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Dull, Dirty, and Dangerous: The FAA's Regulatory Authority Over Unmanned Aircraft Operations

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Introduction

"Dull, Dirty and Dangerous" is a common description of the potential uses and utility of unmanned aircraft, operated as military surveillance and communications platforms, hardened weapons delivery systems, observation and interdiction assets for national security and border protection, and any number of civilian or non-military applications. Scientists use them for intercepting and measuring atmospheric phenomena such as hurricanes, sampling the air quality over disaster areas, and flying through volcanic eruptions where manned aircraft would risk loss of aircraft and human life, a few of the many current and envisioned aviation missions. Any current activity in which airborne assets are deployed in a "dull" (long endurance, high altitude, fatigue-inducing), "dirty" (volcanic plumes, chemical spills) or dangerous (high risk, low altitude such as firefighting) environment may potentially be conducted in a safer, less expensive, and more efficient manner with unmanned aircraft. Currently, there is no recognized technology solution that could make these aircraft capable of meeting regulatory requirements *to* see and avoid other aircraft, and for the command and control

integrity that would provide the remotely-piloted aircraft with the equivalent level of safety of an aircraft with a pilot on board.

This article describes the history of unmanned or remotely-piloted aircraft, the technological challenges facing operators of such systems, and the unique regulatory issues that have arisen because of the rapid evolution of this new, but not-so-new, sector of aviation.

I. A Brief History of Unmanned Aviation

Unmanned aircraft were first designed and utilized or intended to be utilized as military weapons as early as the First World War. Several designs in the United Kingdom and the U.S. were essentially radio-controlled rockets. The "Kettering Bug" and another craft designated the "AT" (for aerial torpedo) were piston-driven biplanes remotely controlled by radio, which were in reality first-generation cruise missiles. Although quite advanced for the time, they were never actually deployed before the war ended.

One of the early pioneers in unmanned aviation was the movie actor Reginald Denny. Denny designed and built radio-controlled model airplanes when he wasn't in front of the camera and, in addition to opening a hobby shop in Hollywood, he founded Denny Industries, a manufacturer of RC model airplanes. Denny unsuccessfully tried to sell his designs for a 12-foot wingspan RC aircraft to the U.S. Army, but later found a taker in the Artillery Corps. The Artillery Corps ordered enough of Denny's aircraft to use as target drones that Denny was able to open factories bearing the name "Radioplane" in Van Nuys, California, and Joliet, Illinois, which continued to manufacture large numbers of aerial targets through the end of World War II.

Development of unmanned or remotely-piloted vehicles ("RPVs") continued after the War, and Radioplane was sold to the large aerospace company Northrop Corporation in 1952. Many other designs, both propeller-driven, and jet-engine powered, evolved in the military environment. Currently, UAVs ("Unmanned Aerial Vehicles") or UASs ("Unmanned Aircraft Systems"—the term preferred by the Federal Aviation Administration) have become one of the more highly sought-after tools for the "war fighter" in combat theaters around the world.[1] They provide both surveillance and weapons delivery capability to all branches of the military, and the demand for these systems has spawned a cottage industry of contractors who are developing and demonstrating systems that range from "micro-UAVs" that fit in the palm of one's hand and are equipped with cameras that send real-time images through telemetry to operators on the ground to

high-flying surveillance aircraft such as Global Hawk that cruise over 350 miles per hour at 60,000 feet.[2] And there are literally hundreds of systems manufactured by more than 250 companies around the world that fit anywhere on the technical and size scale between those two UAS types. A more recent and widely-publicized use of a large, military-type system, commonly known as the "Predator B," has been by the Department of Homeland Security/ Customs and Border Protection agency. This agency flies the "Predator B" (the military designation is the MQ-9, or the "Reaper") along the U.S.-Mexico border out of a remote airport in southern Arizona, and claims over 2,500 arrests and seizure of thousands of pounds of contraband and several vehicles. There are plans to deploy several more MQ-9s to the agency's Northern Border and Southeastern Coastal Regions.[3]

Radio-controlled model aircraft have been flown by the recreational enthusiast since Reginald Denny's days, and the organization that "self-regulates" these "pilots" is the Academy of Model Aeronautics. The AMA "is the world's largest sport aviation organization, representing a membership of more than 170,000 from every walk of life, income level and age group . . ." and ". . . is the official national body for model aviation in the U.S. AMA sanctions more than a thousand model competitions throughout the country each year, and certifies official model flying records on a national and international level."[4]

Falling into a very wide gap between the recreational modeler who flies his or her RC aircraft on weekends for the sheer fun of it (and/or for competition) and the national defense and homeland security missions described above, is the rapidly-evolving civilian UAS community that seeks to operate these systems in a variety of environments and for many commercial or law-enforcement purposes.

II. Recent Developments

A. Law Enforcement

News item appearing in multiple Internet news sites in June of 2006:

> **"US Sky Regulator Clips Wings of Los Angeles Police Drone"**
>
> by Staff Writers Los Angeles (AFP) Jun 22, 2006
>
> US aviation regulators grounded Thursday a Los Angeles crime-fighting drone aircraft due to concerns over potential air traffic accidents.

The SkySeer drone that was tested by the Los Angeles Sheriff's Department relies on surveillance technology most commonly used in combat zones, but law enforcement would like to see it used in the streets of the second most populous US city.

But the Federal Aviation Administration (FAA) said the Los Angeles Sheriff's Department has not yet obtained the proper authorization to test the kite-like craft and has put the case under review.

The Sheriff's Department demonstrated SkySeer for the media last week in the city of Redlands, about 60 miles (100 kilometers) east of Los Angeles.

When the Sheriff's held the press conference last week, we did not expect them to actually fly the craft," FAA spokeswoman Laura Brown told AFP.

"We need to know how and where they plan to operate the craft, and most importantly at what altitude so that it will not interfere with already congested air traffic," she said.

