Keeping Up with the Drones

A comprehensive guide to the remote-controlled aircraft that are changing our world.

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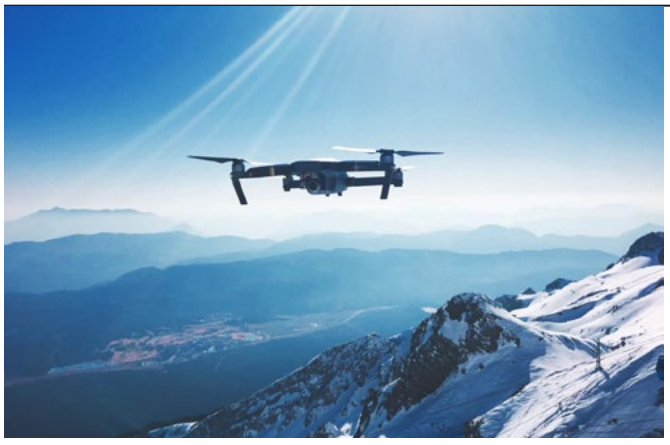
The Basics

In broadest terms, a "drone" is any remote-controlled aircraft. Steve Zaloga, in his book Unmanned Aerial Vehicles: Robotic Air Warfare 1917-2007 (2008), traces the term "drone" back to the mid 1930's. Britain's Royal Navy had developed the "DH 82B Queen Bee" remotely controlled airplane that was used for anti-aircraft practice. The U.S. Navy subsequently developed its own remote-controlled targets, which were called "drones" in deference to the Queen Bee.

Federal statutes and regulations about drones refer to them as "unmanned aircraft" ("UA"). The category includes all aircraft "operated without the possibility of direct human intervention from within or on the aircraft." The "unmanned aircraft system" or UAS refers to the aircraft plus all the other associated parts, such as ground stations and communication links. "Fixed wing" drones look like airplanes while the "VTOL" versions, which stands for vertical take-off and landing, look like helicopters, and are often described by the number of rotors – quad-copters or octo-copters.

Drones range in size from an F-16 fighter (the Predator), to drones the size of some insects or hummingbirds. "Small" drone or "small UAS" is a defined term and means a UAS that at takeoff weighs 55 pounds or less. Mini-drone is a marketing term that refers to drones the size of water bottles or that easily fit into a backpack. Nano- or micro-drones are even smaller and will fit into the palm of one's hand. Prototypes as small as



mosquitoes have been shown at certain tech shows.

Drones can be built from scratch. They can be purchased in various degrees of assembly just about anywhere. Some are ready to fly (RTF) out of the box (other than batteries). Almost Ready to Fly (ARF) drones must be assembled, and Bind-N-Fly (BNF) drones do not come with a transmitter. This allows the owner to select and use the transmitter of choice. These designations are usually marked on the packaging.

There is a drone at every price point. A lot come equipped with built-in cameras and others are more customizable with gimbals that allow different sensors to be attached as needed. One can purchase a $500 camera or a $50,000 camera, a $7,500 LIDAR system or a $150,000 system. Tip: If one does not consider the drone expendable, and one wants to find it if it flies off—and experts agree that it is almost a certainty at some point—invest in a "drone tracker." Maybe you can't buy happiness, but you can buy some peace of mind for about $150-250.

The Sky Really is the Limit on Potential Applications for Drones

Drones can be equipped with cameras (most are) and other data collection devices to gather information previously inaccessible or that has historically been collected by humans. They can usually do this safer, quicker, and less expensively, allowing for a faster and more targeted response to the information.

One of the early embracers of drone technology has been the film industry. For example, drones provide "over the shoulder" views when people are running, riding motorcycles, driving cars, etc. that are generally cost prohibitive using a helicopter.

Drones are already widely being used for inspection of such things as utility-transmission lines, power stations, cell-towers, water towers, bridges, dams, and the like. Insurance companies use drones to inspect roofs for storm damage. Construction companies use images and measurements from drones to support pay applications, to document progress, justify change orders, verify completion, and capture time-lapse marketing video. Drones are being used to inspect historic buildings to assess damage and repairs, to count endangered species, and monitor environmental easements.

Drones can be used for journalism, and have proved invaluable to first responders. During Hurricanes Harvey and Irma in fall 2017, drones were used to find people in need (search and rescue) and in certain cases delivered cell phones or water over an impassable road. They were also used to monitor levees, measure damage, and survey damaged areas. By capturing more information in a shorter time, power companies were able to get the power back on so that recovery could begin.

In the case of firefighting, drones can see "around" the fire and identify hot spots not visible to firefighters due to smoke or heat. Despite bad press about drones grounding helicopters fighting California wildfires, drones were ultimately deployed to combat the fires because they can drop water in

places helicopters cannot or will not go. Researchers at the University of Nebraska have experimented with using drones to set controlled burns. Drones are a perfect way to monitor fire lines.

