Unmanned Aircraft

What is a Drone?

Issues of the Law

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Legal Issues Arising with Civilian UA Integration

UAS integration into the national airspace opens up a variety of legal issues that must be addressed in light of both UAS airframe and payload technologies.
The most basic principles to understand are that a UA is an aircraft, and it obeys the same aerodynamic principles as a manned aircraft.

All unmanned aircraft can be remotely operated ranging from large aircraft such as airliners to high speed jets.

Unmanned aircraft are distinguished due to their technological design which does not center on a cockpit but rather a design of their potential mission functionality.

All unmanned aircraft are designed around a specific functionality, principally their payload.

Without the specificity of their payload, unmanned aircraft would be classified as model aircraft or experimental units.
A Drone is an Unmanned Aircraft
What is a Drone?

- The Federal Aviation Administration (FAA) defines an aircraft in the Federal Aviation Regulations (FAR) § 1.1 (2015) as:

  “A device that is used or intended to be used for flight in the air.”

- This definition, which ultimately derives its authority from 49 U.S.C. 106(g), 40113, 44701, applies to both manned and unmanned aircraft.

- The definition of an airplane, which emerges from the same authority states that an airplane is:

  “An engine driven fixed wing aircraft heavier than air, that is supported in flight by the dynamic reaction of the air against its wings.”
What is a Drone?

• Exploring this concept a step further under the same authority, the definition of a rotorcraft is:

   “A heavier than air aircraft that depends principally for its support in flight on the lift generated by one or more rotors.”

• Since a UAS can be composed of either fixed wing or rotorcraft form, all of the above definitions apply perfectly to an unmanned aircraft since the unmanned aircraft obeys the same three dimensional aerodynamic principles as its manned counterpart and requires the same basic components to operate in the air.

• So where is the definitional variance?
What is a Drone?

• The definition of unmanned aircraft can be found in The FAA Modernization and Reform Act of 2012, Subtitle B § 331:

  “An aircraft that is operated without the possibility of direct human intervention from, within, or on the aircraft.”

• The sole distinguishing factor of manned and unmanned aircraft from a legal definitional standpoint is the absence of a human pilot onboard the physical aircraft.

• This is a major legal point as well as a technological reality.

• Without the human inside of the aircraft, its legal role in the national airspace is vastly different than its manned counterpart although they both are aerodynamically and technologically similar.
What is a Drone?

- In general, it is useful to classify an unmanned aircraft according to three specific criteria:
  
  (1) FAA Operational Categories
  (2) General Airframe Technologies
  (3) Functional Size Categories

- Each UAS will have a specification within each of the three criteria, allowing for a specific type of identification of the aircraft.

- This facilitates a general understanding of the performance, range, and maneuverability of the aircraft at an initial glance.

- This is helpful when dealing with cases involving unmanned aircraft, as initial generalizations can be formed about the aircraft at issue in light of the facts of the specific legal case.
The three types of civilian operational categories of the UAS as defined by the FAA are as follows:

- **Experimental Unmanned Aircraft:** Experimental aircraft are unmanned aircraft which serve various experimental purposes such as airframe testing, payload testing, research and development, pilot and aircrew training, academic and educational training, and systems demonstration aside from air shows and air racing events.

- **Model Unmanned Aircraft:** Model aircraft are recreational unmanned aircraft, with technologies ranging from fixed wing, to rotorcraft to lighter than air models, that are regulated by Advisory Circular AC 91-57 and more currently by The FAA Modernization and Reform Act of 2012 § 336 Special Rule for Model Aircraft.
Operational Categories

• § 336 defines a model unmanned aircraft as:
  
  (1) capable of sustained flight in the atmosphere  
  (2) flown within visual sight of the person operating the aircraft; and  
  (3) flown for hobby or recreational purposes

• The guidelines for model aircraft in § 336 state that model aircraft are flown strictly for hobby or recreational use, are not more than 55 pounds unless otherwise certified, are operated in a manner that does not interfere with and gives way to manned aircraft, and when flown within 5 miles of an airport the airport operator and air traffic control tower is notified and mutual arrangements are made.

• Model aircraft are flown within community based sets of safety regulations that are based upon national community based model aircraft organizations.
• **Public Unmanned Aircraft:** Public unmanned aircraft are discussed in § 334 Public Unmanned Aircraft Systems.

• This section provides the provisions for the establishment of unmanned aircraft in the national airspace.

