Committee on Transportation and Infrastructure
U.S. House of Representatives
Washington, DC 20515

Bill Shuster
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Christopher P. Bertram, Staff Director

Nick J. Rahall, II
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James H. Zoia, Democrat Staff Director

December 5, 2014

SUMMARY OF SUBJECT MATTER

TO: Members, Subcommittee on Aviation
FROM: Staff, Subcommittee on Aviation
RE: Subcommittee Hearing on "U.S. Unmanned Aircraft Systems: Integration, Oversight, and Competitiveness"

PURPOSE

The Subcommittee on Aviation will meet on Wednesday, December 10, 2014, at 10:00 a.m. in 2167 Rayburn House Office Building to review the state of Unmanned Aircraft Systems (UAS) in the United States. The Subcommittee will specifically hear about the state of the emerging UAS industry including safety of flight, technological issues, the regulatory environment, policy considerations, potential commercial applications and United States' competitiveness. The Subcommittee will receive testimony from representatives of the Federal Aviation Administration (FAA), Government Accountability Office (GAO), Department of Transportation Inspector General (DOT IG), Airware, the Air Line Pilots Association and a Professor of Aeronautics, Astronautics and Computer Science.

BACKGROUND

Overview

UAS have been in existence, in some form, for nearly a century: the U.S. military began research and development of unmanned flight in 1918.[1] Operations of "pilotless aircraft" were addressed in the *Convention on International Civil Aviation* that was signed on December 7, 1944.[2] Today, UAS range in size from small models weighing a few pounds to much larger models with wingspans equal to that of the Boeing 737 airliner. The term "UAS" refers to

[1] John David Blom, *Unmanned Aerial Systems: A Historical Perspective*, Occasional Paper 37, pp 46. Combat Studies Institute Press, US Army Combined Arms Center. Available at: http://usacac.army.mil/cac2/cgsc/carl/download/csipubs/OP37.pdf
[2] See Article 8. Available at: http://www.icao.int/publications/Documents/7300_orig.pdf

unmanned aircraft themselves and also "associated components" such as ground control stations.[3] UAS are either remotely piloted or can fly autonomously (without any direct human control).[4] In the last decade, the American public has become broadly aware of UAS due in significant part to the U.S. military's publicized use in American war efforts and their emerging availability in the general consumer market.

UAS-related Legislation and FAA Actions

In the *FAA Modernization and Reform Act of 2012* (Reform Act), Congress directed the FAA to take certain steps to facilitate safe integration of UAS into the national airspace no later than September 30, 2015.[5] In a report issued in June 2014, the DOT IG reported that the FAA "is behind schedule on most of the act's UAS provisions, and the magnitude of unresolved safety and privacy issues will prevent FAA from meeting Congress' September 2015 deadline for UAS integration."[6]

The DOT IG also noted that the FAA has not developed an "adequate framework for sharing and analyzing UAS safety data" and that the existence of "organizational barriers" is impeding the agency's progress toward the integration and oversight of UAS.[7] In March 2012, the FAA appointed a senior executive position to head a new UAS Integration Office within the FAA Office of Aviation Safety Flight Standards division.[8] However, in June 2014, the DOT IG noted that the office is "not fully staffed –it has lost six people since November 2012 and has identified the need for an additional 20 positions."[9] Further, the DOT IG reported that "questions remain regarding the placement, authority, and structure of the new UAS Integration Office".[10]

Among other things, in the Reform Act Congress directed the Secretary of Transportation to develop a comprehensive plan to safely accelerate the integration of civil UAS into the nation's airspace no later than September 2015.[11] The plan was prepared and submitted to Congress in November 2013.[12] The Reform Act also directed the FAA to issue a final regulation applicable to small UAS (those weighing 55 pounds or less) by approximately August 2014.[13] In its report, the DOT IG observed prolonged and repeated delays in the issuance of this regulation.[14] The FAA has not yet issued a notice of proposed rulemaking (NPRM) which is a threshold step before a final regulation may be issued. According to the DOT IG, given the complexity of the issues and level of interest among the public in UAS, it is unlikely that the

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[3] Pub. L. 112-95, 126 Stat. 11 (Feb. 4, 2012), section 331(9); see also *Unmanned Aircraft Systems (UAS)*, ICAO Circular 328/AN-190 at page x. Available at: http://www.icao.int/Meetings/UAS/Documents/Circular%20328_en.pdf

[4] Remotely piloted versions are sometimes described as Remotely Piloted Aerial Systems (RPAS).