The drone is the same size as a remote control airplane and is outfitted with two tiny cameras that beam real-time images to a ground command station.

Police say the craft, which is inconspicuous and virtually silent, will aid search and rescue missions and may be helpful in tracking suspects fleeing on foot.

The FAA, which normally sets a "band of airspace" for unmanned aerial vehicles, believes the SkySeer exceeded appropriate altitude levels during its field test last week.

Octatron, the designer and operator of SkySeer, could face a civil penalty, according to Brown.

The Los Angeles Sheriff's Department was not available for comment.

Privacy advocates have raised concerns over the potential for SkySeer to infringe on personal space. 'This is really science fiction in our daily lives,' Beth Givens of The Privacy Rights Clearinghouse told AFP."[5]

In response to the Los Angeles event and the high profile attention in the U.S. given to the sale of a parafoil unmanned surveillance system to the Brevard County, Florida, sheriff's department and the FAA's announcement that it had advised the law enforcement agency that it would not be permitted to operate the system—a position that the sheriff's office publicly announced that

it would challenge, the FAA published a policy notice on February 13, 2007 declaring reliance upon recreational model aircraft regulations to operate small unmanned aerial vehicles ("UAVs") in the regulated U.S. national airspace to be a violation of FAA policy and Advisory Circular 91-57.[6]

Advisory Circular 91-57 was published on June 9, 1981, with the stated purpose of outlining and encouraging voluntary compliance with safety standards for model aircraft operators.[7]

One prior FAA policy statement, AFS-400 UAS POLICY 05-01, "Unmanned Aircraft Systems Operations in the U. S. National Airspace System—Interim Operational Approval Guidance," published September 16, 2005, to be discussed below, was the only other formal pronouncement by that agency of any official policy pertaining to non-military unmanned aviation.[8] It, too, references AC 91-57 and specifically excludes model aircraft from evaluation under the criteria of that policy.

B. Military Needs

Military UAVs have in the past been operated in restricted airspace (over training and test ranges controlled and operated by the Federal Government) or in war theaters. Thus, there has been little or no opportunity for conflict between UAVs and manned civilian aircraft. The September 11, 2001, terrorist attacks had an immediate impact on commercial and general aviation, and airspace security has been become as important as aviation safety. In recognition of the immediate need for approved military and homeland security operations of unmanned systems outside of restricted airspace, requiring the safe integration of military unmanned and manned civilian flight operations in the U.S. National Airspace System (NAS), the Office of the Secretary of Defense and the Federal Aviation Administration undertook a joint OSD-FAA airspace effort, in furtherance of the OSD's vision to have "File and Fly" access for appropriately equipped unmanned systems while maintaining an equivalent level of safety to that of an aircraft with a pilot onboard.[9] As of this writing, that vision has yet to be realized, but the effort is underway.

C. National Security and Border Protection

When the Department of Defense or the Department of Homeland Security declares that a UAS operation is a matter of "national security", the FAA may approve an application for a Certificate of Waiver or Authorization ("COA") that, under normal circumstances, might not otherwise conform to the policies set forth in published FAA policy. In such a situation, the requirements for

national security may override the FAA's mandated risk mitigation requirements and the applicant must declare in the COA application acceptance of all risks associated with the UAS operations. According to the FAA Policy Statement pertaining to these situations, such requests should be directed to the Administrator, Federal Aviation Administration, from an equivalent level individual of the applicant's organization.[10] The FAA's Air Traffic Organization is responsible for the COA process as outlined in FAA Order 7610.4, Special Military Operations, and FAA Order 7210.3, Facility Operations and Administration.[11] The primary function of the Air Traffic Organization is to move air traffic safely and efficiently. The organization's "customers" are commercial and private aviation and the military.[12]

The U.S. Customs and Border Protection agency operates a fleet of 261 aircraft of 20 different types, including UAV systems. They have been flying unmanned aircraft of varying types and capabilities since 2004, and introduced their Predator B (MQ-9) in 2005, which operates along the Southwestern Border. This remotely-piloted aircraft is capable of flying at an altitude of 50,000 feet MSL (above Mean Sea Level) and remaining on station for 30 hours, sending "real-time" Electro-optical/Infrared images to ground operators who utilize the asset as a supplement to ground and air-based officers. Although the aircraft is physically launched from an Army airfield in Sierra Vista, Arizona, the "Command and Control" personnel and equipment are located in Riverside, California. The operations are conducted at night, along the southern border, and flown in restricted airspace corridors known as "TFRs," or Temporary Flight Restrictions.[13] When active, a TFR may not be traversed or entered by any aircraft without permission from the controlling authority (the FAA Air Traffic Control facility responsible for the area).[14] The FAA provides radar support and oversight of the flights.[15] The first "Predator B" acquired by the CBP was lost on April 24, 2006 when it crashed in a remote area due to what was determined to be "pilot error."

Although federal law enforcement, homeland security, and military UAV operations are often conducted in the U.S. national airspace, requiring coordination with the appropriate FAA air traffic control facility so as to avoid conflict with manned civilian aircraft, the Department of Defense merely "attests to" the FAA that the systems and pilots are in compliance with the FARs respecting airworthiness issues and aircrew qualifications.[16] Although the military and other federal agencies that operate fleets of aircraft "self-certify" their aircraft and pilots, those pilots or opera-

tors are not similarly exempt from the airspace rules (except for military test ranges) found in 14 CFR Part 91.[17]

D. Evolution of Civilian UAS Operations

As discussed in the first section of this article, unmanned aircraft have been a part of civil and military aviation for nearly 90 years. Although small airplanes and rotorcraft flown by recreational modeling enthusiasts make up a significant portion of known unmanned aircraft currently flying, a small but sustained civilian market for remotely-piloted aircraft services has emerged. Commercial, non-military applications that actually have been implemented include, but are not limited to:

- Aerial photography
- Precision agriculture/remote sensing and aerial application
- Power transmission line monitoring
- Commercial fisheries
- Wildlife management and surveillance
- Fire detection and suppression
- Motion picture and television production,
- Environmental research and air quality management/control
- Law enforcement/Border and Coastal Protection
- Humanitarian rescue and recovery missions
- Disaster response
- Digital mapping and planning, land management
- Satellite augmentation systems
- Ground transportation monitoring and control
- Communications and broadcast services

Fredrick W. Smith, founder and Chairman, President and Chief Executive Officer of FedEx Corporation, has long advocated operation of unmanned intercontinental air freighters.[18] The technology necessary to conduct such operations is available now, and the major barriers to implementation are system safety requirements, public perception, and a regulatory scheme that addresses both issues.

