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DRONES: THE NEXT GENERATION OF COMMERCE?

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CONTENTS

Page

Hearing held on June 17, 2015 1

WITNESSES

The Hon. Michael Whitaker, Deputy Administrator, Federal Aviation Administration, U.S Department of Transportation
- Oral Statement 5
- Written Statement 8

John Cavolowsky, Ph.D., Director, Airspace Operations and Safety Program, National Aeronautics and Space Administration
- Oral Statement 17
- Written Statement 19

Mr. Paul E. Misener, Vice President of Global Public Policy, Amazon.com, Inc.
- Oral Statement 30
- Written Statement 32

Mr. Brian Wynne, President and CEO, Association for Unmanned Vehicle Systems International
- Oral Statement 39
- Written Statement 41

Mr. Harley Geiger, Advocacy Director and Senior Counsel, Center for Democracy and Technology
- Oral Statement 46
- Written Statement 48

APPENDIX

Statement of Mr. Chaffetz 88
Statement of Mr. Connolly 89
RESPONSE: Whitaker-Faa to Chaffetz QFRs 90
RESPONSE: Misener-Amazon to Duckworth QFRs 95
RESPONSE: Wynne-AUVSI to Duckworth QFRs 96

DRONES: THE NEXT GENERATION OF COMMERCE?

Wednesday, June 17, 2015

HOUSE OF REPRESENTATIVES,
COMMITTEE ON OVERSIGHT AND GOVERNMENT REFORM,
WASHINGTON, D.C.

The committee met, pursuant to call, at 9:04 a.m., in Room 2154, Rayburn House Office Building, Hon. Jason Chaffetz [chairman of the committee] presiding.

Present: Representatives Chaffetz, Mica, Duncan, Jordan, Walberg, Amash, Gosar, DesJarlais, Farenthold, Massie, Meadows, Buck, Walker, Hice, Carter, Grothman, Hurd, Palmer, Cummings, Maloney, Norton, Lynch, Connolly, Duckworth, Kelly, Lawrence, DeSaulnier, Welch, and Lujan Grisham.

Chairman CHAFFETZ. The Committee on Oversight and Government Reform will come to order.

Without objection, the chair is authorized to declare a recess at any time.

I'm excited about this hearing. I appreciate the panelists that are here today. This is a first in a series of hearings the Oversight and Government Reform Committee intends to have as we talk about emerging technologies. One of the great competitive advantages for the United States of America is our leadership in information technology. It's our leadership in creativity. It is the entertainment industry. We lead in a lot of different areas. And one of the things that the United States has done, has been a bastion, it's been a great place for entrepreneurs to come up with creativity and allow those ideas to enter the marketplace and thrive. And they create whole new industries. They create literally millions of jobs and billions of dollars in revenue and income. And there are also some interesting public policy issues that we need to discuss.

As you have new and innovative companies and ideas and products and services that consumers are demanding and that the public wants, then we have an opportunity, I think, to make sure that we're fostering that growth and creating an atmosphere where those businesses and entrepreneurs can thrive. So today, we're going to start talking about drones, the next frontier for commerce because it does offer some exciting possibilities. But it also does create some challenges and some things that as the public and as a society we need to talk through.

Right now, drones are being widely used. First responders are using them to deliver food and medical supplies in areas hit by disaster. Law enforcement envisions using drones to locate missing persons. I, in the State of Utah—we have, State of Utah, for in-

stance, with a very big rural component, where we have, at times, raging wildfires and massive public lands. We have people who travel from out of State and want to enjoy our national parks, like Arches and Canyonlands, and yet they get lost sometimes. And it's terrain that's very difficult and very expensive for a helicopter to traverse. Maybe drones are the way to do that.

Companies big and small are finding new and innovative ways to use drones for inspecting and ensuring the safety of infrastructure, railroad tracks, and telecom systems. I think about Alaska and the pipelines. And there are other great places where drones can be of great help. These drones are being used to monitor oil and gas pipelines, as I mentioned, crops and livestock. They're using them at music festivals and giving the real estate industry a whole new perspective on property and real property, as people look at potentially purchasing things. You have the big, innovative companies that just a decade or two weren't even a business, weren't even around, companies like Amazon or Google, who are researching and developing systems that would allow merchants and customers to deliver and retrieve packages via drones.

This is a huge, massive opportunity for the United States of America. On February 15 of this year, the FAA released a proposed rule on the commercial use of drones. This came after years of delays on the heels of a June 2014 report by the Department of Transportation inspector general that criticized the FAA for being significantly behind its efforts to integrate drones into the National Airspace System. The IG concluded that it was unlikely that FAA would meet the statutory deadline of September of this year, 2015, to integrate drones into our airspace.

In addition, under current FAA regulations, as well as the proposed rule, it is very difficult for companies that are interested in developing transformative drone technology to even go through the testing of these ideas. Developers have been forced to either limit their testing to small confines of indoor spaces in the United States or to test overseas in a country where the rules are more flexible.

In March of 2014, Google's so-called Project Wing started testing deliveries of drones but did so in Australia. A year later, in March of 2015, Amazon began testing drone deliveries in Canada and the United Kingdom, after months of waiting for an approval here in the United States of America, so that they could test real-world environments in the United States.

According to the UAV trade association—and, yes, there is UAV trade association—every year that integration is delayed, the United States loses more than $10 billion in potential economic impact. I recognize that privacy and safety concerns exist. And I personally share many of those. I don't want my neighbor flying a drone over my backyard, peering in my window.

And I certainly don't want law enforcement using drones for constant surveillance, particularly on private property. But are there appropriate uses for drones in the law enforcement atmosphere dealing with large crowds and large events, say, the Super Bowl or a Major League Baseball game or whatever it might be? Yes, I think there are appropriate uses. But can they be overused? Yes. And that's why we need to talk about, candidly, about the parameters of that.

I also do believe that there are states' rights; States have a say in this. At what point does the airspace start to become a Federal issue? What is the Federal nexus? At what point is it a State issue? Because maybe these drones are going to land. I think the States and municipalities probably want to have a say in that as well.

But I would like to think that we can get this right. In fact, we must get it right. The opportunities truly are limitless. And this is why we're having the discussion today.

We have a leader in the transportation industry, the former chairman of the T&I Committee, Transportation and Infrastructure, T&I Committee here in the United States Congress. He's the chair of our Subcommittee on Transportation and Physical Assets. I would like to yield some time to Mr. Mica for his comments.

Mr. MICA. Thank you. And I'll be brief. You've covered quite a bit, Mr. Chairman. Thank you for conducting this hearing, particularly at the full committee level because this does demand not only the Congress' attention but the Nation's attention.

Drones are here. And UAVs are here. And they're here to stay. When we worked on FAA reauthorization back in 2003, which is not that long ago really, a dozen years ago, we never even talked about drones. In the last FAA reauthorization, about 6, 7 years ago, we did direct FAA to move forward with rules. And we—it's important, it's important, first, for safety. I think we've been very fortunate. We've had some near misses, and we've had some hits. But I think you can have the potential of having deadly, involving fatalities incidents with so many—we now have so many of these UAVs and drones in the air. We now have thousands of them flying. The rules are sketchy. The rules of incomplete.

Looking over the progress that has been made and the rule has been semifinalized. It's not finalized. People have had a period to comment. But it's still going to take, I'm told, at least another year to finalize that rule and get it in place. In the meantime, again, we have the safety issue. Today, we're focusing on commercialization use of the drone.

And I'm told that we lose as much as $10 billion a year in revenue for possible use of this, with this technology with commercial applications. So we can't delay. I think this is good timing for the hearing. We'll find out where we are with the progress of the approval and then some of the applications and then try to stay ahead of the game, which is our responsibility in Congress, particularly on the commercialization side and the benefit of the American people.

So, with that, Mr. Chairman, I yield back.

Chairman CHAFFETZ. I thank the gentlemen.

Now recognize the distinguished ranking member, Mr. Cummings of Maryland, for his opening statement.

Mr. CUMMINGS. Thank you very much, Mr. Chairman, for calling this hearing.

This is a really interesting hearing and one that I think is extremely important. Drones are an exciting new technology with a lot of potential uses in the not so distant future. Companies are developing new technologies to use drones to fight forest fires or even to deliver pizza.

However, Mr. Chairman, I share the same concerns as you and many other Americans. I want the use of drones to be safe. And I want to make sure that the privacy interests of the American people are protected. As with any new, groundbreaking technology, our regulatory regime has not yet fully caught up with drones. And existing rules do not fully address the concerns Americans have. Our goal must be to balance these concerns in a way that allows for the robust development of these new technologies while ensuring that necessary safeguards are in place.

In 2014, there were more than 9.5 million commercial airline flights carrying more than 850 million passengers in the United States, according to the Bureau of Transportation Statistics. Our aviation system is among the safest in the world. And, obviously, we must ensure that drones do not imperil the operation of our commercial airlines. Allowing drones to fly in the airspace used by commercial jets is a long-term aspiration rather than an imminent possibility.

However, although the FAA has approved only a small number of drones to operate in the United States airspace, the assistant inspector general of the Department of Transportation has testified to Congress that airline crews have already reported seeing unmanned aircraft around airports, in some cases at altitudes above 2,000 feet.

Right now, there does not appear to be a proven technology to ensure that an unmanned aircraft can act on its own to identify and avoid other aircraft. There also does not appear to be a proven technology to ensure that radio links between drones and their operators are maintained consistently. This could cause drones to crash or, equally dangerous, fly out of control. Our aviation system does not allow a wide margin of error. A system to manage drone traffic, even at low altitudes, is still in the very early stages of development and is not really for deployment.

Recognizing the limits of existing technology, the FAA has proposed new regulations that would allow drones weighing less than 55 pounds to operate only during daylight hours, under 500 feet, and less than 100 miles per hour. These rules would also require that drones fly within the line of sight of their operators, who would be allowed to operate only one drone at a time.

The use of drones in the United States airspace also raises significant privacy concerns. Drones have been used to gather a wide variety of film footage of people and property. They have been used to gather real-time data on the movements of people without those people even knowing the drones were present. This data can be stored indefinitely. And it can be analyzed and integrated to create very detailed pictures of almost every aspect of a person's life. These possibilities raise a host of privacy concerns that have not been fully addressed by current law or legal precedent.

Once it has been lost, privacy is not easily regained. Successfully introducing drones into U.S. airspace will require all parties to strike a balance that threads numerous needles carefully. I'm confident that this can be achieved. But I'm certain it will take time and thoughtful analysis.

And I certainly appreciate the opportunity to consider these issues today. And I look forward to the testimony of our witnesses.

Mr. Chairman, you're absolutely right. We have to get this right. And we have to get it right in a bipartisan way. And I look forward to doing that.

With that, I yield back.

Chairman CHAFFETZ. I thank the gentleman.

I'll hold the record open for 5 legislative days for any members who would like to submit a written statement. I now recognize our panel of witnesses. And we do appreciate all five of you participating with us today.

We are pleased to welcome the Honorable Michael Whitaker, Deputy Administrator for the Federal Aviation Administration of the United States Department of Transportation; John Cavolowsky—did I pronounce that properly I hope—PhD, he's also the Director of the Aerospace Systems Program Office at the National Aeronautics and Space Administration; Mr. Paul Misener, who has been with us before, I think yesterday, the vice president of global public policy at Amazon.com; Mr. Brian Wynne is the president and chief executive officer of the Association of Unmanned Vehicle Systems International—we are pleased that you're here with us as well; and Mr. Harley Geiger is the advocacy director and senior counsel at the Center for Democracy and Technology. He'll give us an interesting perspective, particularly as it comes to privacy issues.

Welcome all.

Pursuant to committee rules, all witnesses are to be sworn before they testify. So if you would please rise and raise your right hand.

Do you solemnly swear or affirm that the testimony you're about to give will be the truth, the whole truth, and nothing but the truth? Thank you. Let the record reflect that all witnesses answered in the affirmative.

In order to allow time for discussion, we would appreciate it if you would limit your verbal comments to 5 minutes. You'll see a light there that will give you an indication. And then your full written statements will be entered into the record.

We also anticipate that members after the hearing will have additional questions. We call them QFRs, questions for the record. We would appreciate your response to those as well.

But for your verbal comments, we'll start with Mr. Whitaker who is now recognized for 5 minutes.

WITNESS STATEMENTS

STATEMENT OF THE HONORABLE MICHAEL WHITAKER

Mr. WHITAKER. Thank you, Chairman Chaffetz, Ranking Member Cummings, members of the committee. I appreciate the opportunity to be here today to discuss the safe integration of unmanned aircraft systems, or UAS, as we refer to them, in the national airspace.

Aviation has always been an industry driven by new technology. Unmanned aircraft are born from that same spirit of innovation. As you've noted in your opening remarks, this technology has thousands of potential uses, from agricultural to news gathering to firefighting and border patrol.

But it also introduces new risks into the Nation's airspace. At the Federal Aviation Administration, our challenge is to allow for this innovation while maintaining the highest level of safety. I'm pleased to report that we've made great strides over the past year towards safely integrating UAS into what is the largest, most complex aviation system in the world.

The FAA Modernization and Reform Act of 2012 laid out a framework of the safe integration of UAS into the airspace by September 2015. And FAA has made significant progress in meeting those milestones. Perhaps most important among these accomplishments is the publication of the "Small UAS Notice of Proposed Rulemaking." This rule, as proposed, creates one of the most flexible regulatory frameworks in the world for UAS operations. We've received thousands of comments to the NPRM. And we're in the process of reviewing those now. Issuing a final small UAS rule remains one of our highest priorities.

At the same time, we are taking other steps to enable industry to take advantage of this new technology now. The FAA continues to issue exemptions under section 333 of the 2012 act to allow for commercial activity in low-risk, controlled environments. Currently, the FAA is, on average, issuing more than 50 section 333 exemptions each week. We also continue to work with our partners in government and industry to overcome the largest technical barriers to UAS integration, while ensuring the continued safety of the airspace. There is still a lot to learn about the capabilities and risks posed by UAS. That is why we are leveraging a variety of research tools to give industry greater flexibility and provide FAA additional data that could inform future standards.

In December 2013, the FAA selected six cites to test UAS technology and operations. These test sites are providing valuable data to our tech center in New Jersey. And we recently announced the Pathfinder Program to study UAS operations in circumstances beyond those currently being approved. For example, BNSF Railroad will explore the challenges of using these aircraft to inspect rail infrastructure beyond visual line of sight in isolated areas.

These partnerships with industry will help us determine if and how we can safely expand unmanned aircraft operations beyond the parameters set forth in the proposed rule. Beyond commercial applications, UAS's have become increasingly available and affordable to the average consumer, most of whom are not trained aviators. Accordingly, the FAA is taking a proactive approach to educate the public on the safe and responsible use of UAS's. We partnered with members of industry and the modeling community to initiate the Know Before You Fly outreach campaign, providing recreational operators with the information they need to fly safely and responsibly. This outreach has been successful. And several UAS manufacturers now voluntarily include educational materials in their packaging.

The FAA also initiated a No Drone Zone campaign to raise awareness of the prohibition of flying unmanned aircraft near outside sporting events. In May, we built on that success and launched a public outreach campaign for Washington, D.C., to reinforce the message that the city itself and all communities within 15 miles of National Airport constitute a No Drone Zone.

While our preference is to educate amateur operators about legal compliance, we will use administrative and enforcement action to gain compliance when appropriate. Local law enforcement is often in the best position to respond quickly. The FAA recently issued guidance to first responders on how they can best assist us. The United States has the safest aviation system in the world. And our goal is to integrate this new and important technology while maintaining that high level of safety. The FAA has successfully integrated new technologies in our aviation system for more than 50 years. And we will do the same with unmanned aircraft. We look forward to continuing to work with Congress and industry to achieve these common goals.

Thank you. And I'm happy to take questions.

[Prepared statement of Mr. Whitaker follows:]

STATEMENT OF MICHAEL WHITAKER, DEPUTY ADMINISTATOR, FEDERAL AVIATION ADMINISTRATION, BEFORE THE HOUSE OVERSIGHT AND GOVERNMENT REFORM COMMITTEE, ON DRONES: THE NEXT GENERATION OF COMMERCE? JUNE 17, 2015.

Chairman Chaffetz, Congressman Cummings, Members of the Committee:

Thank you for the opportunity to appear before you today to discuss the status of the safe integration of Unmanned Aircraft Systems (UAS) into the National Airspace System (NAS).

The Federal Aviation Administration (FAA) is safely and steadily integrating UAS into the largest, most complex aviation system in the world. At the same time, UAS technologies continue to advance at a rapid pace. We are working diligently to develop a regulatory framework that will allow for innovation while ensuring the safety of other users of the airspace and people and property on the ground.

The FAA Modernization and Reform Act of 2012 (2012 Act) established the framework for the integration of UAS into the NAS and tasked the FAA with the safe integration of civil UAS into the system by October 2015. We followed through with Congress' intent in the 2012 Act and completed milestones forming the foundation for future integration. This includes long-term planning for the future of integration, including a small UAS Notice of Proposed Rulemaking (NPRM), collaborative research and development with interagency partners and with industry, and the establishment of test sites and airspace for UAS research and development and testing.

Consistent with the authority in section 333 of the 2012 Act, the Department and FAA are issuing exemptions that allow for commercial activity in low-risk, controlled environments. The initial exemption process took longer than we liked. After gaining experience with various types of operators, the FAA recently expedited its approach for section 333 exemptions. We are now

able to issue summary grants when we find that we've already granted a similar exemption. Summary grants are more efficient because they do not require applicants to repeat analysis that has already been performed. This streamlined approach now allows the FAA to issue between 40 and 50 section 333 exemptions a week.

As part of this new approach, the FAA grants a blanket Certificate of Waiver or Authorization (COA) for flights at or below 200 feet when it issues the section 333 exemption. This applies to aircraft that weigh less than 55 pounds, operate during daytime Visual Flight Rules (VFR) conditions, operate within visual line of sight (VLOS) of the pilots, and stay certain distances away from airports or heliports. Operators wishing to operate above 200 feet would need to request a separate COA.

From the outset, we have worked closely and successfully with government partners and industry stakeholders to achieve milestones put forward by the 2012 Act. In coordination with other governmental agencies and industry, we developed two long-term planning documents, the Comprehensive Plan and a five-year Roadmap. We have worked with members of the UAS Executive Committee (ExCom) to leverage our collective assets and conduct research and development on UAS integration while ensuring the continued safety of the NAS. The FAA collaborated with the National Aeronautics and Space Administration (NASA) on studies advancing air traffic control interoperability with future use by UAS of detect-and-avoid (DAA) systems in controlled airspace. We continue to collaborate with the industry on flight tests to validate RTCA[1] standards for DAA systems as well as command and control radios. RTCA began work on the standards at the request of the FAA in 2013 and they are scheduled for

[1] RTCA, Inc. is not-for-profit organization that serves as a federal advisory committee to the FAA. *See* http://www.RTCA.org.

completion in 2016. These standards will help resolve two of the difficult challenges facing the industry for integration of UAS into the NAS. NASA, the FAA, and industry partners have successfully demonstrated a proof-of-concept airborne DAA system and prototype radios for use as command and control systems for UAS.

In November 2012, the FAA released its Arctic Implementation Plan to establish permanent operational areas and corridor routes in the Arctic for the operation of small UAS as required by the 2012 Act. In July 2013, a restricted category type certificate was issued to Insitu's ScanEagle X200 and to AeroVironment's PUMA so that each UAS could conduct Arctic flights for commercial purposes. In September 2013, ConocoPhillips began using Insitu's ScanEagle for its marine mammal and ice surveys. In June 2014, BP began using AeroVironment's Puma AE to survey its pipelines, roads, and equipment at Prudhoe Bay, Alaska. Safety and operational data from these flights will be used to develop UAS operations and performance standards. The FAA has also issued 176 special airworthiness certificates in the experimental category for civil UAS, 34 of which are currently active. Special airworthiness certificates are issued for research and development, crew training, and market surveys.

In December 2013, the FAA selected six test sites for non-federal entities to test UAS technology and operations. All of the UAS test sites, which were selected based on geographic and climatic diversity, were operational by September 2014. They will help us gather operational data to foster further integration. Flights of unmanned aircraft have already been conducted, including flights for research on agricultural and wildlife monitoring and on law enforcement and emergency services support.

Test sites are providing data about the types and sizes of aircraft, number of operations, number of flight hours, notable operating parameters (for example, whether the flight was within or beyond visual line of sight), and any incidents and accidents. Each site has also established its own research agenda. A significant portion of test site data analysis is being performed at the FAA William J. Hughes Technical Center. Qualified FAA personnel are visiting each UAS test site to evaluate how data is captured and maintained, ensure the integrity of data transferred to the FAA, and determine whether additional data collection would help the FAA meet its research objectives. The FAA also invited public comment in the proposed small UAS rule (discussed in more detail below) on how the agency can improve or further leverage its test site program to encourage innovation and safe UAS integration; those comments are now being reviewed.

In the interim, to further advance use of the test sites, in 2014, the FAA implemented a Designated Airworthiness Representatives program that permits test site designees to issue experimental certificates for unmanned aircraft for research and development, crew training, and market surveys. Test site designees must complete FAA training, available online or in person, to be authorized to work within this new program. This new delegation authority will improve access to the test sites by UAS manufacturers, as well as help decrease the workload on the FAA to process UAS experimental certificates.

In April 2008, even before the 2012 Act, the FAA chartered the small UAS Aviation Rulemaking Committee (ARC). It included members from a wide spectrum across the aviation community, to provide recommendations on how small UAS could be safely integrated into the NAS. In April 2009, the committee provided recommendations and the FAA began working on a rulemaking that encompassed the widest possible range of small UAS operations. The

approach utilized a regulatory structure similar to the one used for manned aircraft: small UAS operations that pose a low risk to people, property, and other aircraft would be subject to less stringent regulation, while those posing a greater risk would be subject to more stringent regulation to mitigate the greater risk. Developing this broadly-scoped approach to the rulemaking effort required time to strike the right balance between mitigating safety risks, while also allowing for changing technology and innovation.

On February 15, 2015, the Department and the FAA issued the Small UAS NPRM that would allow small UAS to operate for commercial and other non-recreational purposes without first obtaining an airworthiness certificate, a section 333 exemption or a COA. The proposed rule would allow unmanned aircraft weighing up to 55 pounds to operate if the operations take place under a set of parameters to maintain safety including operating at speeds below 100 mph and below 500 feet in altitude. It would allow operations during daylight hours and would require the operator to be able to see the unmanned aircraft at all times. Rather than requiring a private pilot certificate, operators would obtain an unmanned aircraft operator's certificate from the FAA by passing a written proficiency test. Before each flight, operators would conduct a preflight inspection, just as pilots do with manned aircraft today. The proposal does not permit flight over persons not directly involved in the operation unless they are under a covered structure, or operating under the proposed microUAS option. Also, without permission from air traffic control, unmanned flights would be restricted from operating in certain busy airspace or in airspace otherwise restricted to most or all aviation users. The proposal would offer a flexible framework for the safe use of small unmanned aircraft, while accommodating future innovation in the industry. The FAA intends to establish a risk-based approach to this rule and to lay a strong foundation that will facilitate safe integration.

The public comment period on the proposed small UAS rule closed on April 24, 2015. Issuing a small UAS final rule is one of the FAA's and the Department of Transportation's highest priorities. As proposed, the United States would have one of the most flexible UAS regulatory frameworks in the world.

In addition to the efforts described above, the Administrator recently announced the Pathfinder Program to study UAS operations in circumstances beyond those currently being approved. The FAA is partnering with three leading U.S. companies that have committed extensive resources to perform research that will help us determine if and how we can safely expand unmanned aircraft operations.. BNSF Railroad will explore the challenges of using these vehicles to inspect rail infrastructure beyond VLOS in isolated areas. CNN will examine how VLOS operations might be used for newsgathering in urban areas. Precision Hawk, a UAS manufacturer, will survey crops in rural areas using UAS flying outside of the pilot's direct vision. All of this information will help us determine how UAS are ultimately integrated into the NAS.

The FAA also continues to use all available information from its partners as well as its own research and development to identify challenges, validate advanced mitigation strategies, and explore opportunities to proceed in integrating UAS into the NAS.

