The Fast-Evolving Uses and Economic Impacts of Drones

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Good morning Chair Burgess, Ranking Member Schakowsky, and members of the subcommittee. Thank you very much for the opportunity to testify today on the important topic of domestic unmanned aircraft systems (UAS), often referred to as "drones."

I am a professor at UCLA, where I hold faculty appointments in the Electrical Engineering Department, the Department of Public Policy, and the School of Management. In addition, during the current academic year I am a visiting professor at the UCLA School of Law. I also have several academic affiliations outside of UCLA, including an appointment as a National Fellow at the Hoover Institution at Stanford. The views I am expressing here are my own, and do not necessarily represent those of any of the organizations with which I am affiliated.

In my testimony today I am focusing on UAS used by private entities such as companies or hobbyists. I am not addressing UAS operation by government entities such as law enforcement agencies, although that of course raises its own set of important policy issues.

The testimony that follows provides an overview of UAS technology, a review of some aspects of the current legislative landscape, and a discussion of consumer protection, which is an aspect of UAS that I expect to be particularly relevant to this subcommittee.

Unmanned Aircraft Technology: A Wide Variety of Platforms

Today's hearing is part of a series the Subcommittee on Commerce, Manufacturing, and Trade is holding on disruptive technologies, a term that certainly applies to UAS. UAS actually have a much longer history than is widely known, with work dating back to before the Wright Brothers' 1903 demonstration of sustained, powered, heavier-than-air flight, and that continued through essentially the entirety of the 20th century. Thus, the concept of unmanned aircraft is anything but new.

Yet in recent years UAS have proliferated, spurred by a combination of technology advances in airframe design, integrated circuits, wireless communications, and very lightweight, small-form-factor imaging systems. Due to these advances, it is now possible to acquire amazingly capable platforms at remarkably low costs.

Unsurprisingly, this is creating both opportunities and challenges. The opportunities lie in the many economically beneficial applications that UAS can enable. The challenges lie in accessing those benefits while ensuring that UAS are operated safely and in a manner protecting privacy.

In discussing UAS policy issues, it is helpful to keep in mind the enormous variety of platforms involved. Today a UAS can include everything from a small toy helicopter that might cost only $10 to a jet-powered Global Hawk, which can weigh 15,000 pounds and cost $100 million. There are solar-powered aircraft that can stay aloft in the stratosphere for weeks[1] at a time, and hobbyist "quadcopters" that may weigh only a pound or two and that have flight durations measured in minutes.

Some unmanned aircraft are amazingly small. The Nano Hummingbird developed by California-based AeroVironment weighs only two-thirds of an ounce, including an on-board video camera.[2] And that is technology that is now almost half a decade old. In 2013, a team of Harvard researchers reported the successful flight of the RoboBee, a robotic insect powered by electricity delivered through a thin wire attached to an external power source. The RoboBee weighs less than one three-hundredth of an ounce.[3] As these examples make clear, a term like "drone" or "UAS" can refer to many different things.

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[1] Andrew Chuter, *Solar UAV Lands After Record 2 Weeks Aloft*, DEFENSENEWS, July 23, 2010, http://www.defensenews.com/article/20100723/DEFSECT01/7230304/Solar-UAV-Lands-After-Record-2-Weeks-Aloft.

[2] Press Release, AeroVironment Inc., AeroVironment Develops World's First Fully Operational Life-Size Hummingbird-Like Unmanned Aircraft for DARPA, Feb. 17, 2011, *available at* http://www.avinc.com/resources/press_release/%20aerovironment_develops_worlds_first_fully_operational_life-size_hummingbird.

[3] Press Release, Wyss Institute for Biologically Inspired Engineering at Harvard University, Robotic insects make first controlled flight, May 2, 2013, *available at* http://wyss.harvard.edu/viewpressrelease/110/.