Falling somewhere between the civilian, commercial, and local law enforcement uses of UASs listed above and the high-tech, military applications described in section C are the "RC" modelers.

These recreational enthusiasts operate airplanes and rotorcraft that are commercially available through a variety of sources such as hobby shops and Internet vendors. Many of these aircraft are box kits that are assembled from a set of manufacturer's instructions, while others, at the high end, are considerably more sophisticated flying machines that are designed and built by their owners from engineering drawings and diagrams based upon actual aircraft designs. In the latter category are scale model replicas of modern airliners, military aircraft, and vintage World War II bombers and fighters, some with fuselages that are over twelve feet long and tails that stand nearly six feet high. Seen in the air from a distance it is nearly impossible to distinguish between a radio-controlled model 300 yards away and a real, full-sized aircraft that may be a mile away. These airplanes are capable of, and sometimes do, fly considerably higher than the 400-foot AGL (above ground level) limit set by FAA policy.[19] Some of these aircraft are larger and capable of higher performance than many commercial UAVs that are currently on the market.

Among the many challenges faced by UAS/UAV designers, manufacturers, and operators seeking an opening or opportunity in the civil and commercial markets, perhaps the most significant is the lack of airspace regulation that covers all existing and contemplated unmanned systems. Of course, liability for civil operation, insurance requirements, payload and sensor capabilities, lack of secure non-military radio frequencies, system reliability, operator/pilot training issues, and airframe and power plant, navigation, and communication systems certification are no less important to the maturity of the UAS industry. However, access to the airspace is the key to everything, for if the FAA's assertion of jurisdiction over all UAS operations goes unchallenged, anyone intending to launch a UAV into any FAA controlled airspace must do so in strict compliance with the FAA's rules, policies, and guidelines. Failure to comply has many implications, none of them favorable to the UAV operator.

III. The Aviation Regulatory Environment

A. History of the Regulations

The Federal Aviation Administration was created by the Federal Aviation Act of 1958.[20] It is part of the Department of Transportation, and derives its rulemaking and regulatory power from Title 49 of the U.S. Code, Section 106. The U.S. government has exclusive sovereignty of airspace in the U.S.[21] A citizen of the U.S. has a public right of transit through the navigable airspace.[22] Among other powers the statute confers upon the Administrator of

the Federal Aviation Administration is the mandate to develop plans and policy for the use of the navigable airspace and assign by regulation or order the use of the airspace necessary to ensure the safety of aircraft and the efficient use of airspace.[23] The Administrator may modify or revoke an assignment when required in the public interest. The Administrator shall prescribe air traffic regulations on the flight of aircraft (including regulations on safe altitudes) for navigating, protecting, and identifying aircraft; protecting individuals and property on the ground; using the navigable airspace efficiently; and preventing collision between aircraft, between aircraft and land or water vehicles, and between aircraft and airborne objects.[24]

Pursuant to its rulemaking authority, the FAA has set forth the standards for the operation of aircraft in the sovereign airspace of the U.S.[25] Commonly known as the "FARs" (Federal Aviation Regulations), these regulations are the "rules of the road" for certification of all civil aircraft,[26] airmen,[27] airspace,[28] certification and operations for air carriers and operators for compensation or hire,[29] air traffic and general operating rules,[30] schools and other certificated agencies,[31] airports,[32] and navigational facilities.[33]

The first section of 14 CFR, Part 1.1, lists the definitions and abbreviations to be observed in the ensuing parts and subparts of the FARs. Of more than passing interest to the unmanned aircraft community is the fact that the terms "UAV" or "UAS" or "unmanned system" or "unmanned aircraft" or any other term referring to remotely-piloted aircraft are nowhere to be found in the FARs or, for that matter, in any other federal regulation or statute. The term "*aircraft*" is defined as "a device that is used or intended to be used for flight in the air."[34] Similarly, "*airplane* means an engine-driven fixed-wing aircraft heavier than air, that is supported in flight by the dynamic reaction of the air against its wings."[35] "*Air traffic* means aircraft operating in the air or on an airport surface, exclusive of loading ramps and parking areas."[36]

The FAA regulates aircraft, airmen, certain categories of employees of airlines and commercial or common carrier operations, airports, and the national airspace. The FAA's "toolbox" is the system of regulations, rulemaking processes, certifications, advisory circulars, special authorizations, and directives that the agency uses to carry out its regulatory functions of rulemaking, surveillance, compliance, and enforcement.

Two of the tools that the FAA uses to administer the FARs are Advisory Circulars and Policy Statements. Advisory Circulars ("ACs") are utilized to advise the aviation community on issues pertaining to the regulations, but are not binding upon the public.

The exception to that would be when an Advisory Circular is specifically referenced in a regulation.[37] The Advisory Circulars are issued in a numbered-subject system corresponding to the subject areas of the FARs.[38] The Advisory Circular that has created the most controversy in the unmanned aviation world is AC 91-57, which will be discussed in more detail below. That circular references 14 CFR Part 91 (Air Traffic and General Operating Rules), which contains the airspace regulations.