On May 8, consistent with the direction in the agency's FY 2014 appropriation, the FAA announced Mississippi State University as the agency's new Center of Excellence (COE) for UAS. The COE will focus on research, education, and training in areas critical to safe and successful integration of UAS into the NAS. In addition to Mississippi State, team members include 12 other universities across the country. This will serve as another resource for

identifying solutions for existing and anticipated UAS-related issues. We intend to forge a union of public sector, private sector, and academic institutions to create a world-class consortium.

UAS have become increasingly available and affordable to the average consumer, many of whom are not trained aviators. Manned aircraft operators have reported close calls with UAS flying in the airspace. The FAA is taking a proactive approach to educate the public on the safe and responsible use of UAS. The FAA provided model aircraft enthusiasts guidance on the "do's and don'ts" of safe model aircraft operations. Last year, we partnered with members of industry and the modeling community to initiate the "Know Before You Fly" outreach campaign that provides UAS operators with the information they need to fly safely and responsibly. The FAA's No Drone Zone initiative, designed to raise public awareness of the FAA Notice to Airmen prohibiting unauthorized aircraft -- including UAS -- from flying over or near NFL regular- and post-season football games is a success. The No Drone Zone video posted on YouTube prior to the 2015 Super Bowl has received over 57,000 hits. Most important, we received no reports of unauthorized activity in the restricted airspace around the University of Phoenix Stadium during the game.

Recognizing that local law enforcement is often in the best position to respond quickly, the FAA issued guidance for these first responders to deter, detect, investigate, and report unauthorized or unsafe UAS operations. While our first preference is to educate UAS operators about statutory and regulatory compliance, we will use administrative and legal enforcement action to gain compliance when appropriate.

We are already looking beyond the small UAS rulemaking at what comes next in terms of the types of operations expected, and what technologies we may need to certify. The FAA has

consulted with the UAS ARC to determine the next areas of focus so we can enable those UAS operations with the highest net societal benefits. These recommendations are being assessed and will result in additional focus areas that will become the centerpiece for FAA's strategic plans for UAS integration.

As the aerospace industry and aviation system grow more complex, we must ensure that our resources are directed to the areas with the highest safety risk. We will need to expand collaborative, data-driven processes with the UAS industry to improve safety and streamline process in areas such as certification. We must meet challenges and take advantage of opportunities.

To reach these objectives, a new advisory circular is being developed to inform the UAS industry how to use a risk based decision-making process to establish certification criteria. This advisory circular is essential for enabling the certification of larger UAS for operation in the NAS.

The safe integration of UAS into the NAS will be facilitated by new technologies being deployed as part of the Next Generation Air Transportation System (NextGen). NAS Voice System (NVS), Data Communications (Data Comm), and System Wide Information Management (SWIM) will provide more information, flexibility, situational awareness and a greater ability to communicate with NAS users.

The United States has the safest aviation system in the world. Our goal is to integrate this new and important technology while maintaining safety as our highest priority. We are committed to ensuring that the United States continues to lead the world in the development and

implementation of aviation technology for safety. We look forward to continuing to work with Congress as we integrate UAS into the NAS.

This concludes my statement. I will be happy to answer your questions.

Mr. MICA. [presiding.] Thank you.

And we will withhold questions until we have heard from all the panelists.

Next, we will hear from Dr. Cavolowsky. He is the Director of Airspace Operations and Safety Program at the National Aeronautics and Space Administration.

Welcome. And you're recognized, sir.

STATEMENT OF JOHN CAVOLOWSKY, PH.D.

Mr. CAVOLOWSKY. Chairman Chaffetz, Ranking Member Cummings, and members of the committee, good morning. And thank you for this opportunity to testify on NASA's Aeronautics Research Program and the R&D challenges associated with the operations of unmanned aircraft systems in the national airspace.

NASA's strategic thrust and assured autonomy defines our vision and approach for supporting the integration of UAS in the NAS. Our near-term research builds the foundation for the more extensive transformative changes that autonomous systems will bring over the mid and far term. UAS and autonomous systems hold great promise for the transformation of our aviation system. And we are witnessing the dawn of a new era of aviation innovation, ushering in flight vehicles and operations that are unimaginable today and opening up entirely new commercial markets, much the way jet engines did 60 years ago.

NASA is performing research and transitioning concepts, technologies and knowledge to the FAA and other stakeholders to help them define the requirements, regulations, and standards for safe, routine NASA access. Still, there are significant barriers and research challenges associated with the introduction of autonomous systems and technologies into our aviation system. Addressing these requires the complex systems to be comprehensibly evaluated to verify and validate they're operating as designed, thus allowing the FAA to establish operations and equipment standards.

Now, a significant part of NASA's near-term research work towards safe UAS integration is focused in three areas: First, our sense-and-avoid research is helping to determine performance requirements for a certifiable system to ensure safe separation of UAS with all vehicles operating on the NAS. Second, we're developing secure, robust, reliable communication systems and protocols. And, third, we're addressing the design of ground control stations and displays to maximize pilot effectiveness and safety.

Now, to transfer our research findings, NASA has built effective partnerships with key stakeholders, certainly the FAA, but the Department of Defense, also the Department of Homeland Security, and industry and academia as well. In these partnerships, NASA is playing a significant role, supporting critical activities from the executive level down to our subject-matter experts.

Now, for mid-term applications, NASA is researching novel concepts and technologies to facilitate safe operation of the UAS at altitudes that are not actively controlled today, such as small UAS, 55 pounds or lighter, operating at altitudes of 500 feet or below. In order to safely enable widespread civilian UAS operation at lower altitudes, NASA is developing an air traffic management-like system called UAS Traffic Management or UTM. You can think of this

much like today's surface traffic management where vehicles operate within a rule-based system, consisting of roads, lanes, signs, and traffic lights. Similarly, the UAS system would provide services, such as airspace corridors, terrain avoidance, route planning, and separation management.

Working alongside many committed partners, NASA will lead the research, development, and testing of the UTM, utilizing a series of prototypes or builds, each increasing the capability. In fact, the first build will be evaluated in a demonstration in August of this year. Also, in late July, NASA is holding a UTM convention to explore and define the needs of low-altitude, small UAS operations. Over 500 attendees representing the UAS stakeholder community, Federal, State, and local government, and the general public have registered to attend.

So through game-changing, long-term research, NASA enables growing, sustainable, and transformative aviation systems. Achieving this through partnerships built upon clear roles and responsibilities, on long and productive working relationships, and in close and continuous coordination for the specific needs of UAS integration. As the challenges of UAS integration evolve and emerge, NASA Aeronautics will continue to advance the research and develop the enabling technologies that will assure the safe realization of the transformative benefits of UAS and increase the competitiveness of the U.S. Civil aviation industry.

Thank you again for the opportunity to speak today. And I'll be pleased to answer any questions the committee may have.

[Prepared statement of Mr. Cavolowsky follows:]

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BY WITNESS
June 17, 2015

Statement of

Dr. John A. Cavolowsky
Director, Airspace Operations and Safety Program
Aeronautics Research Mission Directorate
National Aeronautics and Space Administration

before the

Committee on Oversight and Government Reform
U.S. House of Representatives

Mr. Chairman and Members of the Committee, thank you for this opportunity to testify on NASA's Aeronautics Research program and the R&D challenges associated with Unmanned Aerial Systems and Autonomy.

NASA Strategic Vision

NASA's innovative aeronautics research and development portfolio is aimed at transforming the aviation industry through game-changing advances in the safety, capacity, and efficiency of the air transportation system, while minimizing negative impacts on the environment. NASA Aeronautics Research Mission Directorate (ARMD)'s FY15 aeronautics research portfolio is aligned with six strategic research thrusts to directly address the growing global demand for mobility, severe challenges to sustainability of energy and the environment, and technology advances in information, communications, and automation technologies.

Each strategic thrust is designed to address an important area of research and technology development that will further U.S. leadership in the aviation industry and enhance safe,

sustainable global mobility. NASA's research is performed with an emphasis on multi-disciplinary collaboration focused on the critical, integrated challenges (aligned to the six research thrusts). Together, these research thrusts combine to enable safe, sustainable growth in the overall global aviation system, while pioneering transformative capabilities that will create game-changing opportunities.

ARMD's strategic thrust in Assured Autonomy for Aviation Transformation defines ARMD's vision and approach for supporting the integration of Unmanned Aircraft Systems (UAS) into the National Airspace System (NAS) in the near-term while pioneering the more extensive transformative changes that increasingly autonomous aviation systems will bring over the mid- to far-term. Research to address this strategic thrust is primarily focused in two programs – the Integrated Aviation Systems Program, and the Airspace Operations and Safety Program – although there will be implications of autonomy across the entire ARMD portfolio.

Unmanned Aircraft Systems and Autonomy

UAS and more broadly inclusive autonomous systems and technologies hold great promise for the transformation of our future aviation system. All elements of an aviation system could possess some level of autonomy, ranging from flight vehicles to air traffic management, ground support vehicles, ground control stations and all other elements. We are witnessing the dawn of a new era of aviation innovation. The introduction of autonomous vehicles and technologies can usher in totally different flight vehicles and operations that are unimaginable today and open up entirely new commercial markets, benefitting consumers as well as manufacturers, much as jet engines did 60 years ago. Under Section 333 of the FAA Modernization and Reform Act of 2012 the FAA has granted regulatory exemptions for UAS operations for companies performing operations for aerial surveying, construction site monitoring, oil rig flare stack inspections, and film and video productions. NASA and US industry are actively exploring autonomy concepts and technologies specific to the aviation enterprise, as well as identifying advances in other sectors (automotive, electrical systems, or internet-of-things, to name a few) that could be adapted to aviation. The United States is not the only country seeing this opportunity – there is significant interest and research in aviation autonomy by our international counterparts as well, presenting strong competition and at the same time many opportunities for collaboration to advance the state-of-the-art in this field.

There are significant research challenges associated with the introduction of autonomous systems and technologies into our aviation system. Before becoming operational, autonomous systems will need to uphold the highest levels of safety and assurance. This requires the complex systems to be evaluated through new methods and approaches to verify and validate that these

systems are operating as designed as well as certifying these systems for flight. New test and evaluation capabilities are required for the development, integration and evaluation of these autonomous systems.

Introduction of UAS into the NAS is the first stepping-stone on the path toward the introduction of autonomous systems more broadly. Significant barriers exist for routine UAS access such as the lack of an on-board pilot to see and avoid other aircraft, the reliance on command and control communication frequencies used primarily by the military and the wide variation in UAS size (e.g., Northrop Grumman Global Hawk, which has a 131 foot wingspan and has an empty weight of almost 15,000 pounds vs. AeroVironment Nano Hummingbird, which has a 6.3 inch wingspan and weighs less than an ounce) and performance characteristics (altitudes, speeds and duration). Understandably, in order to continue to ensure safety of the NAS, the FAA needs to gather information in each of these areas in order to determine the safety of these aircraft and to set prudent operations and equipment standards before routine access is granted.

NASA's Research and Development Approach

ARMD is not the end user of the concepts and technologies resulting from our research. NASA does not build and sell aircraft, engines or air traffic management systems. Through the research we conduct and the research we sponsor with universities and industry, we help to develop the technology that enables continuous innovation in aviation.

Close coordination with our partners and stakeholders throughout the research process is essential if we are to successfully transfer new operational concepts and technologies for commercialization by industry or adoption by the FAA and other federal agencies to help them meet their missions. By matching NASA mid- and far-term research with current problems and making a timely transfer of the needed technology, we are helping the FAA and other stakeholders to realize benefits in near-term applications. NASA research provides to the FAA and other international civil aviation regulatory bodies the concepts, technologies and scientific data that can inform development of regulations and certification procedures, thereby facilitating the use of new technologies in the National Airspace System.

For example, ARMD, in partnership with FAA and industry, is demonstrating an effective and harmonious integrated suite of air traffic management tools, which will expand airspace capacity with more fuel-efficient flight planning and diminish delays on the ground and in the sky. ARMD also is improving safety and reducing development costs of new aviation technologies through development of new methods of validating and verifying complex flight systems and development of a system wide safety management system, in partnership with the FAA.

ARMD is developing design tools for advanced, low-noise supersonic vehicle designs, and conducting research to understand the impact of low sonic booms on communities, to provide critical, timely information for the FAA, the International Civil Aviation Organization (ICAO) and other aviation regulatory agencies required to consider modifying regulations and certification standards for supersonic flight over land.

Similarly, NASA research provides concepts, technologies and scientific data to support FAA's development of regulations and certification requirements for civil UAS operations in the NAS. To ensure that the results of NASA's research can be used for this purpose, NASA's research portfolio is developed in close coordination with other federal agencies.

One can characterize NASA's research and development efforts focused on autonomous systems into three time frames, near-, mid- and far-term. The following three sections describe NASA's work in these three time frames and the approach that NASA is taking to coordinate our work with the stakeholder community and transition research findings in an effective manner.

Near-Term - The UAS Integration in the NAS Project

The majority of NASA's research work toward near-term integration of UAS into the NAS is organized under the UAS Integration in the NAS Project, which is part of the Integrated Aviation Systems Program. The goal of the project is to contribute capabilities that reduce technical barriers related to the safety and operational challenges associated with enabling routine UAS access to the NAS.

Current work is focused in these areas that represent key barriers to UAS integration.

Sense and Avoid/Separation Assurance Interoperability (SSI)

Fundamental questions that must be addressed to effectively and safely integrate UAS in to the NAS include, but are not limited to: How can UAS sense other vehicles and avoid them? What are the appropriate variables needed to evaluate the safe interoperability of manned and unmanned aircraft in the NAS? How do you quantify those variables in a way that could lead to aircraft certification minimum operating standards of the sense and avoid system?

This research area focuses on validating technologies and procedures for UAS to remain an appropriate distance from other aircraft and to safely and routinely interoperate with other aircraft in the NAS. NASA research will help determine the combination of technologies, systems, procedures and standards required to ensure that UAS operating in the NAS remain outside the separation minima defined by the FAA.

NASA researchers will employ a suite of methodologies to address this safety goal including simulations and flight tests. Research results will be transitioned to various stakeholders including the FAA and Radio Technical Commission for Aeronautics (RTCA) Special Committee (SC)–228 Minimum Operational Performance Standards for Unmanned Aircraft Systems.

Communications

Communication is another critical element for safe UAS operation. What frequency spectrum is appropriate for UAS? How do we develop and test a communication system? What are the security vulnerabilities that might exist in such a communication system?

The UAS Communication work within NASA's UAS Integration in the NAS Project addresses safety aspects of UAS communications when operating in the NAS. The Project is working with the international community to identify spectrum bands to enable safe control of UAS. NASA assisted the community to identify spectrum for line-of-sight (terrestrial) UAS communications and to consider spectrum for beyond line-of-sight (satellite) for UAS communications. NASA is testing a prototype control communication radio system to allow the validation of proposed UAS communication system requirements in a relevant environment, utilizing frequency bands identified for UAS operations. Finally, NASA is conducting large-scale simulations of the UAS communication systems that would be needed for a NAS-wide deployment of UAS.

Human Systems Integration (HSI)

Given effective communications, humans will continue to play a role in highly automated UAS operations. How does the NAS accommodate a UAS pilot who is on the ground compared to a pilot in the cockpit? How do we design ground control station displays to maximize pilot effectiveness and safety?

NASA researchers in this focus area are working to ensure that the unmanned aircraft pilot operates as safely in the NAS as a manned aircraft pilot. Human Systems Integration (HSI) is achieving this through: 1) identifying the tasks and requirements that allow a pilot to operate safely; 2) developing a prototype ground control station (GCS) that supports those tasks and requirements; and 3) demonstrating this capability in simulation and flight tests in both nominal and off-nominal conditions. The results of this work will be the basis for developing guidelines for GCS designed to operate in the NAS. The lessons learned from these Human Systems Integration evaluations will inform GCS design guidelines for operations in the NAS that will be vetted through RTCA SC – 228 leading to recommendations to the FAA.

Technology Transfer

The driving force behind NASA's UAS research is to be able to transfer tools and solutions for operation in the civil airspace to the UAS community. Transfer is enabled by the coordination and close working partnerships that form during the research process. We have applied our experiences working with other federal agencies and industry partners to how we prioritize, execute and transfer our research findings to the stakeholder community.

Inter-Government Interfaces

The work that NASA is performing to support the safe integration of UAS into the NAS is dependent on external government agency interfaces to coordinate ongoing work as well as to transfer research deliverables. To ensure that the research products NASA delivers are well aligned across the multi-agency, multi-national efforts to enable routine UAS access to national and global airspace, NASA's R&D efforts require close coordination with the FAA's UAS Integration Office, industry standards organizations and international organizations. The close working relationship with the FAA's UAS Integration Office is critically important to ensure that NASA's research provides validated findings that inform the FAA's policy and rule making processes. This includes the prioritization of key technologies to research, as well as the design of critical simulations and flight test campaigns.

Other formal and informal interfaces and forums are also vitally important for collaboration and coordination of inter-Agency research. Two key inter-government interfaces in which NASA is involved are the UAS Executive Committee (ExCom) and the Sense and Avoid Science and Research Panel (SAA SARP).

In response to integration challenges and the growing demand for UAS NAS access by government agencies, Congress created the UAS ExCom to enable the DoD, the DHS and NASA to obtain routine UAS access to the NAS in order to execute their agency missions of national defense, security and scientific research. The expectation is that the experience gained by these agencies may enable the FAA to extend normalized or routine operational procedures to other public UAS operators and eventually civil UAS operators. The composition of the UAS ExCom includes senior executives from all four agencies. Working closely with the ExCom, the FAA has streamlined the Certificate of Authorization (COA) application process and extended the length of the COA from 12 months to 24 months and has established expedited procedures to grant one-time COAs for time-sensitive emergency missions such as disaster relief and humanitarian efforts.

NASA supports and closely cooperates with the DoD chartered Sense and Avoid Science and Research Panel (SARP). DoD recognized that a key challenge to integrating UAS into the NAS is a means for UAS to sense and avoid other aircraft. To ensure sound technical approaches to overcome this challenge DoD has established a SARP composed of experts from organizations that are performing SAA research. The SARP's primary purpose is to promote partnerships between the DoD and the broader academic and science community on UAS NAS integration science and research initiatives. The stakeholder community benefits from these partnerships through a broader range and depth of scientific expertise applied to challenges that affect all aspects of potential UAS operations.

NASA is also working closely with (1) the Air Force Research Lab to leverage research efforts associated with sense and avoid, (2) the US Northern Command in their flight test efforts to validate the DoD Concept of Operations for UAS access, (3) the Navy Broad Area Maritime Surveillance Program on safety case analysis in addition to sense and avoid testing and (4) is coordinating research activities with the DoD Policy Board for Federal Aviation and the DoD's UAS Task Force to further expand our collaborations with the DoD.

Industry Interfaces

In addition, NASA works closely with industry and other government agencies on the UAS Aviation Rulemaking Committee and RTCA Special Committee 228, which was described earlier. NASA is an integral contributor to the FAA's UAS Aviation Rulemaking Committee. This committee was formed to provide a forum for the Nation's aviation community to discuss UAS related issues and provide recommendations to the FAA for various UAS rulemaking projects. This includes providing information and input to the FAA to help develop the means to continue integration of UAS with manned NAS operations that address safety, capacity and efficiency objectives consistent with global aviation.

Global Harmonization

A final area of collaboration in which NASA is engaged is global harmonization. The data and research findings that are being developed in the communications activity are being shared with the international community through the International Telecommunication Union meetings associated with the World Radio Conference. NASA is also involved in several International Civil Aviation Organization (ICAO) activities as part of the U.S. delegation led by the FAA and the State Department, including the Flight in Non-Segregated Airspace work, the UAS Study Group, the Civil Air Navigation Services Organization and various ICAO working groups.

Mid-Term – UAS Traffic Management/UTM concept

NASA also is researching novel concepts and technologies that may facilitate safe operation of UAS at altitudes that are not actively controlled today, such as low-altitude operation of small UAS (less than 55 pounds). Initial investigations in this trade space have drawn interest among a broad range of traditional and non-traditional aerospace companies and show promise of opening up entirely new markets and operational models.

Many beneficial civilian applications of UAS have been proposed for operation in this airspace, from goods delivery, agricultural monitoring and infrastructure surveillance, to civil emergency search and rescue. As some UAS operations may operate in the same airspace where a mix of general aviation aircraft, helicopters and gliders currently operate, there is a strong need to safely accommodate all of these vehicles at lower altitudes. Currently, there is no established infrastructure to enable and safely manage the widespread use of low-altitude airspace and UAS operations, regardless of the type of UAS.

In order to safely enable widespread civilian UAS operations at lower altitudes, NASA is initiating development of air traffic management-like system called UAS Traffic Management (UTM), much like today's surface vehicles that operate within a system consisting of roads, lanes, stop signs, rules and lights. The goal of UTM is to enable safe and efficient low-altitude airspace operations by providing critical services such as airspace design and geo-fencing, separation management, weather and wind avoidance, routing and contingency management. UTM will support UAS ranging from those with minimal avionics capability, to those that are autonomous and allow safe operations in presence of current vehicles (e.g., gliders, general aviation, helicopters). UTM is essential to enable the accelerated development and use of civilian UAS applications. UTM will provide structure such as corridors and geo-fences where absolutely necessary and flexibility where possible.

Two types of UTM systems are envisioned. The first type is a Portable UTM System, which would move between geographical areas and support operations such as precision agriculture and disaster relief. The second type of system is a Persistent UTM System, which would support low-altitude operations and provide continuous coverage for a fixed geographical area. The UTM will require persistent communication, navigation and surveillance coverage to track, ensure and monitor conformance. Industry is considering a variety of options such as ground-based radars, cell phone and satellite based Automatic Dependent Surveillance - Broadcast (ADS-B) for surveillance and tracking.

NASA's near-term goal is the development and demonstration of the UTM to safely enable low-altitude airspace and UAS operations within five years. For the longer-term (10 to 15 years in

the future), the goal is to safely enable the anticipated dramatic increase in density and diversity of all low-altitude airspace operations. Working alongside with many committed government, industry and academic partners, NASA will lead the research, development, testing and implementation of the UTM, exploring functional designs, concepts and technology development and testing of proposed UTM systems utilizing a series of builds, each increasing in capability. NASA is using a spiral development approach targeting these four builds to be delivered at 12-16 months intervals. NASA will test the first UTM prototype (Build 1) this August in collaboration with a broad collection of partners.

During the UTM's development, NASA has collaborated closely with the FAA. The UTM system concept was presented in an all-stakeholder workshop in February 2014 that was attended by over 150 representatives from UAS manufacturers, operators, system integrators, test sites, as well as the FAA, NOAA and DoD.

From the stakeholder workshop attendees there was solid support for the concept and NASA's role as a coordinator. Further, many organizations expressed interest in building partnerships with NASA to develop and test UTM. As a result, several Space Act Agreements have been developed. In order to ensure further inclusiveness, NASA issued a request for information (RFI) on the federal business opportunities website to solicit further collaborators. To date, NASA has received over 120 potential collaboration requests. These collaborators represent UAS manufacturers, operators, software systems developers, communications companies, ADS-B manufactures and airspace operations providers, to name a few. This highly collaborative approach allows NASA to verify UTM concepts, address the needs of a wide range of stakeholders, identify available and applicable technologies and ensure a comprehensive understanding of potential use cases.

NASA has also developed a research transition team (RTT) for UTM with the FAA. This collaboration and technical exchange management structure has successful roots in the delivery of several key air traffic management advanced technologies from NASA to the FAA over the last several years. The RTTs routinely engage FAA's NextGen, Aviation Safety and Air Traffic Operations organizations and the FAA William J. Hughes Technical Center.

Interest from the UAS community has been very high and anticipation of rapid progress in system development and implementation is equally high. The pace of collaborative research and demonstration planned for UTM is critical to address the demand of the UAS community.

After thorough testing, transfer of the technologies associated with a UTM prototype to the FAA is expected by 2019. The ultimate goal of this research is to assist all low-altitude operations (i.e., manned and unmanned) in an autonomous manner to accommodate future vehicles and future demand.

Far-Term –A Vision for Adopting Autonomy

The growing UAS industry and the varied user base is a harbinger of the potential for change that increasingly autonomous systems will bring to aviation. It has the potential to revolutionize existing transportation applications and enable fundamentally new uses of the National Airspace System. But enabling these changes will require substantial research and experimentation to ensure the safety and efficacy of these systems. As the National Research Council (NRC) Committee on Autonomy Research for Civil Aviation indicated in their recent report on the subject – "civil aviation is on the threshold of potentially revolutionary changes in aviation capabilities and operations associated with increasingly autonomous systems. These systems, however, pose serious unanswered questions about how to safely integrate these revolutionary technological advances into a well-established, safe and efficiently functioning NAS."