[5] Pub. L. 112-95, 126 Stat. 11 (Feb. 4, 2012), Title III, Subtitle B

[6] *FAA Faces Significant Barriers to Safely Integrate Unmanned Aircraft Systems in the National Airspace* System, DOT IG Report: AV-2014-061, Jun. 26, 2014. Pg.13.

[7] *Id.* at 11-12.

[8] *Id*.

[9] *Id.*

[10] *Id*

[11] *Id*. at § 332(a), 126 Stat. 73

[12] See: https://www.faa.gov/about/office_org/headquarters_offices/agi/reports/media/UAS_Comprehensive_Plan.pdf

[13] *Id*. at § 332(b), 126 Stat. 74

[14] DOT IG Report: AV-2014-061, *supra*, Pg.15.

FAA can issue a final regulation integrating even small UAS by the September 2015 statutory deadline.[15] The DOT IG also noted that FAA's plans for 2015 "do not represent full, safe integration" and that "it remains unclear when FAA will achieve safe and full integration of UAS in U.S. airspace."[16]

Section 333 of the Reform Act gave FAA to the authority to allow UAS operations meeting certain criteria *in advance of the completion* of the small UAS regulation and other materials required by statute.[17] As of December 2014, nearly 160 applications to operate UAS have been submitted to the FAA under section 333.[18] However, only seven applications have been granted to date, and all of them were granted to firms in the motion picture industry.[19] The seven applications were granted within 120 days of their submission; the majority of the pending applications have been submitted to the agency since September 2014.

The Reform Act directs the FAA to establish a program to integrate UAS at six test ranges chosen by the agency. The purpose of the pilot program is to allow for the development of UAS technical and safety standards.[20] In December 2013, the FAA announced the following entities as test site operators:

1. The University of Alaska;
2. State of Nevada;
3. Griffiss International Airport, New York;
4. North Dakota Department of Commerce;
5. Texas A&M University; and
6. Virginia Polytechnic Institute and State University (includes sites in Virginia and New Jersey).[21]

The DOT IG observed that the FAA "has not developed goals for what it intends to accomplish with the test sites once they are established" and also noted the FAA was 14 months late in having the first test range operational."[22] According to the FAA, all six test ranges are now operational.

Technical and Safety Issues

The United States has the most complex and heavily trafficked airspace in the world. On average, there are over 85,000 flights per day that occur in U.S. airspace.[23] U.S. aircraft operations are also more diverse than those in any other country in the world. This creates unique challenges for the safe integration of UAS into national airspace that do not necessarily exist elsewhere in the world. While many countries around the world have well-developed and

[15] DOT IG Report: AV-2014-061, *supra*, Pg.3
[16] *Id.* at Pg.15.
[17] Reform Act, *supra.,*. at § 333, 126 Stat. 75
[18] FAA supplied chart dated Dec. 1, 2014
[19] See: https://www.faa.gov/uas/legislative_programs/section_333/
[20] Reform Act, *supra* at § 332(c)
[21] See: https://www.faa.gov/news/fact_sheets/news_story.cfm?newsid=15575
[22] DOT IG Report: AV-2014-061, *supra*, Pg.14.
[23] http://www.faa.gov/nextgen/snapshots/nas/

sophisticated air transportation networks, the United States is unique because of its very large and vital general and agriculture aviation communities. Pilots from these communities generally operate smaller aircraft at lower altitudes (than airliners) for pilot training, recreation, crop dusting and numerous other purposes. These are a few of the key factors that the FAA will very likely consider as it works to safely integrate UAS into the national airspace.