The second advisory tool is the Policy Statement. Administrative implementation (as announced or documented by a published Policy Statement) of a particular statutory provision shall be accorded deference by the courts when it appears that Congress delegated authority to the agency generally to make rules carrying the force of law, and that the agency interpretation claiming deference was promulgated in the exercise of that authority. Delegation of such authority may be shown in a variety of ways, as by an agency's power to engage in adjudication or notice-and-comment rulemaking, or by some other indication of a comparable congressional intent.[39] The FAA has issued two policy statements pertaining to unmanned aircraft, AFS-400 UAS Policy Statement 05-01, and a second policy published in the *Federal Register*, entitled "Unmanned Aircraft Operations in the National Airspace System," which likewise references 14 CFR Part 91.[40]

B. Current Regulation of Unmanned Aircraft

As discussed above, there is no specific reference in any of the Federal Aviation Regulations to unmanned aircraft, pilots/operators of unmanned aircraft, or operations in the national airspace of unmanned aircraft. A literal reading of the definitions listed in 14 CFR 1.1 would include all unmanned aircraft in the description of "aircraft." There is no case authority, nor is there a rule or regulation that says that unmanned aircraft of any size or capability are *not* regulated. This conceivably would include radio-controlled model aircraft. In recognition of the reality that RC aircraft are aircraft, but not of the type that the FAA is inclined to regulate, Advisory Circular 91-57 was published in 1981. This AC encourages voluntary compliance with safety standards for model aircraft operators. The circular also acknowledges that model aircraft may pose a safety hazard to full-scale aircraft in flight and to persons and property on the ground.[41] Modelers are encouraged to select sites that are sufficiently far away from populated areas so as to not endanger people or property and to avoid noise sensitive areas such as schools and hospitals. Aircraft should be tested and evaluated for airworthiness and should not be flown more than 400 feet above

ground level. If the aircraft is to be flown within 3 miles of an airport, contact with local controlling authorities should be initiated. And, above all, model aircraft should always give way to, or avoid, full-scale aircraft, and observers should be used to assist in that responsibility.[42]

FAA policy statement AFS-400 UAS Policy 05-01 was issued September 16, 2005, in response to dramatic increases in UAS operations in both the public and private sectors.[43] The Policy was intended to provide guidance to be used by the FAA to determine if unmanned aircraft systems (UAS) may be allowed to conduct flight operations in the NAS. AFS-400 personnel are to use this policy guidance when evaluating each application for a Certificate of Waiver or Authorization (COA). Due to the rapid evolution of UAS technology, this policy is to be subject to continuous review and updated when appropriate.[44] The policy is not meant as a substitute for any regulatory process, and was jointly developed by, and reflected the consensus opinion of, AFS-400, the Flight Technologies and Procedures Division, FAA Flight Standards Service (AFS); AIR 130, the Avionics Systems Branch, FAA Aircraft Certification Service (AIR); and ATO-R, the Office of System Operations and Safety, FAA Air Traffic Organization (ATO).[45]

The 05-01 Policy recognized that if UAS operators were strictly held to the "see and avoid" requirements of 14 CFR Part 91.113, "Right-of-Way Rules," there would be no UA flights in civil airspace.[46] The right-of-way rule states that ". . . when weather conditions permit, regardless of whether an operation is conducted under instrument flight rules or visual flight rules, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft. When a rule of this section gives another aircraft the right-of-way, the pilot shall give way to that aircraft and may not pass over, under, or ahead of it unless well clear."[47] The FAA's policy supports UA flight activities that can demonstrate that the proposed operations can be conducted at an acceptable level of safety.[48]

Another collision avoidance rule states that: ". . . no person may operate an aircraft so close to another aircraft as to create a collision hazard."[49] The FAA also recognizes that a certifiable "detect, sense and avoid" system, an acceptable solution to the "see and avoid" problem for UA, is many years away.[50]

Through the implementation of this policy, the FAA has given civil UAS developers and operators two choices: (1) They can operate their systems as public aircraft and apply for a Certificate of Waiver or Authorization ("COA") that will permit operation of a specific aircraft in a specific operating environment with specific

operating parameters and for no more than one year at a time; or (2) they can follow the normal procedures set forth in the Code of Federal Regulations to obtain a Special Airworthiness Certificate for their aircraft,[51] operate the aircraft in strict compliance with all airspace regulations set forth in 14 CFR Part 91 and have them flown by certificated pilots.[52] The policy also references Advisory Circular (AC) 91-57, Model Aircraft Operating Standards, published in 1981, as it applies to model aircraft, and states that "... UA that comply with the guidance in AC 91-57 are considered model aircraft and are not evaluated by the UA criteria in this policy."[53]

The FAA has furthermore declared in this policy that it will not accept applications for civil Certificates of Waiver or Authorization, meaning that only military or public aircraft are eligible for the COA.[54] A "public aircraft" is defined in 14 CFR Part 1.1 as follows:

> *Public aircraft* means any of the following aircraft when not being used for a commercial purpose or to carry an individual other than a crewmember or qualified non-crewmember:
>
> (1) An aircraft used only for the U.S. Government; an aircraft owned by the Government and operated by any person for purposes related to crew training, equipment development, or demonstration; an aircraft owned and operated by the government of a State, the District of Columbia, or a territory or possession of the U.S. or a political subdivision of one of these governments; or an aircraft exclusively leased for at least 90 continuous days by the government of a State, the District of Columbia, or a territory or possession of the U.S. or a political subdivision of one of these governments.
>
> (i) For the sole purpose of determining public aircraft status, *commercial purposes* means the transportation of persons or property for compensation or hire, but does not include the operation of an aircraft by the armed forces for reimbursement when that reimbursement is required by any Federal statute, regulation, or directive, in effect on November 1, 1999, or by one government on behalf of another government under a cost reimbursement agreement if the government on whose behalf the operation is conducted certifies to the Administrator of the Federal Aviation Administration that the operation is necessary to respond to a significant and imminent threat to life or property (including natural resources) and that no service by a private operator is reasonably available to meet the threat.
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> (ii) For the sole purpose of determining public aircraft status, *governmental function* means an activity undertaken by a government, such

as national defense, intelligence missions, firefighting, search and rescue, law enforcement (including transport of prisoners, detainees, and illegal aliens), aeronautical research, or biological or geological resource management.