In a similar vein, public safety and law enforcement are using drones for search and rescue (lost hikers, Alzheimer's patients), situational awareness, to track fleeing suspects, and accident investigation. At an accident scene that has stopped traffic on a major interstate, what might take two hours to do with measuring tapes and measuring wheels can be now be done with a drone in 20-30 minutes.

Drones are revolutionizing agriculture with superior soil and field analysis, crop spraying, and health assessments, allowing the farmer to respond quicker and more precisely. They can be used to identify mosquito larvae and eventually to assist with eradicating them.

A California company called Zipline is using drones to deliver blood, medicine and vaccines in areas of Rwanda where there are no roads or the roads have washed out. A company in Ohio called Aerial Anthropology produces real-time views of anywhere in the world. Hospice patients can revisit places in their past in real time from their beds.

One limiting factor, however, is that most small UAS are battery powered. Batteries of small UAS typically allow for about 30 minutes, maybe 45, of actual flying time, depending on wind or weather conditions. Mini- or nano-drones may only be able to fly for 5 to 8 minutes before a battery change. Manufacturers may advertise much longer battery life, but those estimates are usually based on "ideal" or laboratory conditions.

Reports of Personal Injury from Drones

Although drones can come in very small sizes, they are not really toys. The propellers on drones and projectile drone parts can inflict serious, sometimes irreparable damage.

In 2017, a products liability suit was filed against Parrott SA, its related companies, and component manufacturers to recover for injuries allegedly caused by Parrott's Rolling Spider, an "ultra-compact mini-drone" that fits in the palm of the hand and is designed for both indoor and outdoor use. According to the complaint, the plaintiff alleges that he purchased the drone for his son for Christmas in 2014, and that while the son was operating it "in an appropriate and anticipated manner in the home when the drone's unguarded blade came into contact with [the father's] left eye." The plaintiff alleges "full thickness corneal laceration" that required emergency surgery and an extended recovery.

In fall 2015, a toddler (18 mos. old) in England lost an eye when he was hit by a propeller after the operator lost control of the drone. Also in 2015, in Seattle, Washington, a woman was knocked unconscious by a drone that ricocheted off a building. There have been reported cases of lacerations, drones crashing through condominium windows, into wedding guests, and into cyclists—resulting in injuries and sometimes lawsuits. In a case arising from a drone used during a fraternity-sponsored event, the victim was

struck in the head, and later reported having trouble concentrating.

Flying drones is one of those activities that appears to have a modest risk of causing accidents but the resulting damage can be severe or even life threatening. It's best to follow the rules and err on the side of caution.

Regulation of Drones

The purpose for which drones are flown dictates what rules apply. There are three general categories of use: Governmental, Commercial, and Recreational.

Governmental operations are those carried out by the military or a governmental unit for governmental purposes. The military has its own rules for operating UAS, and its operations are subject to international humanitarian laws and treaties. Domestically, agencies that are considered political subdivisions of government (law enforcement, fire, first responders, EMS, etc.) may operate UAS either as a Public Aircraft Operator pursuant to individual Certificates of Authorization with the Federal Aviation Administration under 14 CFR Part 91, or pursuant to the rules governing civil commercial operations under 14 CFR Part 107. Each has advantages and disadvantages pertaining to liability, governmental use, ownership, and the ability to self-certify and self-train.

Most aspects of public aircraft operation, including airworthiness, pilot certification, and maintenance, are not subject to FAA oversight, while civil operations are regulated under 14 CFR for FAA monitoring, oversight, enforcement, and surveillance. Governmental agencies sometimes prefer to determine their operation, depending on statute application for governmental purpose, mission, aircraft, and crew. The two paradigms differ mainly on authorization to fly under certain conditions and in certain airspace, either by utilization of a Public Aircraft jurisdictional or blanket Certificate of Authorization, or by operating under 14 CFR Part 107 for small unmanned aircraft.

An operation is considered to be recreational if the drone is being operated solely and exclusively for recreational or leisure purposes, not for work, business purposes, or for compensation or hire. The FAA's position is that recreational flying is flying the drone for "refreshment of strength and spirits after work; a means of refreshment or division."

Every other operation, by default, is considered to be a commercial operation. In short, a commercial operation is any operation not solely for recreation and not by the government for governmental purposes.

Recreational Flight

Recreational operators, a/k/a hobbyists, may elect to follow one of two sets of rules. The hobbyist may comply with what's known as the (1) "Special Rule for Model Aircraft" or (2) the FAA's Small UAS Rule also referred to as "Part 107" (because it is codified in Part 107 of Chapter I, Volume 2, Title 14 of the Code of Federal Regulations).