A Complex and Evolving Legal and Regulatory Landscape

As the members of this subcommittee are well aware, unmanned aircraft have received significant attention in recent years from Congress, the White House, the FAA, state legislatures, and the public. Much of the growth in attention has occurred since 2012, when the FAA Modernization and Reform Act of 2012 (FMRA)[4] was signed into law. The FMRA laid out a schedule for integration of UAS into the National Airspace System (NAS), and spurred strong interest in UAS from manufacturers, potential UAS users, and the general public.

The legislative and regulatory attention since the 2012 enactment of the FMRA has primarily been directed to two issues: safety and privacy. With respect to safety, the key goals are to 1) ensure that UAS can share the National Airspace System (NAS) without putting manned aircraft at risk, and 2) ensure the safety of people on the ground in the vicinity of UAS operations.

Airspace safety, of course, falls under the purview of the FAA, which has a mission "to provide the safest, most efficient aerospace system in the world."[5] In February 2015, the FAA released a long-awaited Notice of Proposed Rulemaking (NPRM) for commercial "small" UAS (sometimes referred to as "sUAS"), defined as those weighing under 55 pounds. Recognizing that the safety issues raised by sUAS depend in large part how large they are and the manner and location in which they are operated, the proposed rules create, within sUAS, a separate subcategory of "micro" (weighing 4.4 pounds or less) UAS. As explained in the NPRM, "a very light (micro) UAS operating at lower altitudes and at lower speeds, that is made up of materials that break or yield easily upon impact, may pose a much lower risk to persons, property, and other NAS users than a UAS that does not operate within these parameters."[6]

It is important to note that the FAA's rulemaking efforts described above are primarily directed towards UAS operations by *commercial* entities. UAS hobbyists, by contrast, provided that they meet several criteria,[7] including operating "in accordance with a community-based set of safety guidelines and within the programming of a nationwide community-based organization,"[8] are explicitly *not* covered by the FAA's recently proposed sUAS rules. This is due to a "Special Rule for Model Aircraft" included with the FMRA stating that, provided that those criteria are met, the FAA "may not promulgate any rule or regulation regarding a model aircraft."[9] However, the FAA still maintains the right to pursue enforcement actions against hobbyist UAS operators who fly in an unsafe manner.

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[4] Pub. L. No. 112-95, § 331, 126 Stat. 11, 72 (2012)
[5] *About FAA*, FAA.GOV, http://www.faa.gov/about/ (last visited Nov. 16, 2015).
[6] FAA Notice of Proposed Rulemaking, *Operation and Certification of Small Unmanned Aircraft Systems*, Dkt No.: FAA-2015-0150; Notice No. 15-01 (Feb. 15, 2015) at 57-58, *available at* https://www.faa.gov/regulations_policies/rulemaking/recently_published/media/2120-AJ60_NPRM_2-15-2015_joint_signature.pdf.
[7] Pub. L. No. 112-95, § 336, 126 Stat. 11, 77 (2012).
[8] *Id*.
[9] *Id*.

Despite this statutory exception to the FAA rulemaking, the landscape regarding the specific regulatory framework that will apply to hobbyists remains in flux. In October 2015, U.S. Transportation Secretary Anthony Foxx and FAA Administrator Michael Huerta announced that UAS hobbyists would be required to register their aircraft.[10] In an announcement describing the decision, Transportation Secretary Anthony Foxx said that "[r]egistering unmanned aircraft will help build a culture of accountability and responsibility" and will "help protect public safety in the air and on the ground."[11] In November 2015 a task force is due to issue a report on this issue that will include recommendations regarding which toy and small hobbyist UAS to exempt from registration.

I would also like to emphasize the valuable role that self-regulation can play—and in fact, due to the number of UAS operators and aircraft platforms involved, will have to play—as UAS use continues to increase. Congress has already recognized the value of self-regulation when promulgating the "Special Rule for Model Aircraft" in the FMRA. As noted above, that rule leaves authority to develop safety guidelines to nationwide community-based organizations. In addition, there is also an important potential private sector role for self-regulation as a mechanism for facilitating safe airspace sharing. Along these lines, there is a new startup company, AirMap, that has developed software to help UAS operators (both commercial and hobbyist) visualize the airspace around them, including the complexities associated with nearby restricted airspace.