(iii) For the sole purpose of determining public aircraft status, *qualified non-crewmember* means an individual, other than a member of the crew, aboard an aircraft operated by the armed forces or an intelligence agency of the U.S. Government, or whose presence is required to perform, or is associated with the performance of, a governmental function.

(2) An aircraft owned or operated by the armed forces or chartered to provide transportation to the armed forces if—

(i) The aircraft is operated in accordance with title 10 of the U.S. Code;

(ii) The aircraft is operated in the performance of a governmental function under title 14, 31, 32, or 50 of the U.S. Code and the aircraft is not used for commercial purposes; or

(iii) The aircraft is chartered to provide transportation to the armed forces and the Secretary of Defense (or the Secretary of the department in which the Coast Guard is operating) designates the operation of the aircraft as being required in the national interest.

(3) An aircraft owned or operated by the National Guard of a State, the District of Columbia, or any territory or possession of the U.S., and that meets the criteria of paragraph (2) of this definition, qualifies as a public aircraft only to the extent that it is operated under the direct control of the Department of Defense.[55]

In summary, the FAA mandates that one intending to operate an unmanned aircraft in the national airspace must do so either under the permission granted by a Certificate of Waiver or Authorization (available only to public entities, which includes law enforcement agencies and other government entities), or with an experimental airworthiness certificate issued pursuant to relevant parts of Title 14 of the Code of Federal Regulations. Specifically proscribed are operations that are of a commercial nature, without the protection of a COA, but ostensibly under the guidelines set forth in Advisory Circular 91-57.

In recognition that some commercial for-hire UAS operators are flying their systems in the national airspace under AC 91-57 guidelines, the FAA published a second policy statement on February 13, 2007.[56] This notice was a direct response to increasing efforts by

U.S. law enforcement agencies and some small UAV manufacturers to introduce systems into operational service on the back of model aircraft regulations. The policy states that the FAA will only permit UAV operations under existing certificate of authorization and experimental aircraft arrangements.

The policy states:

> The current FAA policy for UAS operations is that no person may operate a UAS in the National Airspace System without specific authority. For UAS operating as public aircraft the authority is the COA, for UAS operating as civil aircraft the authority is special airworthiness certificates, and for model aircraft the authority is AC 91-57. The FAA recognizes that people and companies other than modelers might be flying UAS with the mistaken understanding that they are legally operating under the authority of AC 91-57. AC 91-57 only applies to modelers, and thus specifically excludes its use by persons or companies for business purposes.
>
> The FAA has undertaken a safety review that will examine the feasibility of creating a different category of unmanned "vehicles" that may be defined by the operator's visual line of sight and are also small and slow enough to adequately mitigate hazards to other aircraft and persons on the ground. The end product of this analysis may be a new flight authorization instrument similar to AC 91-57, but focused on operations which do not qualify as sport and recreation, but also may not require a certificate of airworthiness. They will, however, require compliance with applicable FAA regulations and guidance developed for this category.

The gap that is created by these policies is a consistent definition of a "model aircraft," and, as discussed in previous sections of this article, some individuals and agencies have taken advantage of this gap to operate small (and not-so-small) UAVs with cameras and other sensing equipment on board, clearly for either a commercial or law enforcement purpose, without having applied for a COA or a Special Airworthiness Certificate.[57]

C. The FAA'S Enforcement Authority

The FAA has two issues to face with respect to its enforcement authority over UAS operations. First, it must determine what it *can* regulate, and second, it must decide what it *will* regulate. The answer to the second challenge largely depends upon a resolution of the first.

The FAA issues six types of regulations: Mandatory, prohibitive, conditionally mandatory, conditionally prohibitive, authority

or responsibility, and definition/explanation.[58] Mandatory and prohibitive regulations are enforceable. The other four types represent exceptions or conditions. A thorough analysis of the applicability of a regulation to a particular situation will include answering the following questions: (1) To whom does the regulation apply; (2) what does it say in its entirety; (3) where must the regulation be complied with; (4) when must it be accomplished; (5) how does it apply to the situation in question; and (6) are there any special conditions, exceptions, or exclusions.[59]

Since unmanned aircraft are "aircraft," and there is no exception found elsewhere in the regulations that excludes UAVs from the definition, it could be argued that the FAA has full regulatory authority over all aircraft that are capable of and do fly in the national, navigable airspace.

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Since unmanned aircraft are "aircraft," and there is no exception found elsewhere in the regulations that excludes UAVs from the definition, it could be argued that the FAA has full regulatory authority over all aircraft that are capable of and do fly in the national, navigable airspace. "*Navigable airspace* means airspace at and above the minimum flight altitudes prescribed by or under this chapter, including airspace needed for safe takeoff and landing."[60] Minimum safe altitudes are prescribed at 1000 feet above the ground in a congested area, with a lateral separation from objects of 2000 feet, and an altitude of 500 feet above the surface, except over open water or sparsely populated areas. In those cases, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure.[61] The exception is when it is necessary for takeoff or landing, in which case the navigable airspace goes to the surface (and along a designated approach path or airport landing pattern).[62] The 400-foot AGL altitude limit for model aircraft contained in AC 91-57 was probably an observance of the 500-foot minimum safe altitude for manned aircraft operating anywhere except in "Class G" (uncontrolled) airspace,[63] providing a 100-foot "buffer," in addition to the recommendation to not operate within close proximity to an airport. Research has failed to reveal the actual FAA policy history of AC 91-57, but the foregoing is the commonly-held belief of FAA officials and individuals familiar with the history of model aviation.[64]

If the broad definition of "aircraft" is interpreted to include unmanned aircraft, with no exceptions for models, then the FAA may regulate anything and anyone that operates or pilots an aircraft in the navigable airspace. Even a cursory reading of the FARs will reveal that the vast majority of the regulations are intended to provide for safe operations of aircraft that carry people, both for the protection of the crews and passengers, and for people and property on the ground. Although unmanned aircraft have been on the aviation scene for over 90 years, there is no evidence in any of the preambles to regulations or other historical documents currently available for review that the authors of any regulation contemplated application of a specific regulation to unmanned, remotely-piloted aircraft. Moored balloons and kites,[65] unmanned rockets,[66] and unmanned free balloons,[67] categories of objects or vehicles that are intended to occupy a place in the airspace and are unmanned, are specifically covered by existing regulations, but there is nothing similar for other types of unmanned aircraft.