NASA's long-term research in autonomy seeks to both answer those questions as well as to demonstrate high payoff, integrated applications that advance the safety, efficiency and flexibility of the NAS and increase competitiveness of the U.S. civil aviation industry. Through internal assessments and taking advantage of the previously mentioned NRC Committee's report, NASA has developed a set of research themes that are critical to enabling assured autonomy. These research themes include: advancing test, evaluation, verification and validation techniques; developing autonomous planning, scheduling and decision-making methods; developing the tools to design and analyze autonomous systems; and systems for integrated vehicle control, health management and adaptation.

While the ultimate outcomes of our autonomy research are long-term, the research is beginning today in synergy with other UAS research. For example, the Live, Virtual, Constructive – Distributed Environment being established for high fidelity flight testing and standards validation for the UAS in the NAS Project is being extended to the full NAS to enable shadow mode simulation and testing of advanced airspace architectures including research to achieve real-time, system-wide safety as well as autonomous system operations.

Another example is the later versions of the UAS Traffic Management test-bed that will test the ability to autonomously schedule safe, conflict free trajectories in very complex conditions with vehicles of varying performance. Both of these examples provide platforms for testing advanced verification and validation methods that will be required for confident application of increasingly autonomous systems.

Again, while the ultimate objectives of this research are long-term, we also expect that initial applications of increasingly autonomous systems will be viable in the mid-term. Initial focus

will be on autonomous functions that collaborate with humans to improve safety outcomes and UAS traffic management.

Conclusions

NASA's Aeronautics Research Mission Directorate is a national resource that, through game-changing research advances, enables a growing, sustainable and transformative aviation system. Increasingly autonomous aviation systems will both help solve evolving safety, efficiency and sustainability challenges and enable the type of transformative changes that UAS integration signals. For the near-term, NASA is playing an important role, in partnership with the FAA, DoD, standards developing organizations and industry in general, to achieve the integration of UAS into the National Airspace System. This partnership is built upon clear roles and responsibilities among the partners, long and productive working relationships and close and continuous coordination for the specific needs of the UAS integration challenge.

Moreover, because enabling the introduction of increasing autonomous systems is a major element of NASA's long-term aeronautics strategy, we are committed to sustaining this important partnership. As the challenges of UAS operations evolve and the broader implications of the integration of autonomy throughout the aviation system develop, NASA will continue to advance the research and enabling technologies that will assure the safe realization of the transformative benefits of these systems.

Mr. MICA. Thank you.

Again, we'll withhold questions until we've heard from all witnesses.

Let me recognize now Paul Misener, vice president of Global Public Policy with Amazon.

Welcome. And you're recognized.

STATEMENT OF PAUL E. MISENER

Mr. MISENER. Thank you, Mr. Chairman and Mr. Cummings, very much for inviting me. Drones will provide the next generation of commercial delivery service when permitted. So policymakers should expeditiously adopt rules of operation that emphasize drone safety and system performance. Thank you for your attention to this important topic and for holding this hearing.

Amazon Prime Air is a future service that will deliver packages of up to 5 pounds to customers in 30 minutes or less using small drones, also known as unmanned aircraft systems or UAS. Flying beyond line of sight, under 500 feet, and generally above 200 feet for takeoff and landing, and weighing less than 55 pounds total, Prime Air small UAS vehicles will take advantage of sophisticated sense-and-avoid technology, as well as a high degree of automation to safely operate at distances of 10 miles or more, well beyond visual line of sight.

No country in which we have distribution facilities has yet adopted rules that would allow commercial UAS package deliveries. So we are working with government agencies to develop appropriate rules for small UAS operations. Such rules must allow SUAS operations to take advantage of a core capability of UAS technology, which is to fly with minimal human involvement beyond the visual line of sight of a human operator. Such rules of operation should be proportionate to risk, setting a level of safety but not mandating how that level must be met.

Safety is Amazon's top priority, a top priority I know we share with the FAA and NASA. And we are committed to mitigating safety risks. Key aviation authorities outside the United States are rapidly pursuing regulatory frameworks and operational rules for UAS. Their approach is risk and performance based and is mindful of the tremendous opportunities for innovation and economic benefits that UAS present.

Here in the United States, the FAA also is taking its UAS responsibility seriously. And Amazon is grateful for the attention the agency is giving to this new, innovative technology. The FAA's small UAS NPRM is a step forward, as it speaks to the need for a performance-based approach to rulemaking. We are fully supportive of this approach and agree with it.

At the same time, the NPRM has shortcomings, mostly because some of the prohibitions maintained are not actually performance based. And if adopted as drafted, the rules would not establish a regulatory framework to permit Prime Air operations in the United States.

More specifically, we respectfully disagree with the FAA's current opinion that extending see-and-avoid principles to small UAS, as well as the potential loss of positive control of small UAS present, "unique safety concerns," which, thereby, warrant delayed

consideration. Although these safety concerns present particular engineering challenges to be sure, such challenges are not qualitatively different from the other engineering challenges facing small UAS designers. So they should be assessed starting now, ultimately resulting in performance-based operating permissions.

Granted, regulators here and abroad cannot quickly adopt actual rules for operation beyond visual line of sight. That may take time. But American policymakers should quickly propose regulatory frameworks and rules for future commercial SUAS operations. Amazon believes that the FAA should act expeditiously and asks that Congress provide legislative guidance to the agency and, if necessary, provide additional legal authority.

First and foremost, SUAS regulations must be risk and performance based. That is, SUAS rules should take into account the risks of operation, including, for example, the absence of passenger and crew, the lower kinetic energy of aircraft, and the very low operating altitudes, and evaluate how UAS performance mitigate these risks. Categorical prohibitions—for example, no nighttime operations or no operations beyond visual line of sight—make no sense and must be avoided. Likewise, highly automated UAS vehicles should be allowed to fly if they meet performance-based safety requirements. And, thus, a single UAS operator should be able to oversee simultaneous operation of multiple highly automated small UAS vehicles.

Given the interstate nature of commercial SUAS operations, States and localities must not be allowed to regulate SUAS that the FAA has authorized, including with respect to airspace, altitude, purpose of operations, performance, and operator qualifications. Uniform Federal rules must apply.

In conclusion, Mr. Chairman, I look forward to working with you and your committee and the FAA to help the United States expeditiously adopt rules for SUAS operations that emphasize safety and system performance and, thereby, permitting drones to provide Americans the next generation of commercial delivery service safely and soon. Thank you. I welcome your questions.

[Prepared statement of Mr. Misener follows:]

amazon.com.

Hearing on

Drones: The Next Generation of Commerce?

Before the

Committee on Oversight and Government Reform
United States House of Representatives

June 17, 2015

Testimony of

Paul Misener
Vice President for Global Public Policy
Amazon.com

Thank you, Chairman Chaffetz and Ranking Member Cummings. My name is Paul Misener, and I am Amazon's Vice President for Global Public Policy. Drones will provide the next generation of commercial delivery service, when permitted, so policymakers should expeditiously adopt rules of operation that emphasize drone safety and system performance. Thank you for your attention to this important topic; for calling this hearing; and for inviting me to testify.

I. Amazon Prime Air

Amazon Prime Air is a future service that will deliver packages of up to five pounds to customers in 30 minutes or less using small drones, also known as "unmanned aircraft systems" or "UAS." Flying beyond line of sight under 500 feet, and generally above 200 feet except for takeoff and landing, and weighing less than 55 pounds total, Prime Air small UAS vehicles will take advantage of sophisticated

"sense and avoid" technology, as well as a high degree of automation, to safely operate at distances of 10 miles or more, well beyond visual line of sight.

Not only do we think our customers will love this service, we believe it will benefit society more broadly. Once operational, Prime Air will increase the overall safety and efficiency of the current ground transportation system, by allowing people to skip the quick trip to the store or by reducing package deliveries by truck or car. For the same reasons, Prime Air will reduce buyers' environmental footprint: If a consumer wants a small item quickly, instead of driving to go shopping or causing delivery automobiles to come to her home or office, a small, electrically-powered UAS vehicle will make the trip faster and more efficiently and cleanly.

American commercial entities are innovating and perfecting small UAS ("sUAS") technology, and to do so we are conducting research and development testing. Amazon has a large indoor R&D facility in Seattle. In this facility, our Prime Air team (including roboticists, scientists, aeronautical engineers, remote sensing experts, and even a former NASA astronaut) continues to conduct flight tests on rapidly improving designs. But of course we also need to safely test these designs outdoors, exposed to the real world conditions that our sUAS eventually will experience in operations – namely, wind, turbulence, and a variety of temperatures, humidity, and precipitation. Amazon Prime Air has been conducting outdoor R&D flight testing in multiple locations abroad as well as in the United States, where the Federal Aviation Administration ("FAA") has taken steps to streamline grants of required approvals. Our testing is going well, and we are very pleased with the R&D progress it has enabled.

In addition to our R&D work, we also will prepare our distribution network for the eventual integration of Prime Air delivery service. Preparation will include optimizing our internal systems because, in order to meet our Prime Air customer delivery goal of 30 minutes or less, our sUAS must be loaded quickly, and this presents fascinating logistical challenges, including within our huge warehouses.

II. Public Policy Needs

No country in which we have distribution facilities has yet adopted rules that would allow commercial UAS package deliveries. So, in addition to our Prime Air R&D; testing; and distribution network preparations, we are working with government agencies to develop appropriate rules for small UAS operations. Such rules must allow sUAS operations to take advantage of a core capability of UAS technology: to fly with minimal human involvement, beyond the visual line of sight of a human operator. Such rules of operation should be proportionate to risk, setting a level of safety but not mandating how that level must be met.

Safety is Amazon's top priority – a top priority that I know we share with the FAA – and we are committed to mitigating the safety risks of mid-air collisions and crashes to the ground. In its Notice of Proposed Rulemaking ("NPRM") on sUAS, released earlier this year, the FAA emphasized concerns with the lack of human "see and avoid" abilities and the hazard of ground-to-air communications "link loss." Both of these factors would have been difficult to address even just a decade ago, but automated sUAS *sense* and avoid technology and vehicle on-board intelligence will in practice address these factors and mitigate the related risks.

Key aviation authorities outside the United States are rapidly pursuing regulatory frameworks and operational rules for UAS. Their approach is risk- and performance-based, and it is mindful of the tremendous opportunities for innovation and economic benefits that UAS present. The European Commission ("EC"), for example, has concluded that UAS vehicles should be treated as new types of aircraft with proportionate rules based on the risk of the operation ("rules should be simple and performance based"). The EC also said that rules must be developed now ("the basic regulatory framework should be put in place without delay"); that technologies and standards need to be developed for the full integration of UAS in the airspace; and that the European Aviation Safety Agency ("EASA")

should lead the harmonization of UAS regulation across Europe. For its part, EASA already has announced that:

> The operation of drones should be regulated in a manner proportionate to the risk of the specific operation. Considering the broad range of operations and types of drones, it is proposed to establish 3 categories of operations and their associated regulatory regime.... This concept has been developed to address two main goals: (a) Integration and acceptance of drones into the existing aviation system in a safe and proportionate manner; [and] (b) Foster an innovative and competitive European drone industry, creating new employment, in particular for SMEs.

Here in the United States, the FAA also is taking its UAS responsibilities seriously, and Amazon is grateful for the attention the agency is giving to this new, innovative technology. The FAA's sUAS NPRM is a step forward as it speaks to the need for a performance-based approach to rulemaking. We fully agree with this approach.

At the same time, the NPRM has shortcomings mostly because some of the prohibitions maintained are not actually performance-based and, if adopted as drafted, the rules would not establish a regulatory framework to permit Prime Air operations in the United States. Given the pace at which this technology is advancing, the FAA's proposed rules should more fully embrace and embody performance-based regulation that is flexible enough to keep up with advancements in technology. More specifically, we respectfully disagree with the FAA's current opinion that extending see-and-avoid principles to small UAS, as well as the potential loss of positive control of small UAS, present "unique safety concerns," which thereby warrant delayed consideration. Although these safety concerns present particular engineering challenges, to be sure, such challenges are not qualitatively different from other engineering challenges facing small UAS designers, so they should be assessed starting now, ultimately resulting in performance-based operating permissions. Overly prescriptive restrictions are likely to have the unintended effect of stifling innovation and, over time, will fail to offer any corresponding safety benefit as sUAS technology evolves. By contrast, genuine performance-based regulation would provide a flexible framework for

operators to demonstrate that these types of operations can be conducted safely. In sum, the FAA should consistently adopt a performance-based approach throughout its sUAS rules, and thereby not unnecessarily limit the promising benefits of small UAS technology.

A welcome intermediate development is the FAA's recently-announced "Pathfinder" project with BNSF railroad that is designed to conduct research to help determine how to safely fly beyond visual line of sight. Other similar research initiatives also would help the FAA become familiar with and evaluate UAS, but should not delay or distract from existing avenues for progress. One such avenue is uncertain because, although the FAA has asked a "working group" of one of its industry advisory committees to examine UAS operations beyond visual line of sight (and I am a member of this working group), it has met only twice since its inception last year, and not even once in 2015. This pace is inadequate, of course, especially compared to the regulatory efforts in other countries. Granted, regulators here and abroad cannot quickly adopt actual rules for operations beyond visual line of sight. That may take time. But American policymakers should quickly *propose* regulatory frameworks and rules for future commercial sUAS operations.

III. Opportunities for FAA and Congressional Action

The United States should immediately begin to plan and develop rules for sUAS operations that would encompass highly automated flight, beyond visual line of sight. Amazon believes that the FAA should act expeditiously, and asks that Congress provide legislative guidance to the agency and, if necessary, provide additional legal authority.

First and foremost, sUAS regulations must be risk- and performance-based. That is, sUAS rules should take into account the risks of operations (including, *e.g.*, the absence of passengers and crew, the lower kinetic energy of aircraft, and the very low operating altitude) and evaluate how UAS performance

mitigates these risks. Categorical prohibitions (*e.g.*, no nighttime operations, no operations beyond visual line of sight) make no sense and must be avoided. Importantly, sUAS with increased technical capabilities to detect and avoid aircraft, structures, and other obstacles should be permitted to operate beyond visual line of sight. Likewise, highly-automated UAS vehicles should be allowed to fly if they meet performance-based safety requirements, and thus a single sUAS operator should be allowed to oversee simultaneous operation of multiple highly-automated sUAS vehicles. Also, UAS should be permitted to transport property, including as an external load, for compensation.

Four other important considerations merit attention from U.S. policymakers. First, the FAA, working with industry and other parties, such as NASA, should develop a regulatory structure for commercial and other sUAS operations at low altitudes, say, below 500 feet above ground. Second, given the interstate nature of commercial sUAS operations, states and localities must not be allowed to regulate sUAS that the FAA has authorized, including with respect to airspace, altitude, purpose of operations, performance, and operator qualifications. Uniform federal rules must apply. Third, and similarly, internationally harmonized rules are highly desirable, and ideally would be developed through multinational aviation bodies like JARUS (the Joint Authorities for Rulemaking on Unmanned Systems) or ICAO (the International Civil Aviation Organization). Such harmonization should be an FAA priority. And fourth, commercial wireless spectrum, both licensed and unlicensed, and commercial wireless networks, managed by commercial wireless carriers, must be deemed adequate for sUAS communications functions, including for control links, collision avoidance, diagnostics, and payload communications.

One other consideration may require Congress to provide more than guidance to agencies. If sUAS operators were ever considered "air carriers," some statutory ownership restrictions may be impossible for operators to meet.

Consumer privacy is an area in which the U.S. approach to UAS regulation already is particularly strong. UAS technology could cause privacy infringement if commercial operations are not undertaken in a sensible, privacy-conscious manner. Prime Air is a future delivery service, not a surveillance operation, and we will respect the privacy of every person, with stringent privacy policies accessible to all. Amazon is committed to ensuring that the collection and use of information for Prime Air is consistent with our customer-centric values. We strongly support the effort of the National Telecommunications and Information Administration ("NTIA") to develop, through a multi-stakeholder process, best practices on privacy, transparency, and accountability, and we look forward to working with NTIA and other stakeholders to ensure that consumer privacy is protected as the consumer benefits of innovative UAS technology become available.

IV. Conclusion

In conclusion, Mr. Chairman, I look forward to working with you, your Committee, and the FAA to help the United States expeditiously adopt rules for sUAS operations that emphasize safety and system performance, thereby permitting drones to provide Americans the next generation of commercial delivery service safely and soon. Thank you. I welcome your questions.

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Mr. MICA. Thank you.

And we'll now hear from Mr. Brian Wynne, president and CEO of the Association for Unmanned Vehicle Systems International.

Welcome. And you're recognized, sir.

STATEMENT OF BRIAN WYNNE

Mr. WYNNE. Thank you, Mr. Chairman, Ranking Member Cummings, members of the committee. I appreciate the opportunity to testify today. I represent the Association for Unmanned Vehicle Systems International, the world's largest nonprofit organization devoted exclusively to advancing the unmanned systems and robotics community.

AUVSI has been a voice of unmanned systems for more than 40 years. And currently we have more than 7,500 members, including over 600 corporate members. The unmanned aircraft industry is poised to be one of the fastest growing in American history. Our economic impact study found that the first decade following UAS integration will result in more than $82 billion in U.S. economic activity and create more than 100,000 new high-paying jobs. The FAA Modernization and Reform Act of 2012 established a foundation for government and industry collaboration to advance this emerging sector.

As part of this, the FAA is currently working on finalizing rules for commercial and public use of this technology. The Agency is also granting permission for limited commercial use on a case-by-case basis under section 333 of the 2012 act. But more can and should be done.

Despite these positive steps, we need to permit expanded uses of UAS technology that pose no additional risk to the airspace system. For example, whether within the context of the rule, through the reauthorization, or by other means, we need to allow for beyond visual line of sight, nighttime operations, and operations over congested areas. Otherwise, we risk stunting a still nascent industry.

UAS technology is advancing rapidly thanks to collaboration between industry and government. In order to continuing encouraging innovation and promoting safety, we need to pass and sign into law an FAA reauthorization measure before the current authorization expires in September.

Let me highlight a number of specific directions that we would like to see reflected going forward. First, the industry supports a risk-based technology-neutral framework. This means regulations should be based on the risk profile of a particular UAS operation rather than the platform being flown. For example, low-risk operations, such as aerial surveys above rural farmland, would be regarded as safe with minimal regulatory barriers, regardless of the specific technology or platform used. This flexible framework will accommodate innovations rather than requiring new rules each time a new technology emerges.

Second, we support a comprehensive industry government research plan. There is a lot of good work already being done and better coordination will ensure we're maximizing the impact of these efforts. While the recently announced Pathfinder Program and UAS Center of Excellence show great progress, we need better

visibility on how they will fit into the larger UAS integration picture.

Third, Congress should consider making the FAA UAS tests sites eligible for existing Federal funding. While these test sites have been active for over a year, access to funding will help give industry guidance and an incentive to better utilize the test sites.

Fourth, we support the development of a UAS traffic management system. Some commercial UAS operations will occur at low levels. And this airspace may become complex. A traffic management system will integrate UAS into the existing national airspace infrastructure and ensure the continued safety of the airspace for all users, manned and unmanned.

Finally, knowing that UAS integration must be done in coordination with the NextGen Air Transportation System, there is also an opportunity to consider linking the two efforts and their resources more effectively. We are pleased to see the FAA recognize the need for more senior-level attention, with a new director and a new senior adviser position on UAS integration and look forward to working with those individuals once they are aboard.

In closing, UAS technology is at an exciting and pivotal stage, with new applications being contemplated nearly every day. Unmanned aircraft systems increase human potential, allowing us to execute dangerous or difficult tasks safely and efficiently. Thank you again for the opportunity to testify today. And I look forward to your questions.

[Prepared statement of Mr. Wynne follows:]



PREPARED STATEMENT OF BRIAN WYNNE
PRESIDENT AND CEO, ASSOCIATION FOR UNMANNED VEHICLE SYSTEMS INTERNATIONAL

U.S. House of Representatives
Committee on Oversight and Government Reform
"Drones: The Next Generation of Commerce?"
June 17, 2015

Chairman Chaffetz, Ranking Member Cummings and members of the committee, thank you very much for the opportunity to address the Federal Aviation Administration (FAA) notice of proposed rulemaking (NPRM) on small unmanned aircraft systems (sUAS) and issues that should be considered as the FAA's reauthorization deadline approaches. I am speaking on behalf of the Association for Unmanned Vehicle Systems International (AUVSI), the world's largest non-profit organization devoted exclusively to advancing the unmanned systems and robotics community. AUVSI has been the voice of unmanned systems for more than 40 years, and currently we have more than 7,500 members, including over 600 corporate members.

As you know, UAS increase human potential, allowing us to execute dangerous or difficult tasks safely and efficiently. Whether it is assisting first responders with search and rescue missions, advancing scientific research or helping farmers more efficiently manage their crops, UAS will save time, money, and, most importantly, save lives. However, the benefits of this technology do not stop there; it has incredible potential to create jobs and stimulate the U.S. economy as well.

UAS are poised to be one of the fastest-growing industries in American history. As outlined in our 2013 Economic Impact report, the first 10 years after integration of UAS into the National Airspace System (NAS) will bring more than $82 billion and more than 100,000 new, high-paying jobs to the U.S. economy. Conversely, for every year that UAS integration into the NAS is delayed, the U.S. stands to lose $10 billion in potential economic impact, which translates to a loss of $27.6 million per day.

The benefits I just outlined can be recognized immediately, once the necessary rules are put in place to enable commercial operations. The FAA is currently working on finalizing rules for

commercial and public use of this technology, and we urge the agency to move as quickly as possible in finalizing these rules.

While the proposed rules are a positive step, passing and signing into law an FAA reauthorization measure before the current authorization expires on September 30, 2015, is critical to the future of the UAS industry in the U.S. The *FAA Modernization and Reform Act of 2012* brought the UAS industry to where it is today, and the next reauthorization act needs to build upon this foundation to continue to support this growing industry.

In order to advance this technology and its many economic and societal benefits, the FAA reauthorization bill should focus on two critical areas: accelerating the safe commercial use of UAS and expanding research efforts.

AUVSI has put forward recommendations for the upcoming FAA reauthorization bill that include an essential outline for a risk-based, technology-neutral approach to UAS integration; expanding Section 333 exemption authority from the 2012 act; requiring a comprehensive research plan for UAS integration; better utilizing the FAA-designated UAS test sites; elevating UAS integration leadership; and providing for an operational UAS traffic management system.

1. In order to realize the full benefits—both societal and economic—of this technology, and to keep the U.S. competitive globally, this legislation should take steps to accelerate commercial use of UAS.

    a. **A "Risk-Based, Technology Neutral" Approach**
    For the FAA to continue to keep up with the advancement of UAS technology, it needs to develop a risk-based, technology-neutral framework. By risk-based, technology-neutral, AUVSI means that regulations should be based on the risk profile of a particular UAS operation instead of solely regulating the platform being flown. This philosophy reflects a global trend that has been proven in nations with growing commercial UAS industries, such as the United Kingdom and France.

    For example, low-risk operations, such as aerial surveys above rural farmland and operations with micro UAS that weigh less than 4.4 pounds would be granted access to the airspace with minimal regulatory barriers. In practice, if the computed risk value of a UAS operation is below an acceptable threshold, the operation should be regarded as "safe," regardless of the specific technology used.

By adopting this approach, the FAA can establish a regulatory environment that is able to accommodate any and all UAS technology innovations by using flexible standards rather than continually proposing new rules for different UAS technologies, platforms and operations.

b. **Expanding Section 333 Exemption Authority**
Under the authority granted under Section 333 of the 2012 FAA reauthorization, the FAA has granted permission for limited commercial use of UAS on a case-by-case basis. This process can be used to allow for more uses of this technology in the short term by giving the FAA the clear authority to address Section 333 exemption requests for beyond-visual-line-of-sight operations. Beyond-visual-line-of-sight operations are crucial to many commercial uses of UAS. As written, the underlying provision does not specifically allow for beyond-visual-line-of-sight operations.