An important complement to self-regulation is education. In late 2014, the Association for Unmanned Vehicle Systems International (AUVSI), Academy of Model Aeronautics (AMA) and the Small UAV Coalition partnered with the FAA to launch "Know Before You Fly,"[12] a campaign aimed at "inform[ing] consumers and businesses about what they need to know *before* taking to the skies" with an unmanned aircraft.[13]

Privacy is another vitally important UAS topic. The privacy challenge arises from the very legitimate concern that a small minority of UAS operators might misuse their platforms to obtain imagery from vantage points that create privacy violations. As I have written elsewhere, "[u]se of a UAS to invade an individual's privacy could result in civil or criminal liability. With respect to civil liability, courts in most jurisdictions recognize the two forms of common law invasion of privacy most likely to arise in connection with UAS: intrusion upon seclusion and public

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[10] *U.S. Transportation Secretary Anthony Foxx Announces Unmanned Aircraft Registration Requirements: New Task Force to Develop Recommendations by November 20*, U.S. DEP'T OF TRANSP. (Oct. 15, 2015), https://www.transportation.gov/briefing-room/us-transportation-secretary-anthony-foxx-announces-unmanned-aircraft-registration.

[11] *Id.*

[12] http://knowbeforeyoufly.org

[13] Press Release, Association for Unmanned Vehicle Systems International, AUVSI, AMA, Small UAV Coalition and FAA Launch "Know Before You Fly" Campaign, Dec. 22, 2014, *available at* http://www.auvsi.org/mississippi/blogs/auvsi-membership/2014/12/22/auvsi-ama-small-uav-coalition-and-faa-launch-know-before-you-fly-campaign, emphasis in original.

disclosure of private facts. In addition, some states also have civil or criminal statutes, or both, related to invasion of privacy."[14]

There has been substantial debate regarding whether the existing non-UAS-specific statutory and common law privacy protections are sufficient. This has led to multiple UAS privacy bills in Congress, though none have yet been enacted into law. UAS privacy has also received attention from the White House. In February 2015, President Obama's issued a Presidential Memorandum titled ''Promoting Economic Competitiveness While Safeguarding Privacy, Civil Rights, and Civil Liberties in Domestic Use of Unmanned Aircraft Systems."[15]

Among other things,[16] the Memorandum directed the National Telecommunications and Information Administration (NTIA) to initiate a "multi-stakeholder engagement process to develop a framework regarding privacy, accountability, and transparency for commercial and private UAS."[17] The NTIA framework will not have the force of law, but will instead be a set of "best practices" that commercial and private UAS operators will presumably be encouraged to adopt. On March 5, 2015, the NTIA published a request for public comment[18] and identified a set of 16 questions relating to privacy, accountability, and transparency in relation to commercial and private UAS. This was followed by a series of stakeholder meetings during the second half of 2015, with the goal of releasing a draft code of conduct for public comment in late 2015 or early 2016.[19]

In parallel with all of this, there have been many legislative initiatives at the state level. According to an October 8, 2105 posting from the National Conference of State Legislatures:

> In 2015, 45 states have [as of October 2015] considered 168 bills related to drones. Twenty states–Arkansas, California, Florida, Hawaii, Illinois, Louisiana, Maine, Maryland,

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[14] John Villasenor, *Observations From Above: Unmanned Aircraft Systems and Privacy*, 36 HARV. J.L. & PUB. POL'Y 457, 500 (2013), internal citations omitted.

[15] The White House, Office of the Press Secretary, *Presidential Memorandum: Promoting Economic Competitiveness While Safeguarding Privacy, Civil Rights, and Civil Liberties in Domestic Use of Unmanned Aircraft Systems*, WHITEHOUSE.GOV (Feb. 15, 2015), *available at* https://www.whitehouse.gov/the-press-office/2015/02/15/presidential-memorandum-promoting-economic-competitiveness-while-safegua.

