of aircraft traffic that takes place. These types of airspace control what type of aircraft are permitted to fly in each class of airspace. Broadly categorized by volume of traffic, types of navigation aids available, and the altitude at which aircraft will typically fly, the NAS provides guidance or restrictions to pilots and UAS operators in the national airspace.

Airspace Classifications

Class A airspace encompasses the en route, high-altitude environment used by aircraft to transit from one area of the country to another. All aircraft in Class A must operate under Instrument Flight Rules (IFR). Class A airspace exists within the United States from 18,000 feet above mean sea level (MSL) to and including 60,000 feet MSL.

In *Class B* airspace, all aircraft—both IFR and Visual Flight Rules (VFR) aircraft—are subject to positive control from ATC. Class B airspace exists at 29 high-density airports in the United States as a means of managing air traffic around airports. It is designed to regulate the flow of air traffic above, around, and below arrival and departure routes (these are essentially air highways) used by air carriers. Class B airspace generally includes all airspace from an airport's established elevation up to 12,000 feet MSL, and, at varying altitudes, out to a distance of about 30 nautical miles from the center of the airport. Aircraft operating in Class B airspace must have specific radio and navigation equipment, including an altitude encoding transponder, and they must obtain ATC clearance to land, take off, approach, and otherwise navigate.

Class C airspace is defined around airports with airport traffic control towers and radar approach control. It normally has two more or less concentric circular areas with a diameter of 10 and 20 nautical miles. The top of Class C airspace is normally set at 4,000 feet above ground level (AGL). The FAA had established Class C airspace at 120 airports around the country. Aircraft operating in Class C airspace must have specific radio and navigation equipment, including an altitude encoding transponder, and must obtain ATC clearance. VFR aircraft are only separated from IFR aircraft in Class C airspace (i.e., ATC does not separate VFR aircraft from other VFR aircraft, as this is the respective pilot's responsibility).

Yuneec Typhoon Q500+.
—*Photo by Onfocus*

Class D airspace is under the jurisdiction of a local air traffic control tower (ATCT). The purpose of an ATCT is to sequence arriving and departing aircraft and direct aircraft on the ground; the purpose of Class D airspace is to provide airspace within which the ATCT can manage aircraft in and around the immediate vicinity of an airport. Aircraft operating within this area are required to maintain radio communication with the ATCT. No separation services are provided to VFR aircraft. The configuration of each Class D airspace area is unique. Class D airspace is normally a circular area with a radius of five miles around the primary airport. This controlled airspace extends upward from the surface of the ground to about 2,500 feet AGL. When IFR approaches are used at an airport, the airspace is normally designed to encompass those procedures.

Class E airspace is a general category of FAA-controlled authority that is intended to provide air traffic service and adequate separation for IFR aircraft from other aircraft. Although Class E is controlled airspace, VFR aircraft are not required to maintain contact with ATC, but are only permitted to operate in visual meteorological conditions (VMC). In the United States, Class E airspace generally exists from 700/1,200 feet AGL to the bottom of Class A airspace at 18,000 feet MSL. It generally fills in the gaps between Class B, C, and D airspace at altitudes below 18,000 feet MSL. Federal Airways below 18,000 feet MSL, including Victor Air-

ways, are classified as Class E airspace.

Class G airspace lies between the surface and 700/1,200 feet AGL. ATC does not have the authority or responsibility to manage air traffic within this airspace; however, the Congress enacted laws that give the FAA complete control over all U.S. airspace. While the FAA controls all the airspace, property owners continue to have the right to use the airspace above their property provided there is no interference with air traffic. This includes all airspace used by UAS, for both commercial use and for hobbyists.

At present, hobbyists who fly model aircraft may fly to an altitude of 400 feet may not fly directly over people who are not directly involved with flight operations, and may not fly within restricted airspace or airspace where commercial aircraft fly, such as within 5 miles of any airport. Model aircraft hobbyists are not presently required to obtain licensing or certifications from the FAA to fly in the permitted national airspace; however, they are responsible for the safe operation of their aircraft, are liable for any damage that might be caused by a crash of their aircraft, and can be fined for flying unsafely or in unpermitted areas.

(Source: Airman's Information Manual)

The FAA has a long history of adapting to the changing conditions of our culture and has been very sensitive to the needs of the flying public and commercial aviation over the years. Today is no different. There has been an explosion of UAS sales in the United States. In November 2014, one drone manufacturer reported that a half a million drones had been sold in the United States alone. The impressive surge in new UAS operators is very encouraging for drone manufacturers who are having difficulty keeping up with demand, but it is likewise creating a headache for the FAA administrator. The FAA began requiring all new drone owners to register their devices last November. Not surprisingly, only about 325,000 drones had been registered by February of this year, which means that most of the new unregistered UAS are still airborne and flying incognito. The increased number of drones with high and fast flying capabilities zipping around the national airspace is a real concern and could potentially be a hazard to cargo and passenger aircraft.

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There are some estimates that the UAS market will continue to grow at an incredible rate of 32% between 2015 and 2020, to $5.6 billion in trade. There are nearly limitless applications, from precision agricultural dispersion and monitoring, law enforcement, media production, retail, inspection services, mapping/modeling services, education, and a host of other uses that are on the drawing boards. Cameras are mostly used now, but the variety of lightweight sensors, equipment, and materials that can be attached to UAS is immense, and they can all be deployed remotely.