2. In order to fully integrate UAS into the National Airspace System, we will need to expand research efforts and lay the groundwork for more transformational uses of UAS technology.

a. **A Holistic Research Plan**
Working in conjunction with industry collaborators, a holistic UAS research and development (R&D) plan that takes into account the work being done at the FAA and other numerous federal entities will enable stakeholders to identify those UAS areas that need additional resources and focus. A comprehensive plan could identify areas where industry could come forward with new solutions.

This plan should also outline government and industry roles, milestones and dates for advancing outstanding research needs. These needs include an operationally deployed UAS traffic management program; resolving UAS spectrum issues; potential barriers to beyond-visual-line-of-sight operations; and defining the roles that specific federal facilities and entities will have in implementation of the plan.

The federal facilities and entities that, at a minimum, should be included in this research plan are the FAA's William J. Hughes Technical Center, the six FAA-designated UAS test sites, and the UAS Center of Excellence, as well as the National Aeronautics and Space Administration's (NASA) Ames and Armstrong Research Centers.

b. **FAA UAS Test Sites**

While the FAA-designated UAS test sites have been active for over a year, they are being underutilized. In order to help them perform the valuable research needed for integration and to encourage industry to use them, we should consider making the test sites eligible for federal funding under current FAA offices and programs that are engaged with UAS activities. This would not specifically add new funding for the test sites; rather it could allow for them to receive existing federal funding and give industry guidance and incentive to better utilize the test sites.

c. **Elevating the UAS Integration Initiative**

Federal efforts for facilitating the integration of UAS into the NAS are at a pivotal moment. Leadership and coordination with industry and government partners is absolutely critical to ensure the United States regains trailblazer status in this international industry.

Knowing that UAS integration must be done in coordination with NextGen, there is an opportunity to consider linking the two efforts and their resources more effectively going forward. These areas are very complementary to each other and UAS technologies will make the entire NAS safer. Appropriate high-level leadership will be key to making this focus successful.

d. **Enabling a UAS Traffic Management System**

It will be important to establish an operational UAS Traffic Management System/Network in order to ensure both the safe and efficient use of the airspace. While some initial commercial UAS operations will occur at low levels, this airspace may become complex with established navigation routes, as well as point-to-point route segments, requiring specific equipage requirements. A traffic management system will integrate UAS into the existing national airspace infrastructure and ensure the continued safety of the airspace.

The next several years will be critical to the expansion of UAS technology in the U.S. If we are to realize the full potential of this technology and its economic benefits, it is important that the FAA reauthorization bill give the FAA the authority and ability to create regulations that keep up with the rapid advancement of this technology.

Some of the provisions we are recommending for the FAA reauthorization legislation also apply to our comments on the FAA's sUAS NPRM, most notably the need for a risk-based, technology-neutral framework and allowing for beyond-visual-line-of-sight operations.

In addition to weighing in on the NPRM and reauthorization act, AUVSI has also formally submitted a response to the National Telecommunications & Information Administration's "Comments on Privacy, Transparency, and Accountability Regarding Commercial and Private Use of Unmanned Aircraft Systems." AUVSI supports a constructive dialogue on this issue of privacy. However, we should keep in mind that the role of the FAA is to keep our skies safe for all users – manned or unmanned. Further, there is already have a robust legal framework in place that protects Americans' right to privacy, and these laws apply to UAS just like cell phones, traffic cameras, and other connected devices. Privacy policies should focus on how data is collected and used, as opposed focusing on the specific platform that is being used.

UAS technology is at an exciting and pivotal stage. The technology is developing rapidly, with new applications being highlighted nearly every day, much faster than our country's capacity to develop the necessary regulations. We need to make sure that the FAA adopts the proper framework to keep up with this technology and is sufficiently resourced to work with industry stakeholders to perform essential research ensuring the safety of our airspace.

Thank you again for the opportunity to speak today. I look forward to answering any questions the committee might have.

Mr. MICA. Thank you.

And we'll get back to you for questions.

Mr. Harley Geiger, he is advocacy director and senior counsel for the Center of Democracy and Technology.

Welcome. And you're recognized.

STATEMENT OF HARLEY GEIGER

Mr. GEIGER. Chairman Chaffetz, Ranking Member Cummings, and members of the committee, thank you very much for giving me the opportunity to testify today on the subject of unmanned aircraft systems, also known as drones. I am Harley Geiger, senior counsel at the Center for Democracy and Technology. CDT is a nonpartisan, nonprofit technology policy advocacy organization dedicated to preserving civil liberties, such as privacy and free speech, while enabling government agencies to provide security and companies to innovate.

I have three overarching points that I want to make with regard to drones. My testimony focuses on privacy, although clearly there are many other policy issues that are associated with unmanned aircraft. First, unmanned aircraft systems are a promising technology but have potential to erode civil liberties by enabling pervasive surveillance.

Second, current laws do not provide strong privacy protection from government or private unmanned aircraft. And the lack of privacy protection undermines public trust, which holds back the industry.

Third, to earn public acceptance of UAS, which will promote its commercial growth, both government and the UAS industry should fully address civil liberties issues through a combination of legislation and an industry code of conduct.

In my time remaining, I will expand on these points. The CDT wants to see UAS used for commerce, for journalism, for disaster relief, scientific research, and more. However, neither the government nor the UAS industry should ignore the potential for UAS to enable pervasive surveillance that undermines civil liberties.

Here is a nightmare scenario for civil liberties. Law enforcement establishes a broad-based drone dragnet that constantly tracks individuals in populated outdoor areas, chilling the public's right to free expression, free association and assembly. At the same time, a network of commercial unmanned aircraft record footage of virtually every American who steps out of her home, even if that individual remains on private property.

This may seem like a far-fetched future to some. However, few existing laws would stand in the way. And the public does not yet trust the discretion of the government or the UAS industry to prevent this scenario from becoming a reality.

When it comes to government UAS, CDT believes that prolonged, physical surveillance of individuals in public places violates Fourth Amendment principles. However, the Supreme Court has repeatedly held that Americans have no expectation of privacy from aerial surveillance. The Supreme Court has even held that the Fourth Amendment is not violated when a police helicopter looks into the interior of a private building through a hole in the ceiling without a warrant.

Bottom line, there's very little protection in terms of privacy from government use of UAS outdoors. Law enforcement use is perhaps the most acute concern that the public has with UAS. And to address the public's concern, Congress should pass legislation that, among other things, establishes due process standards for law enforcement use of UAS. And Congress should limit law enforcement use to instances where the government has a warrant or exigent circumstances or other narrowly tailored reasonable exceptions. CDT believes that the Preserving American Privacy Act from Representatives Poe and Lofgren, as well as Senator Wyden's Protecting Individuals from Mass Aerial Surveillance Act, which was introduced today, would provide strong due process protection without unreasonably burdening non-law-enforcement uses, such as scientific research. CDT supports these bills and urges Congress to pass them swiftly.

When it comes to private sector UAS, common law privacy torts provide Americans with some protection from private sector UAS out of the home, but only if the conduct is highly offensive to a reasonable person. However, any government regulation of private UAS must not violate our First Amendment right to take photographs from public places. An industry code of conduct would help provide privacy protections from private UAS where direct regulation cannot. But it will be effective only if the industry agrees to adopt a strong and enforceable code. The code proposed by AUVSI does not cut it.

The code should establish reasonable limits on UAS collection and retention of personally identifiable information. And the code should also create a publically accessible registry of UAS data-collection policies, though there should be reasonable exceptions for that registry. And the code should also establish cybersecurity standards to prevent hijacking and unauthorized damage to UAS systems.

And, finally, CDT recommends that the industry explore technical measures to protect individual privacy in physical space, as well as enhanced transparency for private UAS systems. Thank you very much for holding this hearing. And I look forward to your questions.

[Prepared statement of Mr. Geiger follows:]



Statement of Harley Geiger
Senior Counsel and Advocacy Director
Center for Democracy & Technology

Hearing before the U.S. House of Representatives Committee on Oversight and Government Reform on "Drones: The Next Generation of Commerce?"

June 17, 2015

Chairman Chaffetz, Ranking Member Cummings, and members of the Committee:

Thank you for the opportunity to testify on behalf of the Center for Democracy & Technology (CDT). CDT is a nonpartisan, nonprofit technology policy advocacy organization dedicated to protecting civil liberties and human rights, including privacy, free speech and access to information. We applaud the Committee for holding a hearing that covers the challenges of regulating unmanned aircraft systems (UAS) – "drones" – in a manner that preserves both innovation and privacy.

CDT supports the many beneficial applications of UAS, but also acknowledges the potential for UAS to erode civil liberties. Federal and constitutional law do not provide individuals with clear and meaningful privacy protection from government UAS. Common law provides limited privacy protection from private UAS, though any direct privacy regulation of private UAS must be harmonized with the First Amendment. Public distrust, rooted in a perceived lack of privacy protection, hampers the domestic UAS industry and the growth of the technology. To reap the full benefits of UAS, Congress and the industry should take steps to address the public's legitimate privacy concerns. CDT recommends Congress pass federal legislation to enact privacy and transparency standards for UAS – especially law enforcement use. CDT also recommends that the UAS industry adopt a strong and accountable code of conduct.

I. UAS Privacy Issues

CDT readily recognizes that UAS is a valuable technology with many positive uses that pose little threat to privacy. We agree that unmanned aircraft can save lives, promote research, fight fires, make it easier to farm, track wildlife, relay WiFi signals to remote areas, deliver packages, reduce hardship for the many who work in hazardous conditions, and much more. CDT wants to see UAS utilized for science, commerce, disaster relief, journalism, education, and recreation. However, despite these clearly beneficial uses, we must not dismiss the strong potential for some unmanned aircraft applications to enable pervasive surveillance that degrades civil liberties.

Some have argued that UAS do not raise new privacy issues beyond those posed by manned aircraft, CCTV, or red light cameras. We disagree – because UAS operate from vantage points other systems do not reach, UAS can far exceed the privacy impact of those older technologies. Unlike helicopters, high grade UAS can quietly monitor a wide area for extended periods of time without refueling. CCTV and red light cameras are limited in their coverage: turn the corner, leave the intersection, or enter your fenced-in yard, and these systems can no longer observe you – but UAS can. It can be very difficult to avoid the gaze of high-flying UAS once an individual is outside. Because UAS are relatively inexpensive, they are likely to be used more frequently by more parties than most other aerial surveillance systems (like a helicopter). Combining UAS with cell tower emulators[1], facial recognition cameras[2], license plate scanners[3], thermal imaging cameras[4], open WiFi sniffers[5], and other sensors[6] can make the surveillance all the more intrusive.

Here is a nightmare scenario for civil liberties: A network of law enforcement UAS with sensors capable of identifying and tracking individuals monitors populated outdoor areas on a constant, pervasive basis for generalized public safety purposes. At the same time, commercial UAS platforms record footage of virtually anyone who steps out of her home, even if the individual remains on private property. This may seem an unlikely future to some. However, few existing laws would stand in the way, and the public does not yet trust the discretion of government or the UAS industry to prevent such scenarios from approaching reality.

In the past year, two incidents demonstrated the potential for large-scale federal law enforcement aerial surveillance. In 2014, it was revealed that Justice Department agencies used aircraft equipped with cell tower emulators to scan the identification numbers of the cell phones over which the aircraft flew.[7] The flying range of the aircraft reportedly covered most of the U.S. population, with each flight potentially scanning cell phone data from tens of thousands of individuals with no connection to crime. In 2015, it was revealed that the Federal Bureau of Investigation operated scores of aircraft for surveillance related to ongoing

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[1] *See, e.g.*, Erica Fink, *This drone can steal what's on your phone*, CNN Money, Mar. 20, 2014, http://money.cnn.com/2014/03/20/technology/security/drone-phone/

[2] *See, e.g.*, Noah Shachtman, *Army Tracking Plan: Drones that Never Forget a Face*, Wired, Sept. 28, 2011, http://www.wired.com/dangerroom/2011/09/drones-never-forget-a-face.

[3] *See, e.g.*, Kris Gutierrez, *Drone Gives Texas Law Enforcement Bird's Eye View on Crime*, Fox News, Nov. 16, 2011,http://www.foxnews.com/us/2011/11/16/drone-gives-texas-law-enforcement-birds-eye-view-on-crime.

[4] *See, e.g.*, Draganflyer X6, Draganfly.com, http://www.draganfly.com/uav-helicopter/draganflyer-x6/features/flir-camera.php (last accessed Jun. 15, 2015).

[5] *See, e.g.*, Gary Mortimer, *Wi-Fi Aerial Surveillance Platform, WASP Drone*, sUAS News, Aug. 15, 2010, http://www.suasnews.com/2010/08/587/wi-fi-aerial-surveillance-platform-wasp.

[6] *See, e.g.*, Ryan Calo, *Drones, Dogs and the Future of Privacy* Wired, Mar. 8, 2012, http://www.wired.com/threatlevel/2012/03/opinion-calo-drones-dogs-privacy.

[7] Devlin Barrett, *Americans' Cellphones Targeted in Secret U.S. Spy Program*, Wall Street Journal, Nov. 13, 2014, http://www.wsj.com/articles/americans-cellphones-targeted-in-secret-u-s-spy-program-1415917533.

investigations, usually without court approval.[8] The government used manned flights in these examples, but UAS can make such surveillance more widespread, cheaper, and intrusive.

II. Privacy Laws and Law Enforcement UAS

At present, there are few clear nationwide restrictions on law enforcement use of UAS to monitor Americans outside their homes. There is no federal statutory protection. The FAA Modernization and Reform Act of 2012, which establishes a regulatory roadmap for integrating UAS into US airspace, does not mention privacy or transparency at all.[9] No other federal statute provides privacy protection or prescribes a due process standard for government use of UAS for physical surveillance.

CDT believes prolonged physical surveillance of individuals violates Fourth Amendment principles.[10] However, the federal courts have not provided consistent privacy protection from aerial surveillance. In a series of decisions in the late 1980s, the Supreme Court repeatedly found that individuals have no "reasonable expectation of privacy" – and therefore no Fourth Amendment protection – from warrantless government surveillance conducted from publicly navigable airspace.[11] The Supreme Court even held, in *Florida v. Riley* (1989), that the Fourth Amendment is not violated by warrantless police helicopter surveillance of the interior of a private building through a hole in the ceiling.[12]

Courts have slowly begun to express skepticism of the maxim that there is no reasonable expectation of privacy from warrantless government surveillance out of the home. In *United States v. Jones* (2012), the Supreme Court rejected the government's argument that there is never a reasonable expectation of privacy from warrantless government surveillance out of the home, but the *Jones* opinion is not a clear signal that the pubic has meaningful Fourth Amendment protection from aerial surveillance.[13] More recently, the Eastern District of Washington held, in *United States v. Vargas*, that the government violated the Fourth Amendment through secret surveillance of the front yard of a suspect's rural home continuously for more than six weeks from a pole camera.[14] An important, unanswered

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[8] Jack Gillum, Eileen Sullivan, and Eric Tucker, *FBI behind mysterious surveillance aircraft over US cities*, Associated Press, Jun. 2, 2015, http://bigstory.ap.org/article/4b3f220e33b64123a3909c60845da045/fbi-behind-mysterious-surveillance-aircraft-over-us-cities.

[9] FAA Modernization and Reform Act of 2012, Pub. L. No. 112-05, 126 Stat. 11.

[10] *See*, Amicus Brief of CDT, EFF, et al in U.S. v Jones GPS Vehicle Tracking Case, Center for Democracy & Technology, Oct. 03, 2011, https://cdt.org/insight/amicus-brief-of-cdt-eff-et-al-in-u-s-v-jones-gps-vehicle-tracking-case.

[11] *California v. Ciraolo*, 476 U.S. 207, 222 (1986); *Dow Chem. Co. v. United States*, 476 U.S. 227, 239 (1986).

[12] *Florida v. Riley*, 488 U.S. 445 (1989).

[13] The Court ultimately ruled on grounds that attaching a tracking device to a car was a physical trespass. The Court also said: "Thus, even assuming that the concurrence is correct to say that "[t]raditional surveillance" of Jones for a 4-week period "would have required a large team of agents, multiple vehicles, and perhaps aerial assistance," post, at 12, our cases suggest that such visual observation is constitutionally permissible." *U.S. v. Jones*, 132 S.Ct. 945 (2012).

[14] The court declared that Americans have a reasonable expectation of privacy in the activities occurring in and around the front yard of their homes, and that this expectation prohibits "warrantless, continuous, and covert

question is whether any objective reasonable expectation of privacy on outdoor private property will, as a legal matter, survive in a future in which many UAS regularly traverse the skies.

The Dept. of Justice issued guidance on the domestic UAS that provides only limited privacy protection.[15] The Dept. of Justice guidance states that it will only collect and use information obtained from UAS for an authorized purpose, but this is a very light restraint. The guidance also asks agencies to submit annual privacy reviews, and states that the Dept. of Justice will provide the public with brief descriptions of the types and quantity of its UAS missions. While these steps are positive, they do not provide strong privacy or transparency. Similarly, the International Association of Chiefs of Police issued guidelines recommending that agencies secure a search warrant for UAS only if the UAS will intrude upon reasonable expectations of privacy.[16]

Public concern and the lack of clear federal privacy protection have prompted several states to take action. Approximately 16 states have enacted UAS privacy laws since 2014, and these laws vary widely.[17] Most of the state laws are focused on restricting warrantless law enforcement use, though other states – such as North Carolina and Louisiana – restrict private UAS.[18] Although state UAS privacy laws may reduce public concern within those states, a federal law is preferable to apply to both state and federal UAS, to provide coverage to states that do not have a state UAS law, and to provide greater regulatory certainty to public and private UAS operators.

III. Privacy Laws and Private UAS

Common law privacy torts provide Americans with some protection from private sector UAS out of the home. For example, the torts of intrusion upon seclusion and public disclosure of private facts prohibit intrusions and disclosures that would be highly offensive to a reasonable

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recording." *United States v. Vargas*, No. CR-13-6025-EFS, slip. op. at 2 (E.D. Wash. Dec. 15, 2014), *available at* https://www.eff.org/files/2014/12/15/vargas_order.pdf. The government withdrew its appeal of the ruling.

[15] Department of Justice Policy Guidance, Domestic Use of Unmanned Aircraft Systems (UAS), Dept. of Justice, May 22, 2015, http://www.justice.gov/file/441266/download. The Dept. of Justice's guidance was in response to a Presidential Memorandum. See Presidential Memorandum: Promoting Economic Competitiveness While Safeguarding Privacy, Civil Rights, and Civil Liberties in Domestic Use of Unmanned Aircraft Systems, The White House, Feb. 15, 2015, https://www.whitehouse.gov/the-press-office/2015/02/15/presidential-memorandum-promoting-economic-competitiveness-while-safegua.

[16] International Association of Chiefs of Police, Aviation Committee, Recommended Guidelines for the use of Unmanned Aircraft, Aug. 2012, pg. 3, http://www.theiacp.org/portals/0/pdfs/IACP_UAGuidelines.pdf.

[17] Current Unmanned Aircraft State Law Landscape, National Conference of State Legislatures, Jun. 9, 2015, http://www.ncsl.org/research/transportation/current-unmanned-aircraft-state-law-landscape.aspx. See also 2014 State Unmanned Aircraft Systems Legislation, National Conference of State Legislatures, Sep. 16, 2014, http://www.ncsl.org/research/civil-and-criminal-justice/2014-state-unmanned-aircraft-systems-uas-legislation.aspx.

[18] North Carolina General Statutes, Article 16B, Chapter 15A-300.1. Louisiana Revised Statutes, Title 14, Section 337.

person.[19] Many, though not all, states have voyeurism and peeping tom laws that provide additional protections. However, many voyeurism and peeping tom laws apply only to looking within structures or enclosures, require plaintiffs to have a reasonable expectation of privacy, and may include sexual gratification as a component of the perpetrator's intent.[20] Moreover, as camera-equipped UAS proliferate, it may become increasingly difficult to claim that observation from UAS is objectively offensive, or that an individual has a reasonable expectation of privacy, even when the observed individual is on private property. Still, these and other civil laws[21] provide Americans with limited protection from some egregious conduct that UAS can enable.

More sweeping government regulation of private UAS must avoid infringing on Americans' longstanding First Amendment right to take photographs of things visible from public places.[22] Some state UAS-specific laws may run afoul of First Amendment protection for private photography. For example, North Carolina broadly forbids any person from using UAS to capture an image of an individual or private property for the purpose of disseminating or publishing the image, unless the image is newsworthy.[23] Texas law forbids capturing an image of an individual or private property "with intent to conduct surveillance."[24] We believe such laws infringe on free expression due to their overbreadth and are skeptical that they would withstand a First Amendment challenge.

CDT supports comprehensive baseline consumer privacy legislation that is tech-neutral, and therefore includes physical surveillance platforms such as UAS. However, the application of any such legislation to UAS would be somewhat limited in scope to avoid a First Amendment conflict. While UAS must abide by applicable safety laws, and some UAS platforms could be required to disclose data collection practices, it would likely be generally impermissible to authorize some types of UAS-based recording while restraining others on privacy grounds.[25]

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[19] "One who intentionally intrudes, physically or otherwise, upon the solitude or seclusion of another or his private affairs or concerns, is subject to liability to the other for invasion of his privacy, if the intrusion would be highly offensive to a reasonable person." Restatement (Second) of Torts Sec. 652B (1977). "One who gives publicity to a matter concerning the private life of another is subject to liability to the other for invasion of his privacy, if the matter publicized is of a kind that (a) would be highly offensive to a reasonable person, and (b) is not of legitimate concern to the public." Restatement (Second) of Torts Sec. 652D (1977).

[20] See, Voyeurism Statutes 2009, National District Attorneys Association, Mar. 2009, http://www.ndaa.org/pdf/voyeurism_statutes_mar_09.pdf.

[21] Nuisance and trespass also provide limited privacy protection. However, claims must typically demonstrate a substantial interference with enjoyment of land, and trespass claims likely do not apply to UAS in publicly navigable airspace. Restatement of Torts (Second), Sec. 159(2) (1965), stating that "Flights by aircraft in the airspace above the land of another is a trespass if, but only if, (a) it enters into the immediate reaches of the airspace next to the land, and (b) it interferes substantially with the other's use and enjoyment of the land."

[22] See Know Your Rights: Photographers, American Civil Liberties Union, Jul. 2014, https://www.aclu.org/know-your-rights-photographers.

[23] North Carolina General Statutes, 15A-300.1.

[24] Texas Gov't Code, Sec. 423.003.

[25] See Stephen E. Henderson et al., (2015) "Regulating Drones under the First and Fourth Amendments" *William and Mary Law Review (forthcoming)*, available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2574378.

CDT believes a strong and accountable industry code of conduct would be a helpful step towards achieving effective privacy protection from private UAS without infringing on free expression. Unfortunately, the industry code of conduct developed by the Association of Unmanned Vehicle Systems International (AUVSI) does not provide meaningful protection.[26] AUVSI's industry code merely commits to following the law and respecting the privacy of individuals, without further detail. CDT believes more robust and nuanced industry best practices on privacy and transparency are necessary to build public trust in UAS.[27]

IV. Public Trust of UAS

The perceived lack of privacy protection in law has fed widespread public distrust of UAS. A 2014 Pew poll found that nearly two-thirds of surveyed Americans thought the proliferation of personal and commercial UAS would be negative, despite being generally positive about the future benefits of technological advancement.[28] A 2013 poll from Monmouth University found that three-fourths of surveyed Americans say the government should get a warrant to use UAS.[29] Other polls of residents in specific states show even greater discomfort with UAS surveillance and higher levels of support for a warrant requirement.[30] The lack of trust has prompted the patchwork of state laws and hampered public acceptance of UAS.

This negative sentiment can also manifest in more extreme ways – such as shooting down or disabling UAS in mid-flight. Just two weeks prior to this hearing, on June 4th, firefighters in upstate New York repeatedly tried to spray a UAS with their hoses while it filmed them during the aftermath of a house fire.[31] A New Jersey man shot down a UAS last fall.[32] A 2013

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[26] Unmanned Aircraft System Operations Industry "Code of Conduct," Association for Unmanned Vehicle Systems International, Jul. 2012, pg. 2, http://higherlogicdownload.s3.amazonaws.com/AUVSI/958c920a-7f9b-4ad2-9807-f9a4e95d1ef1/UploadedFiles/AUVSI%20UAS%20Operations%20Code%20of%20Conduct%20-%20Final.pdf.