UAS differ from traditional, manned aircraft in key respects and thus pose unique challenges to regulators and pilots. For example, a fundamental precept of aviation safety is that pilots must "see and avoid" all other aircraft. The see-and-avoid principle, which is codified in FAA regulation, is predicated on the presence of pilots in cockpits with a relatively unobstructed view of all other aircraft.[24] Existing UAS, even those equipped with cameras, cannot currently comply with the requirements of the regulation. As a result of this difference, efforts are underway to develop robust "sense-and-avoid" technology to enable UAS to detect potential collisions and take evasive action.[25] In addition, the risks associated with UAS mechanical failures, such as disrupted radio control links, are different from those of manned aircraft.

In recent weeks, media outlets have reported a large rise in the number of UAS sightings by airline and other aircraft pilots. According to the *Washington Post*, the FAA is receiving approximately 25 reports per month of such sightings, including possible "near-collisions."[26] These sightings have occurred at a variety of altitudes throughout the country including near major airports.

In his report, the DOT IG indicated that while the FAA has begun to authorize certain UAS operations, the FAA "has not developed the procedures, training, and tools for controllers to effectively manage UAS in the same airspace as other aircraft."[27] The DOT IG reported that controllers expressed uncertainty on how to manage certain situations involving UAS operations, including "lost link" events.[28]

Civil UAS Operations in the United States and the *Pirker* Case

The FAA first authorized civil UAS operations within the United States in 1990.[29] Since that time, the FAA's authorizations of civil UAS flights have been largely limited to public interest operations such as law enforcement, firefighting, border surveillance, military training and disaster relief missions performed by public entities such as local government agencies. The FAA authorizes these operations through the issuance of certificates of waiver or authorization (COA) to public entities. A COA specifies conditions on a UAS operation such as limiting flights to certain airspace, requiring coordination with air traffic control facilities or limiting

[24] 14 C.F.R. § 91.113
[25] http://gcn.com/articles/2013/07/12/drone-uav-sense-and-avoid-technologies-civilian-airspace.aspx
[26] Craig Whitlock. *Near-collisions between drones, airliners surge, new FAA reports show*, Wash. Post, Nov.26, 2014. http://www.washingtonpost.com/world/national-security/near-collisions-between-drones-airliners-surge-new-faa-reports-show/2014/11/26/9a8c1716-758c-11e4-bd1b-03009bd3e984_story.html
[27] DOT IG Report: AV-2014-061, *supra*, Pg.9.
[28] *Id.*
[29] https://www.faa.gov/uas/

flight to daytime hours.[30] Before enactment of section 333 of the Reform Act, described above, private individuals and companies had to obtain "experimental" or "restricted" certifications from the FAA to operate UAS. As of June 2014, the DOT IG noted that there were approximately 300 FAA-issued public-use authorizations and 20 experimental or restricted certificates in existence.[31]

Hobbyists operating model aircraft have been able to do so as long as they comply with certain requirements; for example, they must operate model aircraft below 400 feet, at a minimum distance from airports, and within line of sight; must not interfere with operations of manned aircraft; and must not operate the model aircraft for purposes other than hobby or recreational purposes.[32] The Reform Act further clarified the rule for model aircraft. Specifically, the Reform Act prohibits the FAA from promulgating any regulation regarding a model aircraft if the aircraft—is flown strictly for hobby or recreational use; is operated in accordance with a community-based set of safety guidelines; is limited to not more than 55 pounds unless otherwise certified; is operated in a manner that does not interfere with and gives way to any manned aircraft; and, when flown within 5 miles of an airport, the operator of the aircraft provides the airport operator and the airport air traffic control tower) with prior notice of the operation.[33]

As UAS technology has evolved, the distinction between model aircraft and UAS has become less clear in some cases, particularly for smaller devices where the operator is compensated for the operation. This lack of clarity led to a high-profile legal dispute between the FAA and an Austrian national named Raphael Pirker. This was the first case that addressed whether the FAA had the legal authority to regulate UAS.