There is hope on the way for Consulting Arborists and anyone else who wishes to reach for the clouds, fly vicariously in their SHD-equipped UAVs, and make a living at it. Very soon, you may be collecting that impressive aerial video footage and imagery on your own without the need to rely on the limitations of other pilots or the added time, expense, and red tape of obtaining a pilot's license. Instead, you will be collecting a fat fee for doing something that is so fun, you can't believe you get paid to do it!

In response to this wave of new operators in our skies, the FAA has sent out the call and has solicited ideas from the public and the industry on how best to deal with the new UAS presence. Soon to be law, the FAA has proposed an entirely new set of regulations under Title 14 Part 107 to allow commercial use of UAS without a pilot's license.

FAA Notice of New Proposed Rules for UAS

Overview of Small UAS Notice of Proposed Rulemaking Summary of Major Provisions of Proposed Part 107 The following provisions are being proposed in the FAA's Small UAS NPRM.

Operational Limitations:

- Unmanned aircraft must weigh less than 55 lbs. (25 kg).
- Visual line-of-sight (VLOS) only: the unmanned aircraft must remain within VLOS of the operator or visual observer.
- At all times, the small unmanned aircraft must remain close enough to the operator for the operator to be capable of seeing the aircraft with vision unaided by any device other than corrective lenses.
- Small unmanned aircraft may not operate over any individuals not directly involved in the operation.
- Daylight-only operations (official sunrise to official sunset, local time).
- Must yield right-of-way to other aircraft, manned or unmanned.
- May use visual observer (VO) but not required.
- First-person view (FPV) camera cannot satisfy "see-and-avoid" requirement but can be used as long as requirement is satisfied in other ways
- Maximum airspeed of 100 mph (87 knots).
- Maximum altitude of 500 feet above ground level.
- Minimum weather visibility of 3 miles from control station.

- No operations are allowed in Class A (18,000 feet and above) airspace.
- Operations in Class B, C, D and E airspace are allowed with the required ATC permission.
- Operations in Class G airspace are allowed without ATC permission
- No person may act as an operator or VO for more than one unmanned aircraft operation at one time.
- No careless or reckless operations.
- Requires preflight inspection by the operator.
- A person may not operate a small unmanned aircraft if he or she knows or has reason to know of any physical or mental condition that would interfere with the safe operation of a small UAS.
- Proposes a microUAS option that would allow operations in Class G airspace, over people not involved in the operation, provided the operator certifies he or she has the requisite aeronautical knowledge to perform the operation.

Operator Certification and Responsibilities:

- Pilots of a small UAS would be considered "operators."
- Operators would be required to:
  - » Pass an initial aeronautical knowledge test at an FAA-approved knowledge testing center.
  - » Be vetted by the Transportation Security Administration.
  - » Obtain an unmanned aircraft operator certificate with a small UAS rating (like existing pilot airman certificates, never expires).
  - » Pass a recurrent aeronautical knowledge test every 24 months.
  - » Be at least 17 years old.
  - » Make available to the FAA, upon request, the small UAS for inspection or testing, and any associated documents/records required to be kept under the proposed rule.
  - » Report an accident to the FAA within 10 days of any operation that results in injury or property damage.
  - » Conduct a preflight inspection, to include specific aircraft and control station systems checks, to ensure the small UAS is safe for operation.

Aircraft Requirements:

- FAA airworthiness certification not required. However, operator must maintain a small UAS in condition for safe operation, and prior to flight must inspect the UAS to ensure that it is in a condition for safe operation. Aircraft registration required (same requirements that apply to all other aircraft).
- Aircraft markings required (same requirements that apply to all other aircraft). If aircraft is too small to display markings in standard size, then the aircraft simply needs to display markings in the largest practicable manner.
- Model aircraft:
  - » Proposed rule would not apply to model aircraft that satisfy all of the criteria specified in Section 336 of Public Law 112-95.
  - » The proposed rule would codify the FAA's enforcement authority in part 101 by prohibiting model aircraft operators from endangering the safety of the NAS.

Source: https://www.faa.gov/regulations_policies/rulemaking/recently_published/media/2120-AJ60_NPRM_2-15-2015_joint_signature.pdf

The new rules are expected to go into effect later this year, and UAS Operator Certification is expected to be available online before the new rules apply. The FAA has a new handbook that informs UAS operators on what they need to know about the National Airspace System and what they must know in order to fly their aircraft safely. You can find more information on the FAA website at www.faa.gov, and you can find the UAS Operators Certification Manual at: https://www.faa.gov/regulations_policies/rulemaking/recently_published/media/2120-AJ60_NPRM_2-15-2015_joint_signature.pdf

The cost of purchasing quality UAS has dropped by 2/3 compared to just a couple of years ago, and they have become so easy to fly that nearly anyone with a smart phone and good eyesight can own and operate one. Seeing drones fly overhead used to be a rarity, but it is now becoming common place—almost ubiquitous. Now that the FAA rules are changing to make commercial aviation of UAS accessible to anyone without a pilot's license, the average Consulting Arborist will be able to quickly and easily get that picture worth a thousand words or the footage that's worth a million dollars.

Those who take to the air in their UAS will also soon find there are many more uses greater then we can think or imagine right now. I can see the day is coming very soon when flying your drone to capture that critical data from a tree, remotely, high above the canopy, will be the next indispensable Consulting Arborist skillset, and your UAS will become the next indispensable tool in your tool belt!

See the following videos for some of Marty's UAS footage:

- https://youtu.be/1I5QZWrKEFM
- https://youtu.be/o0j7EyXmeVo

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