It could be argued that the FAA has some enforcement authority under existing airspace regulations 14 CFR §§91.111 and 91.113, which require that an operator of an aircraft be able to safely operate near other aircraft and observe the right-of-way rules, but the more difficult and presently unresolved issue is whether such aircraft must meet certification requirements for the systems and the qualification standards, with appropriate certificates, for pilots, sensor operators, mechanics, maintenance personnel, designers, and manufacturers.

Thus far, there has been no litigation challenging the FAA's enforcement authority over unmanned aircraft and their operations. Government contractors, Customs and Border Protection, the U.S. military establishment, and other public aircraft operators have, for the most part, followed the guidelines of AFS-400 UAS Policy 05-01 and AC 91-57. There is no anecdotal evidence that the FAA has initiated any enforcement activity against anyone who is, or is perceived to be, operating a UAS outside of these guidelines, but the time is coming. Absent a robust set of regulations that specifically addresses the unique characteristics of unmanned aircraft, someone will openly and defiantly fly a commercial UAS in such an open and notorious manner that the FAA will be compelled to respond with more than a "friendly" warning (such as that which was issued to the Los Angeles County Sheriff and the Brevard County Sheriff).

The FAA's public position on this issue, as evidenced by the February 13, 2007 policy statement published in the *Federal Register*, is that any unmanned aircraft to be operated in the national

airspace, with the exception of RC models, must comply with the requirements for a Certificate of Waiver or Authorization if it is a public aircraft, or for a Special Airworthiness Certificate if it is a civil aircraft. Thus, for the time being, the Agency has answered the second question (what it *will* regulate) with a broad statement of policy that it is the responsible authority over airspace and aviation.

The next question, then, is even if the FAA exercises its declared authority over airspace and aviation and attempts enforcement against an operator of a "small" (model size) UAS who is using the system for some arguably commercial purpose, without an airworthiness certificate or a licensed pilot in control, just what regulation would be enforced, and what sanction would be appropriate to deter further violations?

An example of such a situation can be found in a product developed by a Canadian company and marketed in the U.S. The small UAS is billed as a "mini agriculture plane that takes high resolution GPS-based digital images for precision agriculture." The aircraft, which has a 4 foot long fuselage and an 8 foot wingspan, and weighs 6 pounds, is equipped with a miniature autopilot that autonomously navigates the craft after it is hand launched over a field. The aircraft and on-board camera perform automatically to take GPS-based digital imagery. The navigation system is programmed to land the aircraft from where it was launched at the conclusion of the flight. The aircraft is advertised as capable of flying to an altitude of 2,200 feet.[68] There are other entrepreneurs and developers around the world whose presence and activities in the civil small UAS market (the UASs are small, the market is not) are putting pressure on the FAA to take the lead in UAS rulemaking. If a farmer or other commercial agriculture concern were to acquire such a system and fly it over fields in what could be characterized as a "sparsely populated" areas, at an altitude where possible conflict with manned aircraft could occur, is there in place a regulatory mechanism to stop this activity? Or, if a commercial photographer were to operate a small UAS equipped with a camera over a similar area for the purpose of photographing the land for advertising or some similar purpose, could the FAA prevent the operation?

The issue for the FAA in the foregoing scenario is what tools are in the FAA toolbox to enforce whatever regulations it may deem enforceable. These systems do not have an airworthiness certificate. The FAA's central mission is to promote compliance with safety standards.[69] FAA Order 2150.3A acknowledges that civil aviation depends primarily upon voluntary compliance with regulatory re-

quirements, and only when those efforts have failed should the Agency take formal enforcement action.

A certificate holder cannot be deprived of "property" (the certificate) without due process.[70] Congress has given the FAA authority not only to make the rules,[71] but to enforce them through a number of methods, including issuance of "an order amending, modifying, suspending, or revoking" a pilot's certificate if the public interest so requires.[72] Any other certificate issued by the FAA can be "amended, modified, suspended or revoked" in the same manner. The problem with the scenario described above is that the "pilot" in all likelihood will not be an FAA certificated pilot, because it is not required for such operations, and the aircraft and its systems will not be certified as airworthy, again because it is not required. So long as the operator/pilot does not interfere with the safe operation of a manned aircraft, or otherwise enter a controlled airspace (such as in an airport environment) without permission, there is no violation of any existing regulation.

Taking the scenario a step further, if the pilot/operator inadvertently allows the UAS to come close enough to a manned aircraft to force the latter into an evasive maneuver (not an unlikely event even in a sparsely populated agricultural region), a possible violation of 14 CFR §91.111 (Operating Near Other Aircraft) could ensue. In this situation, the FAA has no certificate to revoke, and thus no statutory or regulatory authority to proceed with a formal enforcement proceeding pursuant to 49 U.S.C. §44709(b).

This leaves one other mechanism, the civil penalty the Administrator may impose against an individual "acting as a pilot, flight engineer, mechanic, or repairman. . . ."[73] The FAA is authorized to assess a civil penalty for violations of certain regulations, up to $400,000 against large entities or companies, and up to $50,000 against individuals and small businesses.[74] The relevant section of the U.S. Code defines "pilot" as "an individual who holds a pilot certificate issued under part 61 of title 14, Code of Federal Regulations."[75] Again, an argument could be made that a non-certificate holder would not be subject to even the civil penalty provisions of the U.S. Code, thus leaving the FAA with no effective or realistic enforcement power over "unauthorized" civil unmanned aircraft operations.