[16] The Memorandum also addressed federal government UAS, providing a series of policies and procedures aimed at protecting privacy and civil liberties and ensuring transparency and accountability.

[17] *Id.* at §2(b).

[18] Privacy, Transparency, and Accountability Regarding Commercial and Private Use of Unmanned Aircraft Systems, 80 Fed. Reg. 11978 (Mar. 5, 2015), *available at* http://www.ntia.doc.gov/files/ntia/publications/rfc_uas_privacy_03052015.pdf.

[19] Multistakeholder Process To Develop Best Practices for Privacy, Transparency, and Accountability Regarding Commercial and Private Use of Unmanned Aircraft Systems, 80 Fed. Reg. 41043 (Jul. 14, 2015), *available at* http://www.ntia.doc.gov/files/ntia/publications/fr_uas_meetings_notice_07142015.pdf.

Michigan, Mississippi, Nevada, New Hampshire, North Carolina, North Dakota, Oregon, Tennessee, Texas, Utah, Virginia and West Virginia–have passed 26 pieces of legislation.[20]

Not all of this enacted state legislation addresses privacy, though privacy is a frequent theme. For example, a bill in Florida prohibits a person from using "a drone equipped with an imaging device to record an image of privately owned real property or of the owner, tenant, occupant with the intent to conduct surveillance . . . in violation of such person's reasonable expectation of privacy . . ."[21] A bill enacted in California expanded the definition of physical invasion of privacy to encompass knowingly entering "into the airspace above the land of another person without permission"[22] in order to capture an image that violates privacy. A Nevada bill allows property owners, subject to certain exceptions, to bring an action for trespass against the operator of a UAS who repeatedly overflies the property at less than 250 feet above ground level.[23]

Consumer Protection and Unmanned Aircraft

One of the most pertinent UAS-related issues for the Subcommittee on Commerce, Manufacturing, and Trade concerns the extent to which UAS are consumer products that, in the event of a defect creating a safety hazard, fall under the jurisdiction of the Consumer Product Safety Commission (CPSC). UAS distributed purely for commercial/industrial applications clearly are not consumer products. However, for UAS that are marketed as consumer products, I believe that the CPSC will in some cases have a role in the event that a design or manufacturing defect that poses a safety issue.

The CPSC has jurisdiction, with some important exceptions, over consumer products distributed for "personal use, consumption or enjoyment of a consumer in or around a permanent or temporary household or residence, a school, in recreation, or otherwise."[24] Notably, one of the statutory exceptions, in addition to those for motor vehicles, tobacco, drugs, foods, etc., is for "aircraft,"[25] which are defined very broadly: "'[A]ircraft' means any contrivance invented, used,

[20] *Current Unmanned Aircraft State Law Landscape*, NCSL.ORG (Oct. 8, 2015), http://www.ncsl.org/research/transportation/current-unmanned-aircraft-state-law-landscape.aspx.
[21] C.S/C.S/S.B. 766, 117th Reg. Sess. (Fla. 2015), *available at* http://www.flsenate.gov/Session/Bill/2015/0766/BillText/er/PDF.
[22] A.B. 856, 2015-2016 Reg. Sess. (Cal. 2015), *available at* https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB856
[23] A.B. 239, 78th Reg. Sess. (Nev. 2015), *available at* https://www.leg.state.nv.us/App/NELIS/REL/78th2015/Bill/1672/Text.
[24] 15 U.S.C. § 2052(a)(5).
[25] See 15 U.S.C. § 2052(a)(5)(F): "aircraft, aircraft engines, propellers, or appliances (as defined in section 40102(a) of title 49)."

or designed to navigate, or fly in, the air."[26] That definition clearly includes unmanned aircraft. And, notably, the wording of the definition ("any contrivance") makes no distinction based on size.