Under either set of rules registration with the FAA is required. In 2015, the FAA issued a rule requiring ALL owners of small unmanned aircraft to register with the FAA. Then as now, hobbyists were given a single registration number and that number was to be placed on each UAS that the registrant owned that would be operated for recreational purposes. Conversely, commercial operators register the aircraft. A separate registration number is needed for each commercial drone.

The rule requiring hobbyists to register was invalidated by the courts, but reinstated by Congress in December 2017. If a hobbyist is already registered, it appears that nothing further is required. The registration number and expiration date remain unaltered. A person who de-registered most likely will be required to go through the process again. The FAA site will have more detailed instructions

Once registered, if flying under the Special Rule for Model Aircraft, the operator must:

A. Fly for hobby or recreational purposes only

B. Follow a community-based set of safety guidelines

C. Fly the UAS within visual line-of-sight

D. Give way to manned aircraft

E. Provide prior notification to the airport and air traffic control tower, if one is present, when flying within 5 miles of an airport

f) Fly UAS that weigh no more than 55 lbs. unless certified by a community-based organization

The recreational operator must comply with ALL these rules, or else she or he is not operating under the Special Rule for Model Aircraft. Fail to comply with any one, and the operator is automatically subject to Part 107.

The community-based rules in item (b) refer primarily, but not exclusively, to the rules of the Academy of Model Aeronautics or AMA. The AMA safety code can be found on the AMA website. But the safety code is not the only thing to consider. There are also rules for how to organize events, how to segregate participants, insurance requirements, and so forth. In short, contrary to what many novices assume, printing out the AMA safety code and taking it with you, is not really all that's required.

Commercial Flight

The rules for commercial operations are found in Part 107, and certain related statutes. These are federal laws that dictate when, where, how high, and how fast the drones may be flown. Some of the rules are waivable, others are not. Part 107 is available only to UAS weighing 55 pounds or less. If the UAS weighs more than 55 pounds, then the commercial operator needs special exemptions under other aviation regulations. Only one or two such weight exemptions have been granted.

In general commercial drone flight requires (1) a registered aircraft; (2) that the person manipulating the controls must have a remote pilot certificate with a small UAS rating; and (3) airspace authorization for the area and time of flight. Though not required by the FAA, specific aviation insurance is critical.

The basic operating rules require being aware at all times of any manned aircraft in the area and complying with all FAA issued flight restrictions. Drones must be operated no higher than 400 feet above ground or a structure being inspected, under 100 miles per hour. They may not be operated at night, over people, beyond the line of sight (meaning the ability to actually see and react to the drone), or carry hazardous materials. They may be operated from a moving car or boat only if they are flown over a sparely

populated area and not transporting another's property for hire.

Currently, the Holy Grail of commercial operations is to be able to fly over people (journalism, first responders, law enforcement) and beyond the visual line of sight (agriculture, delivery). The goal is to develop technology so that flight paths/routes can be pre-programmed so that UAS can cover long distances or acreages without posing an undue safety risk to manned aircraft or persons or property on the ground. Currently two news agencies have obtained waivers for flights over people, but these are tethered (stationary), light weight, deconstruct-on-impact, and limited to 45 feet in altitude. So there is still a long way to go to fully integrate drones into business life.

Privacy and Property Rights

Everyone's mind nearly always turns to privacy issues. No one wants drones buzzing their backyard much less hovering there. The law is presently trying to figure these questions out. Logically, a crime committed with a drone ought to be no different than any other crime. The difficulty is that the law has never recognized a right to privacy from the air. If the backyard is visible from the neighbor's second story window, then how is a drone any different? There seems to be some discussion about extending the same private property rights as exist on the ground to some amount of airspace above private property. The theory is that one could recover for trespass if a drone were to fly over one's property at a low altitude. One issue that has not been discussed is whether the property owner's legal duties and responsibilities would also attach to that airspace.

Embracing the Future

A perfectly good drone for photography or inspection can be purchased for under $1500, and the cost of getting a remote pilot's certificate is a fraction of the cost and time it takes to get a pilot's license. But that low cost of entry obscures the reality that flying a drone is aviation and that the aviation business is complicated and highly regulated. Passing the remote pilot's test is just the first step. Recreational operators would be well advised to join a community based group and stay educated on the rules and best practices. Businesses interested in incorporating drones into their business model need sound advice from business and legal experts, and the crawl-walk-run approach has produced the best results. For more information, check out the FAA's website at www.faa.gov/uas and feel free to contact the author.

The consensus is that drones today are in the same nascent stage that flight was a century ago. Every day brings revelations of new developments and applications and also new challenges. Every article, video, and press release could appropriately end with the tagline, "Stay tuned for scenes from our next exciting episode." ■

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