IV. Filling the Gaps

The foregoing discussion leads to just one conclusion, which is that the FAA's enforcement "toolbox" is somewhat lacking in substance when dealing with ignorant (of existing FAA policy), uncooperative, or openly defiant UAS operators. The day will come when

the FAA is forced to deal with a UAS operator, pilot, manufacturer, or business entity that is willing to take the FAA to task on its enforcement powers, and "push the envelope" to see how far it can go before a judicial showdown takes place. As market forces create greater opportunities for developers and entrepreneurs to invest capital into more sophisticated systems and bring the industry closer to solving the "sense and avoid" problem, there will be ever-increasing pressure on the FAA to put into place a regulatory structure that will allow the agency to reclaim its "ownership" of the airspace. This necessarily includes implementing reasonable operational and engineering standards through the rulemaking process that will allow the industry to grow while not negatively affecting the overall safety of the aviation environment.

The civilian UAS community needs to have standards by which admission to the airspace can be assessed and authorized. There must be a workable definition of a "commercial" UAS operation so that there is no confusion about flying a commercial UAS mission as a "model aircraft."

—Douglas M. Marshall

The first task is to define the scope of what the FAA can and should regulate. There must be a definition of "model aircraft" that is precise enough to give notice to the public of the exact nature of the aircraft that will remain unregulated. This definition should include such factors as size, weight, speed, performance capability, and kinetic energy, that would describe the physical attributes of the aircraft and its systems. In addition, there should be a precise description of the locations and altitudes where model aircraft can be flown. If modeling enthusiasts want to create increasingly larger and faster models, some of which could easily overtake and possibly bring down a small general aviation aircraft, they must know where those aircraft can be legally operated, and under what conditions.

The civilian UAS community needs to have standards by which admission to the airspace can be assessed and authorized. There must be a workable definition of a "commercial" UAS operation so that there is no confusion about flying a commercial UAS mission as a "model aircraft." A non-enforceable Advisory Circular such as 91-57 is not going to be of much assistance to the FAA as it attempts to deal with commercial, for-hire UAS operators who believe that they are exempt from any certification requirement

and understand that Advisory Circulars are not regulatory and are not rules, nor are FAA policy statements binding on anyone other than the FAA.

The only real alternative for the FAA is to engage in the rulemaking process, subject to the inevitable lengthy comment and revision schedule. That much is clear. What isn't clear is how that process should proceed. One approach is simply to amend the current regulations to state that UASs are "aircraft" and that their operators are pilots for all purposes. An exception could be delineated that would exclude the modelers, subjecting everyone else to the full spectrum of Title 14. This approach would require that all UASs be fully certified as airworthy, that their pilots and operators be properly certificated and rated, and that all airspace regulations be fully complied with. The FAA's system of certification is already in place, and all that is lacking are the standards that must be met in each applicable category of regulation.

A second approach would be to systematically go through each and every part and subpart of Title 14 of the CFRs and amend them as necessary, again through the rulemaking process, as required, to incorporate all known characteristics of unmanned aircraft. Many regulations clearly would have no application to UASs (such as those under Part 121 pertaining to passenger seat restraints or flight attendant requirements), while a large portion of the remainder could have application by interpretation, and thus would be candidates for amendment. This process could conceivably take years, but, if undertaken, the most logical place to start would be 14 CFR Part 91, Air Traffic and General Operating Rules; Part 71, Airspace; then on to Part 61, Pilot and Crewman Certificates; then to the aircraft design standards found in Parts 21 through 49.

A third alternative would be to create an entirely new Part to 14 CFR devoted entirely to UASs, which would incorporate all the issues of "see and avoid" technology, airspace access, pilot qualifications, manufacturing standards, and airworthiness certification.

In the meantime, pending the full integration of UASs into the aviation world, the FAA requires a tool to enforce its authority over the airspace, and to carry out its mandate to promote public safety and to do no harm to the current system through lack of oversight or misguided oversight. This can best be accomplished by a rule that reinforces the FAA's authority over the airspace, and provides for sufficient sanctions against violators who do not possess certificates to be revoked or suspended, or who are otherwise immune from civil penalty.

VI. Conclusion

The Federal Aviation Administration is facing a potential crisis. Unmanned aircraft have become the tool of choice for the battlefield commander, and are viewed as economic drivers and arguably the greatest innovation in commercial aviation since the Wright brothers' Flyer. The crisis lurks in the vast body of federal aviation regulations that are continually under review and are evolving with changes in technology and scientific sophistication, but were never intended for, nor did they even contemplate, the unique characteristics of unmanned aircraft.

The task before the FAA is to bring the regulations in line with what is actually happening in the unmanned aviation sector so that a disastrous event that could well set the industry back a decade or two can be averted. The worst nightmare for anyone involved in unmanned aviation is for one of these aircraft to collide with a manned aircraft and cause a serious injury or fatality. Although it is well to say that the regulations are already in place, and that the burden is on the industry to design and build systems that can comply with those regulations, the reality is that there are responsible operators who are relying upon the FAA for regulations and guidance, since standards would help them obtain insurance. And, there are others who view the lack of clear and enforceable rules as an opportunity to operate "under the radar" in the expectation that they either won't get caught or, if they do, the FAA has no authority to do anything about it. Either way, the need for a regulation scheme that specifically deals with unmanned aircraft systems is urgent, and standards must be put in place to ensure the highest possible safety standards for all users of the U.S. airspace.

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Endnotes

[1] Aviation Week & Space Technology, Feb. 12, 2007, at 1, *http://www.aviationweek.com/aw/generic/story.jsp?id=news/aw021207p1.xml.*

[2] Bill Yenne, "Attack of the Drones: A History of Unmanned Aerial Combat," Zenith Press, 2004.