Yet despite this language that could be read to place *all* "aircraft" outside CPSC oversight, precedent confirms that in practice, small, consumer-grade UAS, including but not limited to toy UAS, *have* in fact been treated as consumer products under CPSC jurisdiction. The CPSC web site lists numerous examples of recalls involving toy helicopters. Recalls have also targeted products used by hobbyists to control unmanned aircraft. In 2009, for example, the CPSC issued a recall for a radio transmitter[27] used to control certain model aircraft. The recall notice, which covered about 15,000 units, stated that "[t]he defective radio transmitters can cause model airplanes and helicopters they control to fall from the sky while in flight and crash into bystanders or property" and that the radio transmitters could cause the propellers on model aircraft to "spin unexpectedly injuring a person standing too close or working on the aircraft. This poses impact and laceration hazards to consumers and a risk of property damage."[28]

Of course, no one would suggest that the CPSC should have jurisdiction over a Global Hawk, or that the CPSC should be involved in developing regulations governing flight operations. But it would also be inconsistent to suggest that the CPSC should have absolutely *no* role in relation to UAS. Precedent makes it clear that with respect to product safety the CPSC will be in the mix—and in fact has already been in the mix—when it comes to consumer UAS.

As consumer UAS offerings continue to grow, there will be an increased need for coordination between the CPSC and FAA. For instance, there will be some UAS products that serve both consumer and non-consumer markets. A safety issue with one of those products might be initially reported to the FAA and not the CPSC, or vice versa. The good news is that the CPSC has proven adept at addressing an extremely broad range of products in the past, and there is every reason to believe it will be capable of addressing the growing number of consumer UAS product offerings that fall within its jurisdiction—and capable of coordinating effectively with the FAA when product safety issues arise with UAS that straddle consumer and non-consumer markets.

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[26] 49 U.S.C. §40102(a)(6). The definition in 14 C.F.R. §1.1 is similarly broad: "a device that is used or intended to be used for flight in the air." It is also worth noting that under the 2012 FMRA (see Pub. L. No. 112-95, § 331, 126 Stat. 11, 72 (2012)), "unmanned aircraft" have been defined as "an aircraft that is operated without the possibility of direct human intervention from within or on the aircraft," and UAS have been defined to mean "an unmanned aircraft and associated elements (including communication links and the components that control the unmanned aircraft) that are required for the pilot in command to operate safely and efficiently in the national airspace system." These definitions are both silent on any distinction related to size.

[27] Of course, a radio transmitter used to control an aircraft is not, itself, an aircraft, though it is certainly part of a UAS.

[28] Radio Transmitters for Model Aircrafts Recalled by Horizon Hobby Due to Impact and Laceration Hazards, CPSC.GOV (Apr. 2, 2009), http://www.cpsc.gov/en/Recalls/2009/Radio-Transmitters-for-Model-Aircrafts-Recalled-by-Horizon-Hobby-Due-to-Impact-and-Laceration-Hazards/.

Conclusion

In closing, I would like to express my appreciation to the subcommittee for holding this series of hearings on disruptive technologies, including the unmanned aircraft being discussed today. With rapidly changing technologies there can sometimes be a tendency to overregulate—and in doing so to inadvertently stifle innovation, impede future growth, or infringe civil liberties. To ensure a balanced approach when contemplating new policy solutions addressing these technologies, I think it is important to take a full accounting of existing frameworks, some of which can be more applicable than might initially be apparent.

Integrating unmanned aircraft into the National Airspace System will open up a host of socially and economically beneficial applications. In addition, UAS integration will help ensure continued American leadership not only in aviation but also in related sectors such as robotics. I am confident that with the proper mix of education, self-regulation, and government oversight, the overwhelming majority of commercial and hobbyist UAS operators will fly safely and in a manner respectful of privacy and property rights.

Thank you again for the opportunity to testify on this important topic.