[27] See, e.g., Center for Democracy, CDT Comments To NTIA On "Privacy, Transparency, And Accountability Regarding Commercial and Private Use of Unmanned Aircraft Systems," Apr. 20, 2015, https://d1ovv0c9tw0h0c.cloudfront.net/files/2015/04/CDT-Submission-to-NTIA-on-Commercial-and-Private-Use-of-UAS.pdf.

[28] U.S. Views of Technology and the Future, Pew Research Center, Apr. 17, 2014, pg. 3, http://www.pewinternet.org/files/2014/04/US-Views-of-Technology-and-the-Future.pdf.

[29] U.S. Supports Unarmed Domestic Drones, But Public Prefers Requiring Court Orders First, Monmouth University, Aug. 15, 2013, pg. 2, https://www.monmouth.edu/assets/0/32212254770/32212254991/32212254992/32212254994/32212254995/30064771087/409aecfb-3897-4360-8a05-03838ba69e46.pdf.

[30] See, e.g., William Petroski, Iowa Poll: 76% favor requiring warrants for drone surveillance, Des Moines Register, Mar. 11, 2014, http://www.desmoinesregister.com/story/news/politics/2014/03/11/iowa-poll-76-favor-requiring-warrants-for-drone-surveillance/6311137. See also, Sakiyama, et al., Nevada vs. U.S. Residents' Attitudes Toward Surveillance Using Aerial Drones, University of Nevada Las Vegas Center for Crime and Justice Policy, Dec. 2014, http://www.unlv.edu/sites/default/files/page_files/27/NevadaU.S.Residents%27Attitudes.pdf. See also, Poll: 72% of North Carolina Voters Support Warrant Requirement for Drone Surveillance, ACLU of North Carolina, Mar. 2014, http://acluofnc.org/blog/poll-72-of-north-carolina-voters-support-warrant-requirement-for-drone-surveillance.html.

[31] Michael Franco, *Watch firefighters blast drone out of sky with hose,* CNet, Jun. 11, 2015, http://www.cnet.com/au/news/watch-firefighters-blast-drone-out-of-sky-with-hose.

Reason-Rupe poll found that nearly half of surveyed Americans believe they should have the right to shoot down UAS over their property.[33] A bill that would have provided civil immunity to individuals that shoot down UAS over their property passed the Oklahoma Senate Judiciary Committee earlier this spring.[34]

To foster broader public acceptance of UAS, the government and the industry itself should fully address civil liberties issues. We understand that most unmanned aircraft will not be equipped with sophisticated sensors and tracking systems, and it's clear that most businesses want to be good actors. However, the public wants protections from the most troubling capabilities and uses of this technology that we've seen in both theaters of war and domestically. Congress, Executive Branch agencies, and the private sector have important roles to play in providing protections and preserving public trust.

V. Federal UAS Legislation Recommendations

CDT believes Congress should consider legislation regarding UAS to provide privacy where protections are currently weak, to provide regulatory clarity to both businesses and government agencies, and to promote public trust of UAS technology.

The key issue this legislation should address is establishing due process standards for law enforcement use of UAS. While the public has broader concerns with UAS, law enforcement use may be the most acute. The legislation should have a lighter touch for non-law enforcement uses of government ("public") UAS, such as scientific research and other uses with a low impact on civil liberties, but legislation should establish transparency requirements for all public UAS. Any provision regulating private use of UAS should be flexible enough to avoid infringing on free expression and violating the First Amendment.

More specifically, CDT recommends that Congress enact federal legislation that

- Requires public UAS to submit a data collection statement as part of the Federal Aviation Administration's (FAA) UAS certification process. The data collection statement should outline the agency's data collection, retention, and use policies, and provide an individual point of contact.
- Requires the FAA to establish a publicly accessible database indexing public UAS licenses and data collection statements. This could be similar to the FAA's database for private aircraft.[35]

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[32] Jeff Goldman, *Man arrested after shooting down neighbor's remote control helicopter, cops say*, NJ.com, Sep. 30, 2014, http://www.nj.com/cape-may-county/index.ssf/2014/09/man_faced_with_gun_charges_after_shooting_down_remote_control_helicopter.html.

[33] Reason-Rupe Public Opinion Survey, February 2013 Topline results, Feb. 25, 2013, Pg. 5. http://reason.com/assets/db/13620384648046.pdf.

[34] S.B. 492, 55th Leg., 1st Sess. (Okla. 2015), *available at*, http://www.oklegislature.gov/BillInfo.aspx?Bill=SB492&Session=1500. The bill would not affect liability for discharging a firearm, nor liability for violating FAA rules.

[35] FAA Registry, Aircraft Inquiry, Federal Aviation Administration, http://registry.faa.gov/aircraftinquiry (last accessed Jun. 12, 2015).

- Requires law enforcement agencies to obtain a warrant for UAS surveillance of individuals or private property. Exceptions to this requirement should include exigent circumstances such as destruction of evidence, hot pursuit of a fleeing suspect, and emergency situations involving imminent danger of death or serious injury.
- Bans lethal weapons – "firearms" as defined by 18 USC 921 – from public, private, and hobbyist UAS. Exceptions could include military testing, training, taking off and landing in the US.

Many of these recommendations are articulated in legislation in both the House and Senate. CDT supports the Preserving American Privacy Act of 2015, sponsored by Reps. Poe and Lofgren, as well as Senator Wyden's forthcoming "Protecting Individuals From Mass Aerial Surveillance Act of 2015."[36] We believe both bills would establish meaningful protections from overbroad government UAS surveillance while preserving beneficial uses with less impact on civil liberties, such as government research and disaster relief. Senator Wyden's bill has the added benefit of applying to manned, as well as unmanned, aerial surveillance. The Preserving American Privacy Act does include a light restriction on private UAS, but we believe this restriction – which forbids intentionally using UAS, in a manner that would be highly offensive to a reasonable person, to observe an individual engaging in personal activity in circumstances where the individual has a reasonable expectation of privacy – is generally aligned with privacy torts and does not, on its face, violate the First Amendment. CDT urges Congress to swiftly advance these bills.

VI. Private UAS Recommendations

CDT supports comprehensive baseline consumer privacy legislation that includes UAS, but recognizes that First Amendment principles would constrict privacy regulation of UAS-enabled observation. If broadly adopted and faithfully implemented, an industry code of conduct with meaningful privacy, transparency, and accountability requirements could provide protection and foster public trust. CDT supports the National Telecommunications and Information Administration's (NTIA) effort to develop voluntary guidelines for UAS, as required by Presidential memorandum on domestic UAS.[37] Because such guidelines would be voluntary, they should not raise the same First Amendment issues associated with formal regulation of data collection by private UAS.

CDT recommends that the UAS industry work to develop a code of conduct for private UAS that

- Establishes reasonable limits on UAS collection and analysis of sensitive or personally identifying information.

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[36] "Preserving American Privacy Act," H.R. 1385, 114th Cong. (2015). "Protecting Individuals From Mass Aerial Surveillance Act of 2015," 114th Cong. (2015), draft bill on file with author.

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

- Establishes reasonable limits on the retention of sensitive or personally identifying data collected by UAS.
- Creates a publicly accessible UAS registry that includes a data collection statement detailing the UAS owner's collection, retention, and use practices and providing an individual point of contact.
- Provides for reasonable exceptions to a UAS registry, such as registration by proxy or a full exemption, to protect UAS owners' privacy interests in their identifying information, such as investigative journalists.
- Provides for a means of reporting nuisances and other complaints related to UAS.
- Establishes cybersecurity standards to prevent hijacking or unauthorized damage to UAS systems.[38]

In addition, CDT recommends that the industry explore technical measures to protect individual privacy in physical space. One example is the private sector effort to enable individuals to "geo-fence" their property so that UAS avoids flying over, or avoids retaining data collected over, the delineated area.[39] An example of a technical transparency measure would be to equip UAS with transponders that broadcast a signal identifying the UAS – acting as UAS "license plates" that are easier for individuals to read at a distance than tail markings.[40]

Another technical measure CDT recommends the industry explore is are protocols to allow individuals to communicate privacy preferences to UAS and other devices collecting data in physical space. For example, UAS equipped with a camera could halt visual observation of individuals who display a particular graphic symbol or color, or who broadcast a "do not track" signal from handheld devices.[41] While such privacy protective measures are available to Internet users in the online context, few comparable measures are available yet to protect privacy in physical space.[42]

Conclusion

Unmanned aircraft have great potential benefit, but also potential for invasion of privacy. For this reason, the public does not trust UAS. Without public trust, the UAS industry will struggle with acceptance, public hostility, and a regulatory patchwork. Current laws do not adequately

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[38] Center for Democracy, CDT Comments To NTIA On "Privacy, Transparency, And Accountability Regarding Commercial and Private Use of Unmanned Aircraft Systems," Apr. 20, 2015, https://cdt.org/files/2015/04/CDT-Submission-to-NTIA-on-Commercial-and-Private-Use-of-UAS.pdf.

[39] See, e.g., NoFlyZone, About, https://www.noflyzone.org/about (last accessed Jun. 12, 2015).

[40] Joseph Hall, 'License Plates' for Drones?, Center for Democracy & Technology, Mar. 2013, https://cdt.org/blog/license-plates-for-drones.

[41] See, e.g., Jeremy Schiff et al. (2009). Respectful Cameras: Detecting Visual Markers in Real-Time to Address Privacy Concerns. In *Protecting Privacy in Video Surveillance*, Springer, http://goldberg.berkeley.edu/pubs/respectful-cameras-book-chapter-F08.pdf (last accessed Jun. 12, 2015).

[42] A system of this kind would have applications beyond UAS, such as facial recognition and other biometric sensors. See, e.g., Harley Geiger, Seeing Is ID'ing: Facial Recognition & Privacy, Comments to the Federal Trade Commission, Center for Democracy & Technology, pg. 17, https://www.cdt.org/files/pdfs/Facial_Recognition_and_Privacy-Center_for_Democracy_and_Technology-January_2012.pdf.

protect privacy from broad surveillance by unmanned aircraft systems. A combination of federal legislation for government UAS and best practices for private UAS would be good initial steps. The goal should be to meaningfully protect privacy and enhance transparency while preserving essential law enforcement use and maintaining a light regulatory touch on emergency, scientific, and other uses with low impact on civil liberties. We look forward to working with both the government and the UAS industry to preserve privacy, free expression, security, and innovation.

END

Mr. MICA. Thank you. And I thank all of the witnesses.

We'll go right to questions.

As I mentioned in my opening statement, having been involved in this a little while, back in 2003, when we did one of the first FAA reauthorizations, there was nothing in the bill—it's amazing how technology does change our lives. And it's amazing how government does fail to keep up with changes in technology and craft a law to match that. We fall further and further behind it seems. In 2012, when we did the last FAA reauthorization, I tried to get specific and hold people's feet to the fire. And we do that by putting some milestones and deadlines.

And in the law, we said—for example, Mr. Whitaker—we said required planning for integration, this is the law that was passed, comprehensive plan not later than 270 days after the enactment of this act, the Secretary of Transportation in consultation with representatives of the aviation and Federal agencies basically would come up with a plan. Was that deadline met?

Mr. WHITAKER. Yes, sir. Both a comprehensive plan and a 5-year roadmap were developed. They were both published in November of 2013.

Mr. MICA. 2013. Okay. To further hold the feet to the fire, and some things have been done, as we pointed out and I mentioned earlier, we put a deadline, the plan required under paragraph 1, shall provide the safe integration of civil unmanned aviation systems into the national airspace as soon as practical but not later than September 30, 2015. That's the deadline we put in there. Is that deadline going to be met?

Mr. WHITAKER. You certainly won't have full integration of UAS——

Mr. MICA. But the deadline is not going to be met?

Mr. WHITAKER. No.

Mr. MICA. Okay. Okay. When do you predict the deadline will be met?

Mr. WHITAKER. We're taking the issue in manageable bites if you will.

Mr. MICA. Yes. And you testified that you're granting exemptions and waivers at a pretty rapid rate. What did you say, 50 a week or something?

Mr. WHITAKER. Yes, sir.

Mr. MICA. Yes. But is that, that's not what we intended. We intended for, basically, to have the rule in place by September. It's not going to be met. Now we're going to do an FAA bill, guys and gals, and we should hold their feet to the fire again.

I don't know you hold their feet to the fire because we've already, we've missed the deadline that we set in here. But we're going to have to do something. Is there something we're missing, that we haven't done that could provide you with the assets to move forward or make certain this happens as soon as possible? And what is your deadline now?

Mr. WHITAKER. We have broken the task into pieces, if you will.

Mr. MICA. When will it be done, what was directed by law?

Mr. WHITAKER. So the rule was issued earlier this year in February. Comments were closed in April. We received 4,500, approximately 4,500, comments.

Mr. MICA. All that is part of the record. When will we be done?

Mr. WHITAKER. So the rule, we have to adjudicate those comments. We'll clear the rule out by the end of the year.

Mr. MICA. 2016? 2017?

Mr. WHITAKER. The rule will be in place within the year.

Mr. MICA. Within a year?

Mr. WHITAKER. That's correct.

Mr. MICA. Okay.

Mark that down, staff. We could do a hearing a year from now and see if they've completed the task.

The problem we have in the meantime is, again, you're granting exceptions and waivers. It's sort of a spotty policy that's in place. And some folks talked about addressing risks. And that's the most important thing, wouldn't you say, is avoiding risk?

Mr. WHITAKER. Safety is certainly our priority, yes.

Mr. MICA. But by the same token, we're falling a little bit further behind than some of the other countries.

Mr. Misener, what have you seen? This hearing is about commercialization and moving forward. Are we, is the U.S. falling further behind? I cited $10 billion, I guess $1 billion a year for the next 10 years we would lose by not having commercial rules in place for operation of drones.

Mr. MISENER. U.S. planning is not as aggressive, Mr. Chairman, as it in other countries.

Mr. MICA. Okay. But there are a host of issues, privacy, and we had this little question here with the staff and some of us. Who basically is in charge of setting the rules for privacy? Is it the individual States and law enforcement? Is it the Department of Justice? Is this an FAA responsibility in the rules that you're crafting? Mr. Whitaker, maybe you could shed some light on how we protect people's privacy.

Mr. WHITAKER. The President issued a Presidential memorandum in February designating the National Telecommunication Information Administration as the lead on this issue. They have opened for public comment. I think that has closed. We are certainly a stakeholder in this conversation, but we do——

Mr. MICA. So we need to call them and ask them when they'll have their rules in place for protecting privacy.

Mr. WHITAKER. They have the lead on this issue.

Mr. MICA. But it is multijurisdictional, it's beyond just the Federal level to protect privacy, isn't it?

Mr. WHITAKER. Aviation has always been a Federal initiative and preemptive of State authorities, and I would assume——

Mr. MICA. Well, a drone that is operating under 500 feet, whose responsibility would that be? Also Federal? Or can you, I mean, local law enforcement is already using some devices, and other folks are using it. Who controls the—and that's probably the biggest concern of privacy is somebody within 500 feet over people's homes, property, surveillance capability of these drones.

Mr. WHITAKER. By statute, even at those altitudes, it's Federal airspace.

Mr. MICA. Still our responsibility. So we'll wait to see the development of that and specifics on that rule. I predict that there will be—you know, sometimes we don't move until there's an incident.

There will be an incident. There will be a crash. There will be probably fatalities because you have so many of these things flying. I hope it doesn't take down a big commercial aircraft. I hope it doesn't have a lot of fatalities. But I think it's inevitable. How many thousands of these drones are now flying on the—I've heard different figures, from several thousand to 20,000 flying.

Mr. WHITAKER. I don't know the exact figures. Perhaps Mr. Wynne does. But I think it's important to distinguish the vast majority of those are amateur operations. They're not covered under the rule. And we're prohibited by statute from regulating that sector of the——

Mr. MICA. So that still remains the primary risk. Did you want to comment, Mr. Geiger?

Mr. GEIGER. To your question on who is in charge of privacy here, so the FAA is regulating safety. And safety is very limited, a very limited mandate when it comes to also providing privacy regulations. So I have some question as to whether or not the FAA could actually put forth rules on privacy.

Mr. MICA. And that's what's interesting because when we were talking about this several years ago, when we crafted this legislation, I was told it was the Department of Justice or a judicial matter that privacy and it was outside of our realm to regulate. But maybe in this FAA bill, do you think we should have, rather than the President set by edict or whatever—however he did it, what was it, executive order?

Mr. WHITAKER. Presidential memorandum.

Mr. MICA. Presidential memorandum. Should we have something in the Federal law? Final question.

Mr. GEIGER. We do think there should be standards in Federal law. The 2012 bill mentioned privacy exactly zero times. And the privacy issue has absolutely plagued the discussion——

Mr. MICA. You said that 2012——

Mr. GEIGER. The FAA Modernization and Reform Act.

Mr. MICA. And I just explained to you, when we started down that path, concerns were raised on both sides of the aisle about privacy—it's a big deal—that we were told it was outside our realm; it was really a judicial matter and outside the purview of the Transportation Committee that was considering the legislation at the time. So we're basically without anything except what the President has set forth. And maybe that should, some parts of that should be codified. Is that what, that would be a summary or——

Mr. GEIGER. Some parts of it. Although what the President set forth is also quite limited. The Department of Justice essentially says that, there's some good things in the policy guidance from the Department of Justice. But it is also very limited. It says they'll respect laws, they'll use UAS for an authorized use and harmonized with the Fifth Amendment. But it doesn't provide any additional protection really beyond what is in current law. The NTIA process is focused just on commercial drones. So the NTIA process is not going to touch government use.

Mr. MICA. Okay. Well, let's go to the ranking member, Mr. Cummings.

Mr. CUMMINGS. Thank you very much, Mr. Chairman.

Mr. Geiger, the expectation of privacy, you talked about that. And certainly we know that in court cases, a lot of the question comes down to what is expected of the person. I guess when you have drones, it really broadens the expectation, is that right? It kind of throws it, it just opens the door to all kinds of surveillance. Are you following what I'm saying?

Mr. GEIGER. I do. And I believe this is——

Mr. CUMMINGS. Can you speak a little louder please.

Mr. GEIGER. I do. And I believe that this is how courts will interpret that in the future. Right now, the Supreme Court has interpreted the reasonable expectation of privacy doctrine to not include aerial surveillance from the publicly navigable airspace. And I can only imagine that that reasonable expectation of privacy standard or in common law torts what accounts as highly offensive to a reasonable person, I will only imagine that that will shrink as more and more UAS take to the skies.

This is one reason why we are arguing that current Federal law does not provide adequate privacy protection. We should not just rely on common law or the fourth Amendment, that there ought to be something in Federal law that provides a due process standard.

Mr. CUMMINGS. And what would you, if you were trying to put that law together to try to balance allowing drones to operate but at the same time trying to maintain some reasonable semblance of privacy for citizens of our country, what would that look like? I mean, do you have something that you all, that you put together that you—what elements would you be looking at.

Mr. GEIGER. There are a couple of bills out there right now which provide a good starting point, Representatives Poe and Lofgren's Preserving American Privacy Act, Senator Wyden's Protecting Individuals from Mass Ariel Surveillance Act provide good starting points. And both of those bills are focused largely on law enforcement use. And this is, as I said, in my opening statement, in part because the public's concern with privacy and UAS is most acutely felt with law enforcement use. I don't think that people are quite as concerned with uses for research, disaster relief, and so forth. On the commercial side, any regulation would have to be aligned with the First Amendment and, therefore, will be limited. So I think in combination of a due process standard and an industry code of conduct could provide meaningful privacy protection to individuals.

On government use, we think there ought to, generally speaking, be a warrant standard with exceptions for exigent circumstances and other reasonable exceptions for law enforcement use, as well as a registry of government UAS applications that is publicly available, much in the same way that the FAA currently has the registry for small aircraft.

Mr. CUMMINGS. You know, with all of the cameras everywhere on light posts, on buildings, and, of course, as you well know, many crimes are solved, people don't even know that they're being observed. And it seems to me there would be, there's an argument that with all of that now, the technology out there, that why would one want to differ from, I mean stray away, from the idea that a drone is going too far. And just as I'm talking, I'm figuring out the argument, the drone can follow you, as opposed to the light post.

Mr. GEIGER. We do have civil liberties concerns with a ground-based, large-scale surveillance system. Our concern is largely tech-neutral. But drones do have unique capabilities mostly because of their vantage point. If you're taking about ground-based CCTV, then if you turn a corner or enter your fenced-in yard, then the ground-based CCTV can no longer see you. But it would be very hard to escape the scope of observation of a sophisticated and high-flying UAS. So the privacy intrusion is potentially greater.

Mr. CUMMINGS. Mr. Misener, can you tell me, tell me about how Amazon, I just want to know the logistics, how that works. I mean, what are you all trying to do? Somebody has a package that they want in Iowa tonight. So what happens?

Mr. MISENER. Well, the customer places——

Mr. CUMMINGS. And the package is in Washington. Go.

Mr. MISENER. Mr. Cummings, I have 3 seconds.

Mr. CUMMINGS. I just want to picture how it works.

Mr. MISENER. It's a very fast delivery system. We have distribution facilities throughout the country. What we would like to be able to do is enable that network of facilities to deliver packages to customers more quickly than is currently possible using the ground transportation network.

We looked into all different kinds of functionalities of how to get things to customers on a 30-minute-or-less basis. And what really works are drones. And so in this way, our customer will be able to order something off of our Web site and have it delivered in less than 30 minutes to his or her home. That means that she doesn't even have to go to the store, hop in the car, or try to get a delivery truck to bring it. It just gets delivered to her house.

Mr. CUMMINGS. So it just pops up on a drone right in front of your door.

Mr. MISENER. Yes. Yes, sir.

Mr. CUMMINGS. Okay. Mr. Wynne, the FAA's proposed rule-making lists some——

VOICE. We have got a basket of fresh fruit headed your way right now, Mr. Cummings.

Mr. CUMMINGS. —potential uses of drones such as crop monitoring, bridge inspections, and aerial photography. Can you give us a few other examples of potential commercial use of drones?

Mr. WYNNE. There are, there's all manner of infrastructure that needs to be inspected in the country. For example, natural gas pipelines, high-utility, high-voltage lines, et cetera. That would be another example of large industries that are just chomping at the bit to embrace this technology. So there's small uses. There's large uses. There's visual line of sight when it comes to taking pictures of a house from a different angle for a real estate agent, all the way through to insurance companies inspecting after a Hurricane Sandy event what is going on in a particular area, areas that are inaccessible to agents, for example, and gaining information as quickly as possible.

Mr. CUMMINGS. You know, Mr. Whitaker, FAA's mission is, "to provide the safest, most efficient aerospace system in the world." Can you explain some of the challenges of integrating drones into our Nation's airspace.

Mr. WHITAKER. One of the challenges is we have a much more complex and diverse airspace than any other country and a busier airspace. So in addition to four of the biggest airlines in the world and dozens of hubs, you have business aviation, you have nearly 200,000 general aviation operations, helicopters, rescue vehicles that fly in all airspace. So integrating, instead of just setting aside a space to operate, but actually integrating into the airspace requires that these new vehicles be able to stay clear of the existing vehicles. So detect and avoid, or sense and avoid, that's a major technological challenge that has to be solved. And you also have to solve the communications challenge, how the operator communicates with the vehicle, what the spectrum is that is allocated for that, and what happens if that link breaks. So these are some of the technology issues that are being researched in various venues that we need to fully understand and then build standards around so we can fully integrate this into the system.

Mr. CUMMINGS. You know, not long ago, the fellow had a, flew a drone in the vicinity of the White House. And all of us were very concerned about that. And I know that that's a significant concern of many. And I'm just trying to figure out, I mean, if you've got all these objects flying around and then you've got a lot of people on the ground and you've got to protect airspace, it just seems to me like we are headed towards disaster at some point.

Mr. WHITAKER. Well, we're going to try to make sure that doesn't happen. There are actually very robust technologies that will allow this to happen, and they're being tested in various——

Mr. CUMMINGS. That will allow what to happen.

Mr. WHITAKER. They will allow the vehicles to stay clear from humans and other vehicles. We just need to make sure that that technology is robust enough to incorporate into our air system.

Mr. CUMMINGS. And I see my time has expired.

Thank you, Mr. Chairman.

Mr. MICA. Thank you.

Mr. Massie.