[3] *http://www.cbp.gov/linkhandler/cgov/border_security/air_marine/uas_program/uas_presentat ion.ctt/uas_presentation.pdf.*

[4] *http://www.modelaircraft.org.*

[5] *http://www.spacewar.com/reports/US_Sky_Regulator_Clips_Wings_Of_Los_Angeles_Polic e_Drone.html.*

[6] 72 FR 6689:

> Policy Statement
>
> The current FAA policy for UAS operations is that no person may operate a UAS in the National Airspace System without specific authority. For UAS operating as public aircraft the authority is the COA, for UAS operating as civil aircraft the authority is special airworthiness certificates, and for model aircraft the authority is AC 91-57.
>
> The FAA recognizes that people and companies other than modelers might be flying UAS with the mistaken understanding that they are legally operating under the authority of AC 91-57. AC 91-57 only applies to modelers, and thus specifically excludes its use by persons or companies for business purposes.
>
> The FAA has undertaken a safety review that will examine the feasibility of creating a different category of unmanned "vehicles" that may be defined by the operator's visual line of sight and are also small and slow enough to adequately mitigate hazards to other aircraft and persons on the ground. The end product of this analysis may be a new flight authorization instrument similar to AC 91-57, but focused on operations which do not qualify as sport and recreation, but also may not require a certificate of airworthiness. They will, however, require compliance with applicable FAA regulations and guidance developed for this category.

[7] FAA Advisory Circular 91-57, "Model Aircraft Operating Standards," June 9, 1981.

[8] FAA AFS-400 UAS Policy 05-01.

[9] Office of the Secretary of Defense, "Airspace Integration Plan for Unmanned Aviation," November 2004.

[10] FAA AFS-400 UAS Policy 05-01.

[11] FAA AFS-400 UAS Policy 05-01.

[12] *http://www.faa.gov/about/office_org/headquarters_offices/ato/.*

[13] 14 CFR §91.139 "Emergency Air Traffic Rules."
[14] 14 CFR §91.137 "Temporary flight restrictions in the vicinity of disaster/hazard areas."
[15] *http://www.cbp.gov/linkhandler/cgov/border_security/air_marine/uas_program/uas_presenta tion.ctt/uas_presentation.pdf.*
[16] Department of Defense Handbook MIL-HDBK-516B.
[17] 14 § CFR 91.1.
[18] "UAV: Unmanned and Manned Aircraft: Can They Coexist?" Avionics Magazine, November 1, 2006.
[19] FAA Advisory Circular 91-57.
[20] Pub. L. 85-726, 85th Cong., 2nd Sess., 72 Stat. 731; 49 U.S.C. § 1301, as amended.
[21] 49 U.S.C. § 40103 (a)(1).
[22] 49 U.S.C. § 40103 (a)(2).
[23] 49 U.S.C. § 40103 (b)(1).
[24] 49 U.S.C. § 40103 (b)(2).
[25] 14 CFR Part 1.1 *et seq.*
[26] 14 CFR Parts 21-49.
[27] 14 CFR Parts 61-67.
[28] 14 CFR Parts 71-77.
[29] 14 CFR Parts 119-135.
[30] 14 CFR Parts 91-105.
[31] 14 CFR Parts 141-147.
[32] 14 CFR Parts 150-161.
[33] 14 CFR Parts 170-171.
[34] 14 CFR § 1.1.
[35] *Id.*
[36] *Id.*
[37] Advisory Circular 00-2.11 (1997).
[38] *Id.*
[39] *U.S. v. Mead Corp.*, 533 U.S. 218; 121 S. Ct. 2164; 150 L. Ed. 2d 292.
[40] 72 FR 6689, Volume 72, No. 29, February 13, 2007.
[41] AC 91-57.
[42] *Id.*
[43] FAA AFS-400 UAS Policy 05-01, September 16, 2005.
[44] *Id.*
[45] *Id.*
[46] 14 CFR §91.113.
[47] 14 CFR §91.113(b).
[48] FAA AFS-400 UAS Policy 05-01, *supra* note 43.
[49] 14 CFR §91.111(a).
[50] FAA AFS-400 UAS Policy 05-01, *supra* note 43.
[51] 14 CFR §21.191.
[52] FAA AFS-400 UAS Policy 05-01, *supra* note 43.

[53] *Id.*
[54] *Id.* at § 6.13.
[55] 14 CFR § 1.1.
[56] 72 FR 6689, *supra* note 40.
[57] For example, see: *http://www.rcapa.net/home.htm*, Website for Remote Controlled Aerial Photography Association.
[58] Anthony J. Adamski and Timothy J. Doyle, INTRODUCTION TO THE AVIATION REGULATORY PROCESS, 5th Edition 62 (2005).
[59] Adamski & Doyle, *Id.*
[60] 14 CFR § 1.1.
[61] 14 CFR § 91.119.
[62] *Id.*
[63] 14 CFR Part 71.
[64] Benjamin Trapnell, Assistant Professor, University of North Dakota, Lifetime Member of the Academy of Model Aeronautics.
[65] 14 CFR § 101.11 *et seq.*
[66] 14 CFR § 101.21 *et seq.*
[67] 14 CFR § 101.31 *et seq.*
[68] CropCam Website: *http://cropcam.com/index.htm.*
[69] FAA Order 2150.3A.
[70] *Coppenbarger v. FAA*, 558 F. 2d 836, 839 (7th Cir. 1977).
[71] 49 U.S.C. § 44701(a).
[72] 49 U.S.C. § 44709 (b); *Garvey v. NTSB and Merrell*, 190 F. 3d 571 (1999).
[73] 49 U.S.C. § 46301(d)(5)(A).
[74] 49 U.S.C. § 46301 *et seq.*
[75] 49 U.S.C. § 46301(d)(1)(C).

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