• While the ultimate size and limits of the aeronautical technologies of public unmanned aircraft are not defined in § 334, the section does permit government public safety agencies to operate small unmanned systems while the issues of the national airspace are being worked out legislatively.
§ 334 allows for an agency to operate an unmanned aircraft weighing 4.4 pounds or less if operated:

(1) within sight of the operator

(2) less than 400 feet above the ground
(3) during daylight hours

(4) within class G airspace; and

(5) outside of 5 statute miles from any airport, heliport, seaplane base, spaceport, or other location with aviation activities
When looking at an unmanned system, the airframe is the key determinant to the degree of maneuverability that the aircraft will have in three dimensional airspace.

The speed, range, and maneuverability requirements of a UAS will be key factors in determining the choice of technology used to achieve the required mobility for fulfilling the mission of the aircraft.

The size and weight of the payload, too, will determine the choice of a UAS airframe technology, as well as time in air or "persistence" requirements.
There are four basic types of UA airframe technologies, as well as hybrid models, that agencies and organizations will be choosing from to achieve their maneuverability, speed, range, and payload requirements:

1. Fixed Wing UA
2. Rotorcraft UA
3. Tilt Rotor UA
4. Lighter than Air UA

The choice of UA will also depend on a careful analysis of long term mission requirements, cost, and pilot capabilities as well as ground station availability and location.
General Airframe Technologies

FIXED WING UAV

ROTARY WING UAV

TILT ROTOR UAV

LIGHTER THAN AIR UAV
Functional Size Categories

• A final category of UAS is the functional size categorization.

• This category is particularly important in the legal arena as future airspace operations regulations are likely to revolve around UAS size as well as operational category and airframe.

• The functional size of a UAS not only determines its robustness in terms of aeronautical capabilities and payload abilities, but also of its visibility in the air and its maneuverability.

• Both of these factors contribute to the safe operation of the aircraft.

• Functional size categorizations, like other categorizations of unmanned aircraft, vary widely between military services, civilian agencies, and countries.
The functional size categories in the civilian world are arbitrary, except for the small category, which is specifically defined in the FAA Modernization and Reform Act of 2012. The categories are as follows:

- **Large UA**: strategic in nature as opposed to tactical, and are extremely expensive to acquire, operate and maintain. These aircraft have high altitude capabilities, extended ranges and possess the longest endurance.

- **Medium UA**: more tactical nature than the large UAS. It is smaller than a large UA but larger than the FAA defined size of a small UA, thus weighing 55 pounds or more up to the size of a large UA.
• **Small UA**: The small UA is the primary UA targeted by the FAA for initial integration into the national airspace.

  - The FAA Modernization and Reform Act of 2012 § 331 defines a small unmanned aircraft as an "an unmanned aircraft weighing less than 55 pounds."

  - While this is a narrow definition, it sets a concrete and specific definitional standard for small UAS reference.

  - This unmanned aircraft is currently the most pervasive in the civilian world and its use and presence in the skies will increase exponentially as the FAA works out the rules and regulations for its use.
Functional Size Categories

- **Micro/Mini UA**: The micro/mini UAS is an unmanned aircraft similar in size to a model aircraft.
  
  - However, it has a distinct operational function with a payload configured for a specific mission.
  
  - This category tends to be hand held in size as well as hand launched.
  
  - Payloads are usually singular in nature and the entire aircraft may have only a single functional payload capability.
  
  - Research with this category includes security functions such as building security, short range scientific surveying such as tree based wildlife observations, and short range photography.

- **Nano UA**: Extremely small aircraft, currently experimental, potential uses are security and photography
The Federal Aviation Administration has proposed a framework of regulations in February, 2015, that would allow routine use of certain small unmanned aircraft systems (UAS) in today’s aviation system, while maintaining flexibility to accommodate future technological innovations.

The proposal presents various safety rules for small UA (under 55 pounds) conducting non-recreational, commercial type operations.

The rule would limit flights to daylight and visual-line-of-sight operations and addresses height restrictions, operator certification, optional use of a visual observer, aircraft registration and marking, and operational limits.
An unmanned aircraft is not merely an aircraft but in systems engineering terms, a “system of systems” consisting of the aircraft, the ground station, the GPS satellite constellation, the communication infrastructure (L-Band, C-Band), the launch & recovery infrastructure, the personnel, etc.

All aspects of these systems must be accounted for in both the technical and legal domain.
Questions?

Drone Photography by Donna A. Dulo