Mr. MASSIE. Thank you, Mr. Chairman.

Mr. Whitaker, I'm glad to see that we have a proposed rule here. We've been waiting on it for a long time. I serve on the Transportation Committee, and we've been pushing for this. I'm excited to see this. And I think it does allow a large class of operations that, heretofore, have not been able to operate.

Mr. Wynne, can you talk about the types of commerce that won't be facilitated by this rule, particularly the requirement that at all times, there has to be an operator that's got visual line of sight to the drone? Can you talk about some of the—some of the applications that can't be practiced because of that rule?

Mr. WYNNE. The easy one, as Mr. Misener, the application that he was talking about earlier, that does require beyond visual line of sight.

There is all manner of inspections that I was mentioning as well. BNSF was mentioned earlier, being able to check for split rails in advance of trains, other infrastructure, et cetera. And just, if you imagine, one of the early applications, early adopters of this technology will be agricultural interests, farmers, et cetera, looking to do all manner of inspection of their property. Some of these farms

are large, of course, and someone could easily be flying over their property but have that well beyond line of sight, again, basically flying a pattern that a computer is controlling, very low altitude.

So these are the types of operations that we think—some of them are more complex than others. We think that there's a way to advance the technology, to test the technology. The more we're flying, again, equivalent level of safety to the current aircraft system, airspace system that we have today, the more data we can collect, the more we can test technologies like detect and avoid, sense and avoid, et cetera. There are a number of those things, low-hanging fruit so to speak.

Mr. MASSIE. So, Mr. Whitaker, is there any chance before this rule comes out to have a category of drones that are authorized in low-risk situations like agriculture or power line inspection or rail inspection? Is there a chance to get something in the rule for that category?

Mr. WHITAKER. Well, what we've done while the rule is pending is we issue exemptions. And we've done over 600 exemptions for commercial operators. And we've done even more than that for public sector operations, for fire and rescue, that type of thing. The rule, as you mentioned, will take care of a very large subset of operations and will allow a lot more commercial innovation without our involvement.

We've tried to include in the rule the issues where we think we have a clear understanding of the safety risks and how they can be mitigated. The issues that are outside of the rule, like beyond of sight, we think we'll get there, and we're going to try to get there as quickly as we can, but there are still technology issues and standards that have to be developed. So we will have to work very diligently to keep that moving as the rule progresses.

Mr. MASSIE. All right. Thank you. On to the privacy aspect of this, it does present some new challenges. One question that I have is, should there be a floor? I mean, we're talking about a ceiling of 500 feet. Should there be a floor for operation of drones? Do you own the property an inch above your lawn, is a question that I have. If you have a gate, a locked gate, on your property and somebody climbs over the gate, your expectation is they are violating their privacy. What if they fly over the gate? And what if they're hovering an inch above the ground?

Mr. Geiger, could you talk to that. From a personal property aspect, when is your—when are your property rights being violated?

Mr. GEIGER. Courts have generally said that you own a reasonable amount of airspace above your property. The 400-foot level is more or less arbitrary. An inch above your property? Yeah, you probably own that. Thirty feet above your property? Not sure. And what counts as reasonable, again, as more and more UAS fill the sky in tens, hundreds of thousands, which is what we predict in the coming decades, what counts as reasonable will probably shrink. And it's not clear what the floor will be.

But, generally, if you can—you have an expectation of property ownership and as much airspace as you can use. And so the drone would have to violate your—or reduce a substantial interest or use in your property in order to be liable for a trespass claim.

Mr. MASSIE. Maybe the floor is the range for number 12-gauge with six shot in it.

Mr. GEIGER. You know, it's interesting that you bring that up because the concept of shooting down drones, I think, demonstrates the depth of concern that people have. And this is a privacy-based concern with drones. Now, this happens on a pretty regular basis. Right? I mean, just—and 2 weeks ago, there were firefighters that were tending to a house fire and, in the aftermath of that house fire, used their hose to spray a drone that was watching them. The drone was not directly over them. So it was not like a safety issue. But it was watching them.

And, you know, I'm absolutely not condoning that type of activity. I think that it's very risky. But it demonstrates the need for the depth of public concern regarding privacy and I think the need for a baseline.

Mr. MASSIE. So maybe we need rules of engagement in terms—in addition to rules of privacy.

I see my time is expired. I yield back.

Mr. MICA. Thank you.

Ms. Norton.

Ms. NORTON. Thank you, Mr. Chairman.

I must say, we're in the infancy of everything here, the infancy of regulation, the infancy of the technology. We saw that when the drones landed—a drone landed in the White House and indeed on these very Capitol Grounds.

And, Mr. Whitaker, I appreciate that, on May 13, there's a release that indicates that you're trying to make the public understand that there's a 15-mile radius around the Nation's Capitol, that you're not supposed to fly anything. So everybody's playing catch up here.

Now, on one of my other committees, I must tell you, where we're really playing catch up is NextGen. So that when I look at your regulations and it says "must yield right of way to other aircraft, manned or unmanned," I mean, if we had NextGen and we knew where even aircraft were flying, then, of course, then we might expect drones to somehow operate within our airspace safely, more safely. The assistant inspector general has testified about the integration of drones into commercial airspace, and that's what interests me.

Does the FAA receive from commercial pilots each month or on any regular basis whether they have seen unmanned aircraft of any kind?

Mr. WHITAKER. We do receive reports of sightings of unmanned aircraft. They typically will come in over the air traffic control communication network, and we do track those.

Ms. NORTON. Are those required to be reported, Mr. Whitaker?

Mr. WHITAKER. They are required to be reported, yes.

Ms. NORTON. Have any close calls of drones or unmanned aircraft with commercial aircraft been reported?

Mr. WHITAKER. We—I don't have any recollection of any evasive maneuvers being taken as a result. Mostly what we receive is sightings of unmanned aircraft in controlled airspace, usually near airports.

Ms. NORTON. Is there any system of licensing these unmanned aircraft? I mean, do we even now how many there are in our country?

Mr. WHITAKER. We believe that these typically are involving the amateur operators of what we tend to call model aircraft, but the kind that you can buy and operate anywhere. They are unregulated, and we're prohibited by statute from regulating that sector of the operation.

Ms. NORTON. Should somebody be regulating that sector? And who should be?

Mr. WHITAKER. Well, what we have is we do have areas where these operators are prohibited from flying. And so they're wandering into prohibited airspace. So, in that sense, they are violating law. So our focus, as you have pointed out, has been to have an education campaign to let people know where they can fly, where they can't fly. We're working to develop an app that people can use to see if they're in restricted airspace or whether they can fly their unmanned air system. And we work with local law enforcement to give them guidelines on how to interact with people who are operating in an inappropriate fashion.

Ms. NORTON. In light of these proposed rules, Mr. Misener, and Amazon's interest it says an operator should be capable of seeing the aircraft with vision unaided by any device other than corrective lenses. In other words, I suppose you are supposed to be within—somehow you're supposed to be able to see these drones that you have let loose upon the universe. How's that going to work commercially?

Mr. MISENER. Thank you, Ms. Norton. It won't, at least for packaged delivery services. We don't disagree that it's a more difficult use case to fly drones beyond visual line of sight. It is it. It requires a higher degree of automation in vehicles, and we are working on that. That kind of technology is being developed. Our respectful disagreement with the FAA is that we believe that that kind of operation can be considered right now on the same risk-based approach. The risks are higher——

Ms. NORTON. You think the technology is—the technology would allow that now?

Mr. MISENER. Oh, it's in the works, Ms. Norton. And all I'm saying is—I'm not saying that the rules for operation need to be adopted right now, but the serious planning for those future rules need to be undertaken right out. And what the NPRM did earlier this year is essentially list that as a prohibited kind of a category of operation. And what we're trying to say is that that ought to be considered right now, just like other countries are considering beyond-visual-line-of-sight operations right now.

Ms. NORTON. Mr. Whitaker, this notion of lost link scenarios, what's the current state of technology on the links between the operator and the drone and the possibility of the drone getting beyond the vision or, for that matter, the control? I'm sure that the drone that went into the White House grounds was beyond his control, for example.

Mr. WHITAKER. So there's research that goes on. There's a lot of research that goes on at NASA, at DOD, various sectors, on loss of control. We have a center of excellence now at Mississippi State,

where there'll be research along these lines. And as I mentioned——

Ms. NORTON. I mean, if you see a drone going too far, is the technology now such that you can call it back?

Mr. WHITAKER. There is technology there that can be used for that. And that is the technology that's being tested. As that technology is tested, we also have to develop standards for operation, particularly in the radio communications spectrum and how that gets defined.

Ms. NORTON. Standards, for example, that would link—that would make sure that you didn't lose—lose control of your own unmanned aircraft.

Mr. WHITAKER. Right. And there are procedures that could be followed when that happens.

Mr. MICA. I thank the gentlelady.

Mr. Meadows.

Mr. MEADOWS. Thank you, Mr. Chairman.

Thank each of your for your testimony.

Mr. Misener, let me come to you because I think you were indicating that the United States is falling behind on this particular use of drone technology to some of competition that may be in Europe and other places. Is that correct?

Mr. MISENER. Yes, Mr. Meadows, it is.

Mr. MEADOWS. So if we are falling behind—obviously, Mr. Whitaker says, we have a vary complex air system, which I would agree with that, more complex than Europe—but from a regulatory standpoint, do you see that we could perhaps have had in this rulemaking going a little bit further to anticipate new technology to allow for greater innovation so that we don't get beat out by our competition in other parts of the world?

Mr. MISENER. Yes, Mr. Meadows. I firmly believe that, and I acknowledge that the U.S. airspace is complicated. But it's also complicated around Heathrow and other places around the world. And so we need to acknowledge that other countries are just taking a more forward-looking planning approach. Again, I don't blame the FAA for not having rules in place. This is a big challenge, and NASA and the FAA and private industry are working together to address the technical challenges. What I'm suggesting is that the risk-based approach taken throughout much of the NPRM also could be applied to these beyond-visual-line-of-sight and highly automated operations that we foresee.

Mr. MEADOWS. So, Mr. Whitaker, let me come back to you, then. I serve on the T&I committee. We've had a number of hearings, and we've talked about these six regional test areas across the United States. And what I have found interesting is, as we have come out with this proposed rule, is that most of this seems to be a rule that is looking backwards, not forward. For example, I mean, looking at not being able to operate these other than line of sight or at night is extremely shortsighted, I believe, in terms of a rule. And so it's almost like in order to meet some of the deadlines, you've put forth a rule that is very restrictive instead of really saying that if there's the technology, which we have the technology, to manage this other than line of sight, could we not do that in a safe manner?

Mr. WHITAKER. So we had a lot of debate around this as the rule was put together, and I think initially there was an attempt to boil the ocean, if you will, and take on all possible issues in the rule. And the decision was made to come up with a less onerous rule that covers the majority of the types of operations that we know people want to undertake, that the technology is there, it's proven, and it can happen.

So we defined an envelope of operation, if you will, and the things that are in that envelope, it will unleash a lot of the commercial needs that's there. The issues that are still out there to be worked out and to have standards built around, we do have regulatory tools to allow those to go forward without waiting for a rulemaking through exemption.

Mr. MEADOWS. But, Mr. Whitaker, if we're talking about—you say that it would provide for most of what we're talking about, I would disagree with that if we're talking about line of sight. Because what Mr. Misener and Mr. Wynne are talking about really is not line of sight.

You know, Doctor, you know, you work for NASA. Can you put something out in space or on the moon without—in a safe way and do it without line of sight?

Mr. CAVOLOWSKY. Well, I work——

Mr. MEADOWS. Be careful how you answer.

Mr. CAVOLOWSKY. Working in the aeronautics mission at NASA, I won't speak to the space applications.

Mr. MEADOWS. Well, can't some of your colleagues do that, I guess? I mean, do they have to view that the whole way to where it lands in order for it to be safe?

Mr. CAVOLOWSKY. That is certainly not the case.

Mr. MEADOWS. Okay. So I guess, Mr. Whitaker, coming back to you, I'm going to encourage you, as we are looking for a FAA reauth in less than 60 days, I am encouraging you to be a little bit more forward thinking as it comes to the line of sight and some of the technology that is available to us today—the stakeholders, I mean, it's all over—and because if not, your regulations become the throttle or the choke that keeps innovation from moving us forward, and ultimately, we will lose out to competition abroad. Do I have your commitment that you will look at that aggressively?

Mr. WHITAKER. We will. And I think granting the BNSF Railroad authority to operate beyond line of sight is part of that effort to lean forward.

Mr. MEADOWS. All right.

I yield back. Thank you, Mr. Chairman.

Mr. MICA. Thank you.

Mr. Lynch.

Mr. LYNCH. Thank you, Mr. Chairman.

I want to thank the panel members for your help this morning. I think all of your have contributed well to this—to the understanding that we are gaining regarding this technology.

Mr. Geiger, I think some of the ramifications that you've brought to mind are very, very helpful.

Mr. Whitaker, the problem that I have, the greatest concern I have is the interface or the fit between FAA and a technology which might become ubiquitous at some point in the near future.

And in your testimony or in one of your answers, you said that the system being developed will allows us to keep drones away from people and other sensitive areas.

The problem I have is with what you're doing now with aircraft. I represent Logan Airport, that area, myself and Mr. Capuano from Boston, in the Eighth and Seventh Districts, we represent a semicircle around the airport. So we're airport communities. And I hate to put this on you, but I would have to say that out of all the—of all the agencies that we deal with on this committee—and we deal with everybody, NSA, CIA, DOD, you know, Defense Department and others, IRS—FAA is probably the most unresponsive agency that we deal with in government from this committee. And that's just a fact. And I want to give an example.

I am—the FAA has adopted a—since 2013, has adopted a new navigation system around airports, NextGen RNAV, they call it. I don't know what that means. But I do know that the result of that program is that instead of flights being spread out over a number of communities, which I represent all of them, and Mike does too, Mike Capuano, now we have a different system where we have a tractor beam system where all of the flights come over the same, I swear, square foot of land, every day, every night. And so the people who live underneath that tractor beam, I'm worried about their health. Based on the volume and the spirit of the calls that I get continually from those neighborhoods and those towns, this system is not working. And it is detrimental to their health. So, as an elected Representative, I tried to get a meeting with the FAA in the town of Milton, Massachusetts, which is under that tractor beam. And I wrote a letter to Mr. Huerta, who is the regional administrator in my area. He refused to come. First, they agreed to come in the meeting that I had with them, and then, once they got out of the meeting, they changed their mind and said they'd never agree to that.

So I'm trying to get FAA—look, I understand how difficult it is to operate, you know, the airport and do your job, but we have a basic responsibility to meet with the people that we work for. And some of the folks at FAA have said: Those folks have yelled at us.

They have yelled at me too. That's—that's part of the job. And sometimes they have a good reason to yell at me and you, and I think they have one now.

But so I have been so frustrated with this process of just getting a meeting in the town of Milton that I had to go on the floor the other day and put an amendment on the floor to cut $25 million from FAA's budget because we give you money to do outreach. Well, outreach is not happening in the Eighth Congressional District of Massachusetts, I can tell you right now. So I figured since you're not doing that job, I'll take that money and put it somewhere else where somebody will actually use it. So that's where we're at right now, you and me and Mr. Capuano and the FAA.

You're not treating—you know, I don't mind being dissed myself. I can deal with that. That's—look, Congress' popularity is at 6 percent. I'm used to that. However, when you refuse to meet with the people that I represent, then I get mad. I can't have that. Nobody here can have that. We all represent—look, I represent 727,514 people. Those are my bosses. I go to work for them every single

day, and I can't get a meeting with a group of them and the FAA. So we got a problem.

And now here we are talking about, like I said, this new technology at some point could become ubiquitous. So I'm nervous because when we have a problem with drones, I'm going to have to go to the FAA for a meeting. And they're probably going to tell me: Sorry, pal. You know, we're busy. We can't meet with you.

I can't have that answer.

All right. So you got 3 seconds to answer me.

Mr. WHITAKER. Okay. So, first of all, I apologize if the FAA has been unresponsive.

Mr. LYNCH. Apology accepted.

Mr. WHITAKER. I'm not familiar with the issue, but I will vow to get back with you directly with a response to that. And I think community outreach and engagement is one of the most important things that we do. And if we don't do it, particularly as we redesign airspace, it does lead to trouble. So let me make sure that we get back with you shortly.

Mr. LYNCH. Thank you, Mr. Whitaker.

I appreciate the chairman's indulgence. Thank you.

Mr. MICA. All politics is local.

Mr. Hice.

Mr. HICE. Thank you, Mr. Chairman.

Mr. MICA. Wait a second. Mr. Walker was next. I apologize.

You haven't been heard, Mr. Walker.

Mr. WALKER. Okay. Thank you, Mr. Chairman. Thank you, Mr. Hice.

Mr. MICA. I'm sorry, but you are recognized, Mr. Walker. And we'll get to Hice next.

Mr. WALKER. Thank you very much.

As a member on the Committee of Homeland Security, we have had several classified briefings as far as the concerns, even locally and regionally. And I know there's a lot of issues that have to be worked out, particularly with the UAVs and UAS's.

I want to take a little bit of a turn here and talk about some of the pros, some of the positives, from possibly the new technology as we move forward. I always—if you look back historically, anytime there's something that's new that developed, there's always a lit bit of a pushback and a reactionary—even in my 46 years, I can remember several different times—timelines when it comes to technological based industry or other aspects.

I want to talk about—maybe start with Mr. Wynne. According to your data and your department there, believes that the U.S. Could be in line to lose more than $10 billion in potential economic impact every year that U.S. integration is delayed. Would you take just a minute to speak to that. Is that accurate?

Mr. WYNNE. Yes, sir. And that's in the community that I represent, the commercial—commercial UAS community. That goes—I think there's additional value to—that can be added to other industries that want to utilize the technology that go on top of that.

Mr. WALKER. Okay. Mr. Misener, what steps—well, let me back up just a little bit.

According to Amazon Prime Air, you have been doing more testing in other countries. Can you speak to that as—do you have less

restrictions? Why is—why do you seem to be doing a little bit more testing in other countries as opposed to here?

Mr. MISENER. Thank you, Mr. Walker. I think we have turned that corner with the FAA. The FAA has streamlined their tests—approval process in a way that is beneficial to the industry. It's going to accelerate the amount of testing that can be done here domestically. We had some difficulties getting that approval last year and early this year, but I think we've turned that corner now.

The real direction we need to take now is sort of the planning for the operational rules, and we look forward to working with the FAA on that, that we're eager to do so. But on testing, I think we're able to do it in multiple locations, including within the United States.

Mr. WALKER. What is the objective of Amazon, if you give me a timeline over the next year to 18 months, where are you wanting to see this go, providing that things are worked out with the FAA?

Mr. MISENER. Well, we'd like to start delivering to our customers as soon as it's approved regulatorily. So we are working on the technology as quickly as we can. We've got an advance team. Amazon doesn't sound like an aviation company, but we certainly have staffed up with aviation experts, including, on my team, I've got an 8,000-hour—military and commercial pilots on my team. We're taking this very seriously. The safety aspect of it is front and center. The team is trying to develop this service as quickly as possible.

Now, there are other things that are going on here. It's not just the aviation aspects of it. We have to get our fulfillment center and our distribution facilities right because to get that 30-minute promise down, we have to get that item somewhere in a very large building ready to get to the drone. And that—so that presents another set of engineering challenges that we're working on for our——

Mr. WALKER. And are—you said "you're working." Do you have the technology in place to move forward providing that all the other restrictions are given the green light?

Mr. MISENER. Today, no. But we will have it in place by the time any regulations are ready. We are working very quickly. The iteration process in a company like ours and in a robotics mission like ours is very rapid. And so we're confident that we will have it in place. And this is why we look forward to working closely with the FAA on preparing for those rules.

Mr. WALKER. Okay. Mr. Wynne, what specific solutions can you provide this committee that we could act on or—as to not only help the development of the commercial UAS but also satisfy the FAA's concern for safety?

Mr. WYNNE. Well, I think, as I mentioned in my testimony, there's a lot of research and development that's required to prove out equivalent level of safety for the more complex operations that we can envisage today but can't possibly—or can't quite do yet. And NASA plays an important role in this. The FAA plays an important role in this. The DOD has successfully flown unmanned and manned aircraft in theatre for many, many years successfully and safely. They can learn from one another, and industry brings a lot of resources and technology to the table.

So one of the key things is to make certain that all of that is well coordinated. And I think some outside pressure from—for the agencies to work together, I think, is always important. That's beginning to happen now, and we're very pleased with that, but I think there are resources, ultimately, that will be required.

I know the fiscal constraints on the system require—make it difficult for new resources to be brought to the table, but we think that with the right coordination, with the right plan, we can do that, and I think that's an appropriate role for Congress and this committee.

Mr. WALKER. Thank you.

I see my time is almost expired. So I will yield back to the chairman. Thank you very much.

Mr. MICA. Well, thank you, Mr. Walker.

Ms. Duckworth, you're recognized.

Ms. DUCKWORTH. Thank you, Mr. Chairman.

I'd like to follow up on the see-and-avoid rules.

Mr. Wynne, I think that your comparison to the military use is a little bit off mark because I was actually in charge of the State of Illinois National Guard's attempt to establish the rules for flying shadow UAVs stateside. And we certainly had to comply with the keeping the aircraft in sight at all time rules under the FAA on flying it over restricted airspace only as well. And so the military actually has to—if we're going to be flying those UAVs, actually follow the UAV in the air with another aircraft. And I don't think that is something that the commercial entities are willing to do at this point. And I could be wrong.

I do want to talk about the safety issue, and I think I'm going to direct most of my comments—my questions to Mr. Whitaker with the FAA.

I was flying my aircraft over the Eastern Shore in the Patuxent Naval airspace area in contact with air traffic control the entire time. And I had an aircraft, a model aircraft, bust through the airspace 10 feet off the nose of my aircraft about 10 feet away in front. And I was flying at 2,500 feet. If this can happen with recreational model aircraft usage, I have real concerns about UAVs out there flying around.

And I understand that you have commercial operations. This is something where they—what you're trying to do is actually make it more regulated. And I would expect that commercial entities would be much more responsible about how they fly the aircraft.

Are there any moves to require for commercial use the use of transponders on UAVs?

Mr. WHITAKER. So you raise a lot of interesting issues. I think. In the small UAS rule, of course, there would be an aeronautical knowledge test requirement so your operators would be more sophisticated than the amateur operators. A lot of the operators on the amateur side are just not from the aviation sector and don't even realize that they've entered the world of airspace when they open a box for this device. And that's a real issue, which is why we have focused on public education and that type of thing.

As far as the use of transponders, these devices, of course, come in all sizes. When you get to the small UAS, it—we're not sure there's going to be a technology that would allow that kind of equi-

page. If you're flying in airspace that requires a transponder, a UAS would have to have a transponder. Same for the new ADSV rules. But I think when you get to the smaller vehicles, you are really looking to systems that talk to each other and to vehicles around them to achieve that sense and avoid.

Mrs. DUCKWORTH. Okay. So if I'm out there on my single-engine 1959 Comanche, not with the most sophisticated—I'm going to have the correct transponders on it, but even a small UAS hitting the propeller of my aircraft will take me out.

Mr. WHITAKER. Right.

Mrs. DUCKWORTH. Even a small bird will take me out. Are you saying, then, that we are not looking to require some—it's just—explain what you mean by—is it a transponder? Is it interrogating my aircraft? What is it doing? Because I want to know—here's what I want. I as a pilot want to know if there's UAS flying in my vicinity so I can see so that it shows up and I know that they're there. And, two, if I get hit by one ofthese aircraft, I want to know who's flying it. I want a serial number on that aircraft. I want the FAA to be able to find them and say: You just flew into actual general aviation or commercial aviation airspace.

What is—is there anything in that rule—is there any attempt to go after that—those safety concerns?

Mr. WHITAKER. So, right now, we are looking at rule separation and procedure separation. So, under the small UAS rule, the proposal would be below 500 feet. So you're always going to be above 500 feet, unless you're around the airport. And the rule would require the UAS to be 5 miles away from an airport. So as long as they're following the rules and you're following the rules, you have separation. And you also have visual-line-of-sight VFR basic operations. That's all that the rule contemplates.

The other issues that you're raising are some of the issues that we've been talking about that need additional research, need standardization, and a separate set of rules around those expanded operations.