In October 2011, Pirker operated a five-pound Styrofoam powered glider on the campus of the University of Virginia in Charlottesville to take photographs for which he was paid. In June 2013, the FAA assessed a $10,000 civil penalty based on findings that he operated an "aircraft in a careless and reckless manner."[34] Among other things, the agency stated that Pirker also flew within approximately 100 feet of an active heliport and within 50 feet of people. Mr. Pirker appealed the decision and initially prevailed before an administrative law judge of the National Transportation Safety Board (NTSB). However, the NTSB ultimately reversed that decision, concluding that FAA's authority to restrict unsafe flight activity includes unmanned aircraft; the case is pending. [35]

Commercial Potential of UAS Technology

According to a range of stakeholders, UAS technology represents a substantial economic opportunity. According to an Association of Unmanned Vehicle Systems International (AUVSI) report, UAS will create more than 70,000 jobs in the United States and generate economic

[30] *Id.*
[31] DOT IG Report: AV-2014-061, *supra*, Pg. 3.
[32] FAA Advisory Circular 91-57, Jun. 9, 1981.
[33] Reform Act, *supra* at § 336, 126 Stat. 75.
[34] 14 C.F.R. § 91.13
[35] *Huerta v. Pirker*, NTSB Order No. EA-5730 (Nov. 18, 2014)

impact of more than $13.6 billion within the first three years of integration and will grow to 100,000 jobs and $82 billion in economic impact by 2025.[36] The FAA estimates that $89 billion will be invested in UAS worldwide over the next 10 years.[37] There are numerous commercial applications of UAS under discussion including monitoring infrastructure such as pipelines, land surveying, crop-dusting, and filmmaking, to name a few.

U.S. Competitiveness

The United States has long been the global leader in civil aviation. U.S. aerospace firms, airlines, flight schools, regulatory agencies and universities have been at the forefront of global innovation in this industry. Leading U.S. companies, such as Amazon.com and Google, have invested in UAS technology. However, media reports indicate that many of these companies chose to conduct their outdoor UAS testing activities in Canada or Australia rather than in the United States.[38]

There has been substantial UAS activity outside of the United States. For example, SZ DJI Technology Co. (DJI) of Shenzhen, China, is the world's largest manufacturer of consumer-oriented camera-equipped UAS. DJI sells its UAS for approximately $1,000 around the world.[39] Technology firm Parrot of Paris, France, is also considered a prominent manufacturer of consumer-oriented UAS.[40] Australia is now home to at least 100 UAS operators, most of which are small businesses.[41]

Regulators in Germany, the United Kingdom, Canada, France and other countries have recently made substantial progress in authorizing greater UAS operations. For example, the *Wall Street Journal* reported that a $50,000 UAS has enabled a German road engineering company to create three-dimensional maps of a flood-prone road intersection with very high accuracy after 30 minutes of UAS flights.[42] Before acquiring the UAS, the company's workers spent two days taking ground measurements to produce a less detailed two-dimensional map with much lower accuracy.

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[36] The Economic Impact of Unmanned Aircraft Systems in the United States, AUVSI, Mar. 2013. See: http://www.auvsi.org/resourcesold/economicreport

[37] *FAA Faces Significant Barriers to Safely Integrate Unmanned Aircraft Systems in the National Airspace* System, DOT IG Report: AV-2014-061, Jun. 26, 2014

[38] Jack Nicas, *Regulation Clips Wings of U.S. Drone Makers: FAA Ban, Export Controls Weigh Down American Entrepreneurs, Even as Foreign Rivals Fly High*, Wall St. J., (Oct. 6, 2014)

[39] Jack Nicas and Colum Murphy. *Who Builds the World's Most Popular Drones,* Wall St. J., Nov. 10, 2014

[40] See: http://spectrum.ieee.org/automaton/robotics/aerial-robots/parrot-bebop-drone and http://store.apple.com/us/product/HE291ZM/A/parrot-ardrone-20-power-edition-quadricopter

[41] *Certified UAS Operators in Australia hits 100*, Australian Aviation, May 19, 2014, Available at: http://australianaviation.com.au/2014/05/certified-uas-operators-in-australia-hits-100/

[42] Jack Nicas, *supra.*

WITNESS LIST

Ms. Peggy Gilligan
Associate Administrator for Aviation Safety
Federal Aviation Administration

Mr. Matthew E. Hampton
Assistant Inspector General for Aviation Audits
U.S. Department of Transportation- Office of Inspector General

Dr. Gerald Dillingham
Director of Civil Aviation Issues
Government Accountability Office

Captain Lee Moak
President
Air Line Pilots Association

Mr. Jesse Kalleman
Head of Business Development and Regulatory Affairs
Airware

.

Dr. Nicholas Roy