Ms. DUCKWORTH. Okay. Thank you. With the 30 seconds left that I have, I just want to put this out there, and I'll put in a question for the record. If we're going to talk about external load operations, I used to fly sling loads in helicopters. There are some significant restrictions. I would want to know what Amazon—and, Mr. Wynne, also—what your positions are on what are your jettisoning procedures for those loads, all of the issues that a helicopter with sling load operations would have to follow and adhere by as well.

Thank you. I yield back, Mr. Chairman.

Mr. MICA. Thank you.

Mr. Hice.

Mr. HICE. Thank you, Mr. Chairman.

Mr. Whitaker, just kind of a point of clarification for me. I think the answer is yes, but I just want to be sure. Does the FAA or the administration actually have a plan for directing the traffic concerns, or is this something that's being developed and still in process? Is there an actual plan?

Mr. WHITAKER. There are two things I think you could put in that bucket. There's a comprehensive plan that was developed in 2013, and then there's a 5-year roadmap that gets updated periodi-

cally that provides sort of a master planning document, if you will, for——

Mr. HICE. So there is a plan.

Mr. WHITAKER. Yes.

Mr. HICE. Okay. I thought that was going to be the answer, but it was a little confusing.

Let me go, Mr. Cavolowsky, to you. Of course, we all know about the gyrocopter that went down here in the restricted D.C. area this past April. The technology that is being developed with you guys, would it have detected that gyrocopter?

Mr. CAVOLOWSKY. So the research we're doing regarding this UAS traffic management system is to enable the user of the system to be able to track and manage and plan flight routes within a very confined airspace. Others that are working—that are operating within that airspace would also be detected, but if they choose not to file a flight plan, they would not be managed by the UTM. So the opportunity for that system to identify that there is an operator who is not filing plans and not flying within the system can be alerted to the authorities—or, you know, through the system such that actions could be taken in order to address that.

Mr. HICE. All right. Well, that's no different than what we already have. It was detected with the technology we currently have. They thought it was an anomaly or some such kind of thing, and you're saying, with your technology, it would be detected, but still nothing necessarily would have prevented what happened?

Mr. CAVOLOWSKY. With the technology we are putting in place, that is correct. What our technology does is allow for the safe use of aircraft that are participating in the system to manage their trajectories, to be aware of other aircraft, general aviation aircraft, traffic helicopters and the like that are flying there so that they can be safely avoided and the missions and the business objectives can be met.

Mr. HICE. Does your technology differentiate between drones and, say, movement of birds or weather patterns of what have you?

Mr. CAVOLOWSKY. There are radar systems that are being developed as part of this that would be able to detect other flying things of particular size. At this point, I'm not sure exactly how small that detection goes, but it would allow for identification, certainly, of small drones.

Mr. HICE. All right. Mr. Whitaker, back to you, again. Just if I may ask different ones this question, but end of the day, who should control, own, manage the traffic management of UAS? Does this come down to NASA? Does it come down to the government? Does it come down to private enterprise or nonprofits? Where does this belong?

Mr. WHITAKER. Well, we would envision that as NASA develops this UTM, we would go through a normal handover process and it would become part of our airspace that we would manage.

Mr. HICE. All right. So you say FAA.

Mr. CAVOLOWSKY. Yes. If I may, sir. That's exactly correct. We have a very formal process we've developed with the FAA. We refer to them as research transition teams. We work closely with NASA researchers, NFA researchers. At the earliest stages of our development of concepts and technology, to be able to hand to them at de-

termined times that we work by plan for that technology at technology readiness levels such that they have the opportunity to fit it into their overall program planning and the requisition process. So it's very rigorous activity. We have had great success with that with other NextGen deliverables over the last half a dozen years.

Mr. HICE. Okay. So NASA's developing the technology but the FAA would be using it, and ultimately the buck would stop there.

Mr. WHITAKER. That's correct.

Mr. HICE. Okay. All right.

Mr. Geiger, let me go back to you real quickly, just because I think the issues you've brought up are a great—grave concern constitutionally and to many others. And I've just got 20 seconds, but preemptively, what actions do you believe Congress needs to take in order to assure that both the First and the Fourth Amendment are not violated to U.S. citizens?

Mr. GEIGER. For government UAS, we recommend legislation that establishes a due process standard for law enforcement use, and we think that, generally speaking, with some exceptions, that that standard should be a warrant when the UAS is used to surveil individuals in a personally identifiable way or private property.

When it comes to commercial UAS, we think that the First Amendment is going to constrain the scope of any sort of privacy regulation, and you could start with common law privacy torts, which have a highly offensive to a reasonable person or a reasonable expectation of privacy standard. But beyond that, it should be an industry code of conduct, which will, because it is voluntary, avoid the First Amendment issues. And I think that the goal ought to be to provide a reasonable privacy assurance to the public so that applications that have a low impact on civil liberties, such as commerce or scientific research, can grow and the industry itself will take off, so to speak.

Mr. HICE. Okay. Sir, thank you.

Thank you, Mr. Chairman.

Mr. MICA. Thank you.

Ms. Lawrence.

Mrs. LAWRENCE. Thank you. Do we have—Mr. Whitaker, do we have a proposed timeline for the—officially accepting these rules or the process to go through to modify them, make any corrections? Do we have a timeline?

Mr. WHITAKER. So there's a statutory 16-month timeframe from the close of comments, which was in April. We plan to move more quickly than that. We've got 4,500 comments that we're adjudicating now, and our internal working target is to have the FAA portion of this finished by the end of the year so it can go into coordination with the administration and be out early next year.

Mrs. LAWRENCE. So many of you are aware that there is an app: I can call Siri, and I can say, "What's flying above me," and it will tell me what flights are above me in the sky and where they're going, what airline it is. Do you anticipate any such app because my concern right now is, as a citizen, and there's drones flying above me, how do I identify what they are and why they're there and who they belong to?

And that piece—it was interesting to me when this application was introduced to me. And I'm wondering if something similar to that will be required of the—this type of flying vehicle.

Mr. WHITAKER. Well, in today's world, if there's a drone flying above you, it's probably an amateur operator, and there's no system to track who that is and where they're going. It's an unregulated—by statute, an unregulated sector of the market.

As you move forward with more fully integrated operations in the controlled airspace, you would expect to have some ability to know who's out there.

Mrs. LAWRENCE. Well, you said you would expect. I want us to move toward the point of if there is a drone flying in my personal property space, that I as a citizen have the right to know who owns it, what's their purpose, and there would be a way for me to, if I have any issues, to have a way as a citizen to process that concern. And that, to me, is a very high concern of mine and people that I talk to.

So getting back to the public, what will be the process of educating the public? And I would like to ask Mr. Geiger.

Mr. GEIGER. Geiger.

Mrs. LAWRENCE. What is the proposed process so that when we—I anticipate an increase in the number of drones that we'll see. Where's the education process? When we adopt the rules and we get them accepted, where's the education of the public?

Mr. GEIGER. I think that you'll see education of the public from both government and private entities, and certainly there's been a lot of media attention about it to—if the question is how will the public know when there's a drone in their——

Mrs. LAWRENCE. What are my rights?

Mr. GEIGER. Well, your rights are evolving, and I—as I said in my testimony, I think that your rights ought to be strengthened by Congress.

Mrs. LAWRENCE. Yes.

Mr. GEIGER. When it comes to being able to tell whether or not—or what—identify a drone that is in your vicinity and where it's going and so forth, we think that the industry and government ought to work on technology that will enable that sort of transparency for citizens. There—transponders would be one option, but I understand that there are technical limitations due to their weight. I understand also that NASA is working with Verizon to leverage cell towers and that may hold some promise, although that also depends on the network. In addition, we think that there are other technical measures that individuals could use to signal their privacy preferences. One is geofencing. So, for example, noflyzones.org is sort of nascent effort in that regard where you can delineate some property and say: We would prefer if you did not fly here.

And I think there's a variety of technologies that could get you there. I think that they are not quite yet ready for prime time, but I think what's important is that industry and government continue to work on them.

Mrs. LAWRENCE. The other question, I have a few minutes, to Mr. Whitaker, in the rules, it talks about reporting an accident or damage within a certain amount of time. Will there be a require-

ment if you are licensed as a drone operator that you have insurance because if you—if your drone disables and then crashes on my property, or if there is a package being delivered and it destroys my prized rose garden or something, what will be the requirement for insurance?

Mr. WHITAKER. Typically we do not regulate insurance requirements in aviation so we leave it up to individual operators for insurance.

Mrs. LAWRENCE. I just want to say for the record that if we are going to allow—I find it interesting. You don't require airlines to have insurance?

Mr. WHITAKER. Airlines have insurance for their own reasons, and most general aviation pilots have insurance for their own reasons. We're prohibited from regulating model aircraft, amateur aircraft operations. So we would not be allowed by statute to have that provision. But as a rule, we don't get into that area of requirement.

Mrs. LAWRENCE. So if there was an accident, it was reported in 10 days, what happens?

Mr. WHITAKER. What happens with respect to?

Mrs. LAWRENCE. FAA would just have a record of it. It would not be any—any requirement for drone operators to be insured?

Mr. WHITAKER. And there typically is a—will be a reporting requirement for accidents, and we investigate the cause of accidents but don't get involved in adjudicating liability.

Mrs. LAWRENCE. My time is up, but I just want to say for the record that that is a concern of mine. Thank you.

Mr. MICA. Thank you.

We'll now recognize long-suffering waiting and senior member and also former chairman of the Aviation subcommittee, the gentleman from Tennessee, Mr. Duncan.

Mr. DUNCAN. Well, thank you. Thank you, Mr. Chairman, and I don't have any questions, but I do want to express some concerns, and to do that I want to read a couple of—read from a couple of articles that have come out just in the last few days.

I've read several articles about drones over the last year, year and a half, but Bari Weinberger, who's a lawyer who specializes in this area wrote a few days ago: For example, will a drone scheduled to deliver your overnight package be allowed to collect information about you during drop off. And if so, what kind of data? With drone technology advancing at a fast and furious pace, there are now UAVs with the ability to record video and audio, use facial recognition technology and collect electronic data, including signals from cell phones, garage door openers and radio frequency identification data, RFID, a technology used in consumer credit cards.

And he mentions a case in—and some cases in which they are now using drones in divorce cases.

And then Jeramie Scott, who is the head of an organization called the Electronic Privacy Information Center, wrote a few days ago: The FAA has also failed to consider the data collection implications of commercial drones. In an age of Big Data, companies flying commercial drones will likely look to surreptitiously collect data as they fly around performing other tasks, such as delivering packages. We saw a similar occurrence when Google Street View cars

collected WiFi data while taking images for Google Maps. One company has already tested using drones to pinpoint cell phone and WiFi signals in order to identify customers for location-based advertising.

And he goes on to say: There exists a lot of potential for the commercial use of drones, but there needs to be rules in place to protect against broad surveillance and data collection. That's why more than 100 experts and civil liberties organizations petitioned the FAA to develop privacy rules for drones. The FAA denied the petition, and Epic has subsequently filed suit again the agency to force it to consider privacy. Currently voluntary best practices are being developed, but best practices will not establish meaningful privacy safeguards.

There's a lot of concern out there. Most people feel that we really don't have much privacy left anymore anyway due to the Internet and all the modern technology and not just drones. But to show you how much concern there is, I understand that 10 states have now passed laws. And my own home State of Tennessee, which is a very pro-law-enforcement state, very pro-law-enforcement, the legislature passed a law banning law enforcement agencies from using drones to collect evidence, to do surveillance, except in extremely limited circumstances. And so what I'm hopeful is, is that to maybe the FAA and some of your organizations will take a look at all these State laws, because the States seem to be sort of taking the lead in this so far, and see if you can't pick out some good things out of those State laws.

And I think that, Mr. Misener, even companies that want to use this technology extensively, that because there is so much concern about privacy that you would be—your company would be well advised to try to come up with every possible way that you can to protect what limited—what little privacy or what very limited privacy people still have.

And that's all I've got to say, Mr. Chairman. I yield back.

Mr. MICA. Thank you for making those points.

Did you want to response to any of that, Mr. Misener, or Mr.——

Mr. MISENER. Thank you, Mr. Chairman.

Mr. Duncan, I agree that a company like ours has to take privacy extremely responsibly. We've done it for 20 years now, and we'll certainly extend those kinds of privacy protections with respect to Amazon Prime Air, which, of course, is a delivery service, not a surveillance operation.

Mr. MICA. Mr. Geiger.

Mr. GEIGER. If people don't think that they have much privacy now, they should just wait for the new class of technologies that will enable very intrusive physical surveillance. That's just coming. The examples that you read are indeed troubling, and I glad that you mentioned in those passages that there are other types of surveillance that can be enabled by drones besides just video observation. They can be outfitted with an array of sensors that include, for example, cell phone tower emulators that we saw the Federal Government use these on tens of thousands of individuals just in the past year.

In terms of how to provide individuals with that kind of privacy, you know, the privacy torts get you some, but, again, it's limited

because it's limited to a reasonable—reasonable—what is highly offensive to a reasonable person standard. And it is unclear the degree to which Congress can directly regulate those kinds of uses without violating the First Amendment right to collect data in public places.

However, we think that the industry should take the lead and in a strong and enforceable code of conduct. And, unfortunately, the existing codes of conducts are not sufficient for that purpose.

You mentioned your State laws. States are indeed taking the lead on privacy laws, but the—and part of that is because of Federal inertia in response to the concerns of their citizens. But the patchwork of State privacy laws is also going to be difficult for the industry to navigate, particularly for a technology like UAS, which could fly between the borders of individual States. So I think that providing some sort of regulatory certainty with regard to privacy will benefit both individuals as well as commerce.

Mr. DUNCAN. Well, thank you.

Mr. MICA. Thank you.

Mr. Connolly.

Mr. CONNOLLY. Thank you, Mr. Chairman.

And thank you for holding this hearing. It really raises some pretty fundamental questions about the future and values and parts of our philosophy we thought were settled.

And I think, Mr. Geiger, you're quite right to raise the flag on, what does privacy mean as we move toward the future? I mean, even a commercial drone whose mission is purely the delivery of a good could be equipped with surveillance equipment and actually penetrate the walls of a house and look into what's going on. Now, technology isn't far away from being able to do that. I'm not arguing anyone would do that, but we're going to—you know, and the proliferation of drones is going to make it very difficult to enforce even those regulations we ultimately adopt. So it's a fascinating frontier kind of issue for us, and I don't think we have easy answers yet. But I thank you so much for helping highlight them.

Mr. Whitaker, I was listening to Mrs. Lawrence, and before I ask Mr. Misener some questions about Amazon and their operation, what is—if I'm a homeowner, how high up do I go in my property control? Can someone fly 500 feet from my roof?

Mr. WHITAKER. So I think, as Mr. Geiger has——

Mr. CONNOLLY. I'm going to ask all of you please to speak into the mic and move it closer.

Mr. WHITAKER. So I think Mr. Geiger articulated earlier, it's a bit unsettled. Clearly, if it's 500 feet above your house, it's federally regulated airspace. And when federally regulated airspace was defined decades and decades ago, there was no thought of a gray area. But I think now we're probably facing a gray area. But by statute, all the airspace is Federal airspace and regulated federally.

Mr. CONNOLLY. So if a commercial drone is flying within 3 feet of my roof, is that federally regulated airspace?

Mr. WHITAKER. I think you're pushing at those gray areas.

Mr. CONNOLLY. Yeah. Yeah. I just think we're going to have to revisit that too because, I mean, presumably if somebody's flying in to deliver fine chocolates and French bubbly to my neighbor, did I mention fine chocolates and French bubbly, you know, they may

need to get close to land, if that's what they're doing, and they may be violating, from my point of view, my—they're trespassing. They're trespassing on my property, including above my roof.

Mr. WHITAKER. I think these are real issues and the legal structure hasn't had to address them——

Mr. CONNOLLY. Okay. So we've got legal issues, and we've got privacy issues, and we got constitutional issues, and we got commercial issues, and we got economic issues, and all kinds of issues.

Mr. Misener, Amazon's been vocal about its concerns regarding the FAA proposed rule, and Amazon argues, "Overly prescriptive restrictions are likely to have the unintended effect of stifling innovation and, over time, will fail to offer any corresponding safety benefits as small UAS technology evolves."

How do you believe the proposed rule stifles innovation? And I'm going to ask you particularly to speak into the mic. Thank you.

Mr. MISENER. Mr. Connolly, I will speak directly in. Thank you.

We believe that it's overly prescriptive in the sense that it draws distinctions between—within visual-line-of-sight and beyond-visual-line-of-sight kinds of operations in a way that is just artificial. I mean, both should be subjected to a risk- and performance-based analysis. Certainly the risks involved in beyond-visual-line-of-sight operations are greater than those within visual line of sight. Highly automated operations require higher performance than less automated operations. Those are very clear.

But the method of analyzing the different kinds of operations should be identical, and so we are concerned that the NPRM tends to just cut those ones off and proscribe them, just basically say: We're not going to deal with them.

Now, Mr. Whitaker said the FAA is going to get to them. We're just suggesting that they get to them now and consider all these types of operations simultaneously, acknowledging that there are different risks involved and different performance requirements necessary to mitigate those risks.

Mr. CONNOLLY. I understand that Amazon's offered to actually show on a pilot basis that some of the concerns being discussed in the rulemaking can be managed without overly prescriptive regulation, including a line of sight, including multiple drone operation, and other such issues.

Is that the case, that you've offered to do that kind of pilot program?

Mr. MISENER. Yes, sir, in a variety of ways. We're working closely with NASA. In fact, we'll be a keynote presenter at your conference at the end of July, and, you know, the Pathfinder Project being undertaken by BNSF, that's something looks interesting to us. Some—figure out a way to——

Mr. CONNOLLY. But, I mean, have you made that proposal to Mr. Whitaker and his colleagues that why don't you let us show you how it can be done safely before you adopt a final rule?

Mr. MISENER. Yeah, I think these are parallel paths. One is to show the technology, the other is to work on the rules.

Mr. CONNOLLY. Mr. Whitaker, is your—are you and your agency open to that kind of demonstration to at least evaluate the parameters and scope of what is doable and what is problematic?

Mr. WHITAKER. I think the Pathfinder Program, which did that with BNSF, is the kind of program we need to have to prove those technologies. So we certainly are open to that.

Mr. CONNOLLY. And I—if the chair will allow one final question, another provision you have expressed concern about, Mr. Misener, Amazon, that is to say, is the requirement that one operator control no more than one drone system at a time. Why do you believe that's too restrictive?

Mr. MISENER. Thank you, Mr. Connolly. Because the technology exists so that a single operator could allow—could oversee the operation of multiple UAVs, and it—just to restrict one drone to one operator is just overly restrictive and certainly unnecessary, from a technological——

Mr. CONNOLLY. Mr. Whitaker that sounds reasonable on Amazon's part. I mean, I look at FAA controllers. We don't say to an FAA controller: You follow one plane coming in or going out. That's it. Because, otherwise, we don't believe you've got control, and it taxes the system.

Maybe that's not a perfect analogy, but technology kind of does allow us to do more than one thing at a time. What's wrong with Amazon's point of view on that?

Mr. WHITAKER. I think that we will get there in certain circumstances. I mean, right now, you have two pilots in each airplane and you have controllers, and in a new system, you—if it's a large aircraft, certainly there will be one per aircraft, but if it's quite small, there could be scenarios where it's multiple units, but the technology has to be proven, standards have to be developed, and then it comes into play.

Mr. CONNOLLY. Okay. Thank you, Mr. Chairman. And thank you so much for having this hearing. I hope we have more of them, frankly, because I think we've just begun to look at new territory.

Mr. MICA. It's an important subject.

Mr. Hurd.

Mr. HURD. Thank you, Mr. Chairman.

In 2001, when I was under the tutelage of Ambassador Hank Crumpton and we were prosecuting the war in Afghanistan, the CIA, the Counterterrorism Center and Special Operations Division kind of was the innovator in the use of drones in operations. Right? You know, we had Air Force bird Army ordnance under the operational control of the CIA. Something like that had never happened. And almost 15 years ago, when we were doing that, I never would have thought that I'd be sitting somewhere talking about using UAVs to monitor, you know, the herds of cattle in west Texas or having fine chocolate or bubbly delivered to Mr. Connolly's neighbor. So this is an exciting time.

But one of my concerns is, you know, one of the things that's made this country great is we're always on the edge of innovation. You know, we have the greatest entrepreneurs in the world, and my question is to Mr. Wynne. Are—in the development of this technology, is the U.S. leading on this? Do we have other competitors? Are there other countries that are beating us?

Mr. WYNNE. Well, it's a great question, sir, and thank you for your service.

I would say simply that this is a global phenomenon. UAS are really being taken up at very rapid pace around the world for a variety of different reasons. And, ultimately, we want global harmonization of the regulations so that there is safe and responsible flight everywhere.

I would say that we are—we have the potential to continue to lead in aviation innovation in this country. I think we're on the right path to getting back to that. I think there had been a little bit of a culture clash from the technology world into the aviation world. I'm an aviator myself, as are some of the other panelists, and we appreciate the fact that, you know, that this is a different—a different type of approach to aviation. But there's a lot of sky up there that can be used efficiently for an awful lot of things, and a lot of lives, frankly, that can be saved doing things that are very dangerous today that don't need to be done by humans. So we call that enhancing human potential.

Mr. HURD. So my next question is to Mr. Misener. You know, the possibility—when I came up to D.C. from Texas this week, I forgot my running shoes. And the idea of possibly having those delivered by an Amazon UAV within a couple of hours is pretty interesting.

But you've heard a lot of these privacy concerns that we've talked about here. And they're valid. And this is going to continue to be an issue. How are you all, I think one of the things you all are leading in this area in commercial development, how are you planning to gain the trust of the American people?

Mr. MISENER. Thank you, Mr. Hurd.

It's a core question about this service for anyone who is responsibly pursuing the commercial activity here. We have to engender trust. And the trust on privacy matters that we've garnered over the past 20 years is because—has been a result of our focus on consumer information privacy. And we will continue to that when it comes to Amazon Prime Air.

We are strongly supportive of the NTIA process. And we're going to be participating in that and, hopefully, developing solid, serious, best practices for an entire industry.

Mr. HURD. I appreciate that.

Mr. Cavolowsky, the question to you is on this UAS traffic management system that you all are working on, what are kind of the main challenges you all have left that are the barriers to the deployment of the system?

Mr. CAVOLOWSKY. So many of the same concerns that have been brought up by other panelists are things that we need to address in a technological fashion. So these are very complex software systems where there is coordinated interaction among the aircraft. Being able to verify and validate that they are safely, providing that safe separation is a critical challenge. Ensuring safe operations for all UAS but also other general aviation aircraft in that airspace is also a technical challenge we need to step up to, certainly beyond line of sight.

And another key element that has been brought up by the panel is the challenge of the first and last 50 feet of flight. In particular, the last 50 feet, if you will, with the interaction or potential interaction with property and people. The elements of the control of the management of that safely in an environment that can be unpre-

dictable is a major element of what we're trying to develop technology solutions around and procedural solutions around.

Mr. HURD. Thank you.

Mr. MICA. Thank you.

And, waiting patiently, I want to recognize the lady from New Mexico, Ms. Lujan Grisham.

Thank you for your patience. You're recognized.

Ms. LUJAN GRISHAM. Thank you, Mr. Chairman. I, too, want to thank you for the hearing.

And I agree that we ought to have potentially more of the hearings because there's a broad base set of issues that do need to be addressed. And there needs to be a regulatory environment to do that.

I certainly agree that we want to deal with the public safety issues. We want to deal with the privacy issues. But there's a real opportunity to enhance the economic benefits and making sure that that's addressed in a meaningful and balanced way.

I represent a State that has been very slow to recover from the 2008 recession. In fact, we've got the slowest recovery rate in the country. And we've got a company, Volo Pervidi, that has just gotten FAA approval. Our office worked with you all to do that, to do the kind of mapping and the kind of work that we're hearing a lot about in today's hearing. And not only are they talking about the vast economic opportunity in our State, and whenever I have an opportunity to talk about jobs, that's the number one priority, but they talk about nationally that the billions of dollars that could be generated—so I appreciate having Google here at the table—by these investments.

There's also a public safety factor that I don't want to ignore, not just in the regulatory environment that we need to proceed with for unmanned aircraft, but if we're using them to assess problems on the Golden Gate Bridge or we're using them to inspect power lines, we're creating a public safety benefit by not having to use workers to do that work directly and physically, which is high risk and continues to be problematic. When I think about liability for companies and governments and local governments and utility companies, it's significant. So I'm seeing great opportunity. And, with that, there is risk.

I have really two questions. You've been working to address that you recognize there's got to be a thoughtful but balanced approach. And as a former long-time and I would like to think effective bureaucrat for 17 years, bureaucracies don't always find themselves in the most flexible environment. And the problem here is that this technology is changing every minute, probably every second, as all technology does.

And in the thoughtful process that you all have to address privacy and public safety and managing that airspace productively and encouraging companies to come forward and give you ideas so we're not thwarting those economic, valuable economic investments, by the time you make those rules, arguably, they could be outdated.

What is your process for thinking about making sure that this is a fluid, ongoing environment so that we avail ourselves of every opportunity without mitigating our responsibility to manage pro-

ductively for my constituents and for the country real risks associated with any aircraft?

Mr. Whitaker, maybe that's something for you.

Mr. WHITAKER. I think several times this morning it's been mentioned that we need a risk-based and a performance-based regulatory system. And that's very much, we're all very much aligned on that point. We don't want to necessarily tell you how you're going to achieve certain levels of safety, but we want to define what those are and what the necessary standards are to get there. So when we, for example, get to a final rule, then it will provide parameters. And in the operations within those parameters, we don't have to guess what they might be. They'll be allowed as long as they continue to be safe. As we continue to expand the acceptable range of operations, that same principle will apply.

Ms. LUJAN GRISHAM. And maybe, Mr. Wynne, what can Congress do that is more productive in this environment, that provides both productive resources and investments in just exactly this, this sort of risk assessment and performance model? What is Congress' role here? And what can we do to enhance these efforts?

Mr. WYNNE. I appreciate the question. I think the point that I've been laboring to articulate here is that the economic opportunity is not just immediate, it needs to be sustainable. And so all of the questions that we're discussing, in technology, we call it a binary conversation. Really cool technology can do a lot of good stuff, but we have safety, we have security, we have privacy questions. We go through this with every technology pretty much. And the same kinds of questions Mr. Geiger is bringing up can also be applied on a technology-specific basis to license-plate readers. They can be applied to body cameras. They can be applied in a whole bunch of technology contexts.

The industry needs to do this in a way that's sustainable. Otherwise, it won't work. And I agree with Mr. Misener when he said it's in our customer—it's in our interest to make certain that our customer's privacy is protected. And it's in our interest also, as an industry, to make certain that we can do this on a sustained basis. Incidents, mishaps, et cetera, while they are common in aviation and we learn from them, we don't want them. And we're doing our best to make certain that we maintain the extremely high level of safety going forward.

To your question, ma'am, I think all of this comes back to FAA reauthorization, which is an extremely important matter before Congress immediately. And we have submitted for the record of the Transportation Committee what we think is important in that regard. So I won't enumerate that here. But I think it's also really important for the safety of the entire system that we do that on time.

Ms. LUJAN GRISHAM. Fair enough. Thank you very much.

And, Mr. Chairman, I yield back.

Thank you for the panel.

Mr. MICA. Thank you. And thank you for your patience.

I want to thank our panel too.

I've got a couple of quick points. One, okay, Mr. Whitaker, you testified today that it would, in 1 year, you would have the rule

out. Is that going to be September 30 of 2016? Or is that going to be June 17 of 2016?

Mr. WHITAKER. Hopefully before June 17, 2016.

Mr. MICA. That's 1 year from today. We'll note that in the record. And I'll ask the staff to schedule a hearing in June of next year. And we'll see how we're going there.

I think you got to have milestones to get things done. I put a milestone in the bill, which was September of this year. It's not going to be met. And we're operating on sort of a helter-skelter basis with these waivers and exemptions. And you told me you have been doing about 50 a week, is it?

Mr. WHITAKER. That's correct.

Mr. MICA. So 50 a week. We've got 10 weeks; there's 500. By the time of next year, we should be doing how many? Several thousand at that rate. So we'll have a patchwork of exemptions and waivers until we get to the final rule, I mean, if you keep it up at that rate.

WHITAKER. Yes.

Mr. MICA. Just an assumption. See, that's not totally acceptable. I know you have to have something in the interim. The other thing too is the Office of Inspector General published this report June 26, 2014, with a list of recommendations. I've got—1, 2, 3, 4, 5, 6, 7, 8, 9, 10—11 major recommendations by OIG. Now, I have a report as of June—that's this month—of 2015. All of these are unmet. All of these are unmet. Some were supposed to be achieved and accomplished by—here's one, October 30, 2014. I'm going to submit to you and FAA this list. And within the time, we're keeping the record open for 10 days, I want a response that will be in the record of—make certain—that this is your response to OIG. But I want to make certain that that is in the record and confirm when you will achieve the recommendations that OIG put in their audit from 2014 that they're giving me this report on, this month, 2015.

Mr. MICA. Do you see what I want? Any questions?

Mr. WHITAKER. No.

Mr. MICA. In the record by the time—again, we're going to do another hearing a year out. You said you're going to do that. These are important milestones that OIG identified a year ago to be completed. And I want that report in the record so that we have these milestones met.

All right. The final thing, you talked about, Mr. Misener, that sensor and avoidance technologies, now, they're important because you can put these things up, you testified, and you have technology either being developed or on the shelf that can avoid collisions or incidents. Is that correct?

Mr. MISENER. Yes, Mr. Chairman.

Mr. MICA. Okay. But those systems have to be approved by FAA for use, wouldn't they, Mr. Whitaker?

Mr. WHITAKER. Yes. We'll have to verify the technology.

Mr. MICA. See, this goes back to my point at the beginning, I think the last member, too, raised this technology is changing dramatically. But we have a failure of the law to keep up with rules and regulations to keep up. So we're going to have to have some mechanism to make certain that, in fact, the equipment that can avoid risk, avoid a disaster, avoid collision is certified in a manner. Do you have a separate office to certify this type of equipment?

Mr. WHITAKER. We certify aircraft on a number of fronts. And ultimately——

Mr. MICA. I know. But that is also, I hear lots of complaints, how long it takes for certification, how further behind we're falling. But we're doing an FAA bill, we're doing FAA appropriations. We need to make sure that you have the resources, that you set in place a mechanism to quickly certify the technologies or do it in some reasonable fashion. The problem you've got now is by the time they get the damn technology done and you get it approved, there will be another technology right behind it that is even faster. So we're falling further behind in our certification of equipment that will avoid disaster.

Do you see what I'm saying? FAA doesn't look very prospectively or how they're going to sometimes handle these things. If this is all just rolled into normal FAA certification, I don't think it's going to succeed. So if you have a recommendation or something you want to come back at, what you need to beef up, if you need to separate out, if we need someone in FAA focused on this for the future—at stake is, one, safety, and two is our entering the commercial age, which this is all about. But you can't do that unless you've got the rules, the certification, and keeping up with the technology.

They'll find a way to get that, I thought you said chopped liver—Hurd said chopped liver, but it was fine chocolates to Mr. Connolly. I had a little fun with that. But, in any event, whatever we're delivering, it's a commercial opportunity and a great economic boost.

Okay. So those are my quick questions. It's amazing what we've done. They've already flown an unmanned vehicle—or an aerial vehicle from Australia to Los Angeles, a cargo plane, without a pilot. And then another thing too is certifying the pilots because there are different categories of what is going up there, but different categories of who should be qualified if they're not in the drone but they're piloting the drone. We've got to make certain we've got the rules in place so those people also have the qualifications.

But I'm afraid we're not keeping up with it. And we've got to be able to set it in law in the FAA reauthorization or wherever. And then we haven't even talked about the privacy issue here. Again, I go back to the problem we had when we developed this, we were told no to privacy; it was a different domain and jurisdiction. But that is very important. And I'll look at the proposed legislation and the other things you mentioned. But, again, the Transportation Committee was not allowed to go down that path. But it's a serious one we need to address.

I think that those are some of the major issues. And we'll look forward to your responses. We'll make certain the staff gives you a copy of this list. And we want that in the record.

Again, I thank each of you for participating, our members for their patience. It was a productive hearing and hopefully move this all forward together.

There being no further business before the full Committee on Government Reform and Oversight, this hearing is adjourned.

[Whereupon, at 11:23 a.m., the committee was adjourned.]

APPENDIX

MATERIAL SUBMITTED FOR THE HEARING RECORD

Chairman Jason Chaffetz
Opening Statement
Committee on Oversight and Government Reform Hearing
"Drones: The Next Frontier of Commerce?"
Wednesday, June 17, 2015

Today's hearing on drones is the first in a series of hearings the Oversight Committee will hold on emerging technologies.

Drones are already being used in a variety of applications.

First responders are using them to deliver food and medical supplies to areas hit by disaster. Law enforcement envisions using drones to locate missing persons.

Companies big and small are finding new and innovative ways to use drones for inspecting and ensuring the safety of infrastructure ranging from railroad tracks to telecom systems. They are being used to monitor oil and gas pipelines, crops and livestock, and music festivals. Companies like Amazon and Google are currently researching and developing systems that would allow merchants and customers to deliver and retrieve packages via drones.

Some experts believe the use of drones could create more than 100,000 jobs and $482 million in tax revenue for the United States by 2025.

The future is indeed bright for this emerging technology – the question is whether that future is going to take place here or elsewhere.

On February 15, 2015, the FAA released a proposed rule on the commercial use of drones. This came after years of delay and on the heels of a June 2014 report by the Department of Transportation Inspector General that criticized the FAA for being significantly behind in its efforts to integrate drones into the National Airspace System.

The IG concluded that it was unlikely that FAA would meet the statutory deadline of September 2015 to integrate drones into our airspace. In addition, under current FAA regulations, as well as the proposed rule, it is very difficult for companies that are interested in developing transformative drone technology to even test their ideas. Developers have been forced to either limit their testing to the small confines of indoor spaces in the U.S., or to test overseas in a country where the rules are more flexible.

In March 2014, Google's 'Project Wing' started testing deliveries by drone in Australia. A year later, in March 2015, Amazon began testing drone deliveries in Canada and the United Kingdom after months of waiting for approval to test in real world environments in the United States.

According to the UAV trade association, every year that the integration is delayed, the United States loses more than $10 billion in potential economic impact.

I recognize that privacy and safety concerns exist. I share many of those concerns. I don't want my neighbor flying a drone over my backyard, and I certainly don't want law enforcement using drones for constant surveillance and recording everything that happens in a city.

I also agree that safety of the airspace must be the priority.

But we can get this right. And we must. The opportunities are nearly limitless. America has always led when it comes to innovation. We must continue to do so.

I look forward to hearing from our witnesses.

Statement of Congressman Gerald E. Connolly, VA-11
Committee on Oversight and Government Reform
Drones: The Next Generation of Commerce?
June 17, 2015

Chairman Chaffetz and Ranking Member Cummings, thank you for holding this morning's hearing to examine an emerging and rapidly evolving new avenue of commerce: the domestic utilization of unmanned aerial vehicle systems – or "drones" – by commercial enterprises. I have long believed that in the 21st Century, both government and the private sector must fundamentally transform the prism through which we view technology.

In our connected age, society must undergo a paradigm shift where technology is no longer treated as a simple commodity designed to make our daily lives more convenient, but rather, the vast potential of technology must be recognized for what it truly can be – a transformative and powerful force that profoundly alters the manner in which citizens interact with government and reshapes how businesses function, from the supply chain to the customer.

That is why today's hearing is so important. It is vital that Congress actively and continuously engages with the Federal Aviation Administration and other key stakeholders to ensure that an innovative and efficient regulatory framework is in place to guide American businesses seeking to leverage commercial drones in enhancing operations; while never sacrificing the sacred privacy rights and civil liberties that we all hold dear as a Nation.

As our witnesses will testify this morning, despite the lethal reputation that has developed around the use of drones in counterterrorism operations, the use of unmanned aerial systems transcend the battlefield and could have positive applications across society. From vital matters of life and death, such as enhancing emergency response rescue and recovery activities; to less important, yet exciting initiatives, such as the use of drones to strengthen the preparation of professional football teams, the creativity and ingenuity of American enterprises is waiting to be released.

I look forward to examining closely how Congress can best refine and further the statutory and regulatory framework governing the use of domestic drones to significantly strengthen privacy protections and safeguards, without hindering or blocking important societal advances that may be reaped from this technological progress.

Questions for The Honorable Michael Whitaker, Deputy Administrator, Federal Aviation Administration, U.S. Department of Transportation

Questions from Chairman Jason Chaffetz, Committee on Oversight and Government Reform
June 17, 2015, Full Committee Hearing titled: "Drones: The Next Generation of Commerce?"

QUESTION #1: During the hearing, you testified that your agency will commit to working on expanding line of sight operation for commercial use. You also testified that your agency will work aggressively to be more forward when it comes to understanding emerging technology. Please provide clarification with respect to:

a. How do you expect to work with industry, academia, and government when it comes to regulating this emerging technology?

b. How you will address the advances in autonomous and sense and avoid technology when publishing the final rule?

c. How will your final rule take into account potential advances in the aforementioned technology shortly after its publication?

RESPONSE:

a) The FAA published a proposed notice of rulemaking (NPRM) for small UAS operations in February 2015. We expect to finalize this rule in 2016. In the meantime, we are granting operational authorization for uses under section 333 of the FAA's 2012 Reauthorization. In addition, the FAA meets regularly with the UAS Aviation Rulemaking Committee (ARC), which brings together manufacturer and government partners to discuss long-term rulemaking strategy. The six UAS Test Sites and the UAS Center of Excellence provide avenues for the FAA to coordinate research and development across both industry and academia and to gather operational data to support standards being developed.

   The FAA is working with industry partners to explore other unmanned operations beyond those proposed in the NPRM:

   - **Visual line-of-sight operations in urban areas**
     CNN will look at how UAS might be safely used for newsgathering in populated areas.

- **Extended visual line-of-sight operations in rural areas**
  This concept involves UAS flights outside the pilot's direct vision. UAS manufacturer PrecisionHawk will explore how this might allow greater UAS use for crop monitoring in precision agriculture operations.
- **Beyond visual line-of-sight in rural/isolated areas**
  BNSF Railroad will explore command-and-control challenges of using UAS to inspect rail system infrastructure.

Additionally, the FAA's participation in UAS ExCom ensures collaboration across government partners. Researchers from NASA, the Department of Defense (DoD), Department of Homeland Security (DHS), federally-funded research and development centers, and the FAA meet to update research progress and document new research requirements for military and civil aviation communities.

b) In the NPRM, the FAA proposed that small UAS operations be conducted within visual line-of-sight of the operator. The comment period for the NPRM closed on April 24, 2015, and over 4,500 public comments were submitted on this proposed rule. The FAA is currently in the process of considering the issues raised by the comments and drafting the final rule. However, since the comment period closed only about three months ago, that process is not yet complete.

c) The FAA is committed to the safe and efficient integration of UAS into the National Airspace System. The FAA recognizes that UAS-associated technology is evolving rapidly. With that in mind, the proposed framework in the NPRM is, to the greatest extent possible, performance based. This data-driven, risk-based approach will maintain flexibility to accommodate future innovations. The FAA invited comments on the NPRM and is currently in the process of considering the issues raised by those comments and drafting the final rule.

QUESTION #2: During the hearing, you testified that your agency would publish a final rule by June 17, 2016. Please provide clarification with respect to:

a. How do you expect to accomplish this goal?

RESPONSE:
The FAA acknowledges the aggressive schedule for publishing a final rule by June 17, 2016. We have dedicated additional resources to the project and streamlined our internal process.

QUESTION #3: How do you plan on addressing each of the eleven outstanding recommendations from the Department of Transportation's Inspector General Report AC-20140061?

RESPONSE:
The UAS Integration Office, in coordination with other FAA offices, is actively working on addressing each of the eleven outstanding recommendations from report AC-20140061. Each recommendation is unique and involves different offices throughout the Agency. The FAA continues to provide periodic updates to the DOT OIG on the status of each recommendation.

QUESTION #4: Please identify all resources that have been appropriated and planned for the integration of UAS into the national airspace system, including the number of FTEs and contractors. This also includes, but is not limited to, funding for UAS integration from FAA's UAS Integration Office, Air Traffic Organization, and Aviation Safety.

RESPONSE:
FY 2015 enacted levels and planned FY 2016 request:

	FY 2015 ($M)	**FY 2016 ($M)**
Operations	*14.8	12.0
F&E	3.0	7.0
RE&D	**15.0	9.6
Total	**32.8**	**28.6**

*Includes congressional plus-up of $3 million for Aviation Safety activities to facilitate the safe integration of UAS into the national airspace
** Includes congressional plus-up of $6 million, of which $4 million is for the UAS Center of Excellence and $2 million is to help meet FAA's other UAS research goals.

Staffing and Contract Support Fully Dedicated to UAS Integration Work:

	ATO	**AVS**	**ANG**	**Total**
Operations	16	26	0	**42**
F&E	0	20	0	**20**
RE&D	0	0	8	**8**

Total	**16**	**46**	**8**	**70**
Contract Support	21	19	0	40

QUESTION #5: How is FAA working other federal agencies to address potential homeland security issues associated with UAS?

RESPONSE:
The FAA is teaming with the National Security Council (NSC), Department of Homeland Security (DHS), Department of Defense (DOD), Department of Justice (DOJ) and the Intelligence Community (IC) to address the potential homeland security issues associated with UAS.

Protection and defense of the National Airspace System (NAS) from airborne threats is a layered defense. The Department of Homeland Security (DHS) supports a whole-of-community response in which law enforcement at every level plays a critical role in detecting, reporting, and mitigating the threat from non-traditional aircraft. DHS and DOD have the lead roles for coordination of aviation security as directed the National Strategy for Aviation Security. The FAA is responsible for the safety of aircraft operating in the NAS and the provision of air traffic services. The FAA also has the responsibility, within its legal authorities, to support the DoD and DHS in their mission to identify, track, and respond to UAS events for security, defense, or law enforcement purposes. To support DoD and DHS, FAA provides raw radar feeds to enable threat determinations, embeds air traffic staff at a number of DoD facilities to provide operational expertise and support, and operates the 24/7 Domestic Events Network to allow aviation security stakeholders to communicate and access the same information simultaneously to identify and respond to possible security threats in the NAS, including UAS events.

The FAA is working closely with DHS, which was designated lead for counter-UAS (C-UAS) efforts within the Federal Government and is coordinating an interagency and intergovernmental effort. The FAA is a full participant in the interagency C-UAS effort, working with DHS and the other aviation security stakeholders on a variety of initiatives to address the capabilities and requirements associated with identifying and countering the potential security threats posed by UAS and other non-traditional aircraft. The FAA is a key participant in efforts to develop and integrate incident response planning and mitigation options as a whole-of-community approach to address possible UAS threats. While the FAA is

committed to the safe and efficient integration of UAS into the NAS, we are also cognizant of the potential security threat posed by malicious use of UAS. As a result, FAA has significant interests in working with DHS and DoD on the development, testing, and implementation of measures to identify and counter potential threats from UAS to ensure that any deployed C-UAS procedures or technologies do not adversely affect FAA's aircraft and airspace safety missions and services.

DHS, with extensive FAA participation, developed an interagency report on UAS threat concerns and possible C-UAS initiatives in response to NSC tasking from a January 30, 2015 Interagency Policy Committee (IPC). FAA also contributed to the development of the DHS-led interagency National Capital Region (NCR) Non-Traditional Aviation Technologies (NTAT) After Action Report and Whole-of-Community Action Plan, which will result in the development of standard operating procedures that specify community roles and responsibilities for information sharing, notification, threat determination, and UAS incident response actions. The action plan will incorporate a UAS public awareness program, a review of existing legal authorities to inform consideration of potential civil and criminal penalties, an assessment of current and emerging technologies as potential UAS threat mitigation capabilities and two interagency/intergovernmental tabletop exercises (TTX) to address UAS threat concerns and inform follow-on planning, the first of which was held on July 24. FAA is the lead agency for coordinating the public awareness program.

The FAA also works closely with the IC to receive information about and analyze threats from UAS, to include participation in several ongoing analytic working groups, such as the National Counter Terrorism Center (NCTC)-sponsored Remote Controlled Model Aircraft (RCMA)/UAS Threat Working Group and the Office of the Director of National Intelligence (ODNI) Aviation Intelligence Strategy Board. The FAA is participating in the ODNI's IC Assessment on UAS Threats and provided inputs to DHS's recently released Intelligence Assessment on Emerging Adversary Use of UAS and UAS Lexicon Reference Aid.

The FAA is also collaborating with the Federal Bureau of Investigations (FBI) to establish information sharing and analysis capabilities related to the reporting of UAS incidents nationwide. Furthermore, FAA coordinates regularly with the FBI's Civil Aviation Security Program, which resides in the National Joint Terrorism Task Force. In addition, the FAA is working closely with DOJ to seek an increase in the civil penalty cap that can be enforced in situations in which UAS are operated in locations and ways that threaten national security and public safety.

U.S. House Committee on Oversight and Government Reform
June 17, 2015
Hearing
"Drones: The Next Generation of Commerce?"

Questions for the Record

Questions from Representative Tammy Duckworth to
Paul Misener, Vice President of Global Public Policy at Amazon.com

***Question 1**: I used to fly sling loads and helicopters and there are some significant restrictions related to external load operations that a helicopter pilot must adhere to. Applying drones in commerce means we will have to apply specific procedures for these operations with the utmost concern for public safety. What jettisoning procedures is industry developing for loads that will be carried by unmanned aerial systems?*

Safety is Amazon Prime Air's top priority. Not only will we minimize risk by developing systems that safeguard the carriage of parcels, but we will also work with the FAA and stakeholders throughout the industry to develop performance-based rules and procedures appropriate to small Unmanned Aircraft Systems (sUAS). We believe it is crucial that such rules and procedures take into account the mass and size of a sUAS vehicle (in Amazon's case, under 55 pounds total), its package payload (in Amazon's case, five pounds or less), and its operating environment.

***Question 2**: Will you be applying the same restrictions and procedures as the helicopter aviation industry? If there are some variations, how might these variations in procedures apply while keeping in mind public safety?*

The FAA is developing rules and procedures for small Unmanned Aircraft Systems (sUAS) that would regulate sUAS differently than manned aviation. Given the rapid pace of innovation, including the development of sense and avoid technology, it is crucial the FAA take a true performance-based safety approach to regulating sUAS, including for highly automated operations beyond line of sight.

House Committee on Oversight and Government Reform

June 17 2015 Hearing titled: "Drones: The Next Generation of Commerce?"

Questions for the record, Mr. Brian Wynne, President and CEO, Association for Unmanned Vehicle Systems International (AUVSI)

Questions submitted by Rep. Tammy Duckworth

1. I used to fly sling loads and helicopters and there are some significant restrictions related to external load operations that a helicopter pilot must adhere to. Applying drones in commerce means we will have to apply specific procedures for these operations with the utmost concern for public safety. What jettisoning procedures is industry developing for loads that will be carried by unmanned aerial systems?

   Currently, we are not aware of any commercial unmanned aircraft systems (UAS) operations that the Federal Aviation Administration (FAA) has approved via its Section 333 exemption process which allow for external load operations that would require jettisoning procedures. With that said, as we look to more transformational uses of the technology, it is our hope that all types of operations would have to adhere to a risk-base, technology neutral framework, that will accommodate innovations rather than require new rules each time a new technology emerges.

   This means regulations should be based on the risk profile of a particular UAS operation rather than the platform being flown. For example, low-risk operations, such as aerial surveys above rural farmland, would be regarded as "safe," with minimal regulatory barriers regardless of the specific technology or platform used. Conversely, UAS operations that have higher risk profiles, such as jettisoning external loads, would most likely have to demonstrate the appropriate procedures are in place to meet the necessary safety thresholds, among other risk-mitigating factors.

2. Will you be applying the same restrictions and procedures as the helicopter aviation industry? If there are some variations, how might these variations in procedures apply while keeping in mind public safety?

   Ultimately, the commercial UAS industry will operate and abide by the future regulatory framework, and its associated restrictions and procedures, which the FAA puts in place to ensure the safety of the National Airspace System and general public. As a pilot myself, I know that AUVSI is committed to safe UAS operations and continues to meet with other aviation community stakeholders to understand where there could be lessons to be learned.

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