

**UP IN THE AIR: EXAMINING THE COMMERCIAL
APPLICATIONS OF UNMANNED AIRCRAFT
FOR SMALL BUSINESSES**

HEARING

BEFORE THE

**COMMITTEE ON SMALL BUSINESS
AND ENTREPRENEURSHIP
UNITED STATES SENATE**

ONE HUNDRED FOURTEENTH CONGRESS

SECOND SESSION

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UP IN THE AIR: EXAMINING THE COMMERCIAL APPLICATIONS OF UNMANNED AIRCRAFT FOR SMALL BUSINESSES

THURSDAY, MARCH 10, 2016

UNITED STATES SENATE,
COMMITTEE ON SMALL BUSINESS
AND ENTREPRENEURSHIP,
Washington, DC.

The Committee met, pursuant to notice, at 10:04 a.m., in Room 428A, Russell Senate Office Building, Hon. David Vitter, Chairman of the Committee, presiding.

Present: Senators Vitter, Risch, Gardner, Ernst, Ayotte, Shaheen, Cantwell, Heitkamp, Markey, and Booker.

OPENING STATEMENT OF HON. DAVID VITTER, CHAIRMAN, AND A U.S. SENATOR FROM LOUISIANA

Chairman VITTER. Good morning, everyone, and welcome.

Thanks for joining us today for the Senate Small Business and Entrepreneurship Committee's hearing to examine the commercial applications of unmanned aircraft systems, or UAS, by small businesses. We are going to be hearing from one panel of industry experts and one panel of small businesses, and I want to thank all of our witnesses for being here today and really contributing a lot. We appreciate it.

The purpose of this hearing is really twofold. First, to highlight the need to integrate UAS into the national airspace in a way that fundamentally ensures safety as the top priority. I have raised significant concerns about the safe operation of this technology and it is crucial that the Federal Aviation Administration, the FAA, develops regulations to promote a culture of safety and compliance for the growing number of UAS users.

But the second purpose of the hearing is to also recognize that while the FAA has certainly taken an extended period of time to develop these regulations, it risks sacrificing not only safety, but the proper development of this technology for the benefit of the economy and for consumers. The FAA's failure to meet regulatory deadlines has limited the growth of the commercial drone industry. I am hopeful that today's conversation will bring us closer to finding that right balance between the safe integration of drones in the national airspace and moving forward with economic development, not stifling small business innovation and utilization.

The potential of UAS's economic contribution certainly cannot be ignored, and it is not at all surprising that our nation's entre-

preneurs have made quick work of learning to benefit from this technology. In recent years, UAS have developed into useful and major tools for many small businesses. They are used in all sorts of applications across many industries, including agriculture, real estate, construction, film and TV, telecommunications, to name just a few.

The Association for Unmanned Vehicle Systems International recently issued a report and it concluded that precision agriculture is one of the most promising commercial markets for UAS. The report estimated that once FAA regulations are finalized, the UAS industry expects to produce over 100,000 total U.S. jobs and \$82 billion in economic impact within a decade.

In the meantime, drones are prohibited for commercial purposes and the FAA has granted exemptions only on a case-by-case basis, and that is one of the major issues and hurdles, slow-ups, we are going to talk about today. It seems to me case-by-case analysis is not the best way to proceed for safety's sake, and it is certainly not the most efficient way to engage a growing industry, and the FAA needs to update its exemption process to be sure we cover safety and so that small businesses are taken care of in a timely way. The current process is simply unacceptable and leaves too many small businesses out to dry.

The silver lining lies within the simmering growth of the industry. In 2014 alone, the companies that were granted exemptions are estimated to have contributed nearly \$500 billion in revenue and represented over 600,000 jobs. And of the first 1,000 commercial UAS exemptions, small businesses made up about 95 percent of them.

I know that our entrepreneurs and small business owners want to follow the rules and use UAS for low-risk activities. But under the current circumstances, they face unnecessary barriers that prevent growth. The last thing our economy needs is unnecessary obstructions to small business growth, which is responsible for a huge part of sustaining jobs for hard working Americans.

And I also say the other reality of the current state of affairs is that, quite frankly, you have a lot of folks, including small businesses, that simply are not going to comply. It is not practical and not sustainable, and that brings up real safety issues if you have a culture of a pretty wide open common non-compliance.

In light of these realities, I have authored the Micro Drone Safety and Innovation Act. This bill would establish a micro classification for UAS that weigh 4.4 pounds or less in order to prioritize safety while promoting open innovation. The bill calls for strict safety requirements that fall in line with proposed regulations from the FAA. It is my belief that we can help maintain our country's competitive advantage while encouraging a culture of safety and compliance for UAS users.

Now, let us get to today's conversation. I am extremely interested to hear from our witnesses about their experience with FAA's current process and what they expect when proposed regulations are finalized. I also hope our expert panelists will inform us of the impact UAS integration will have on our economy, how it has made a difference in their work, ways we can emphasize safety in our

country's air space. And, of course, I would welcome any comments about my legislation, which we are introducing this week.

Again, I want to thank everyone for being here today and I look forward to the discussion.

And now, I will turn to Senator Booker, who will offer an opening statement in Senator Shaheen's absence.

Senator.

**OPENING STATEMENT OF HON. CORY A. BOOKER, A U.S.
SENATOR FROM NEW JERSEY**

Senator BOOKER. Senator Vitter, I want to thank you very much. It is very good that you are holding this hearing. I want to thank the folks that are here today.

I get really excited about the future and the possibility for us to innovate as a country. We have expanded our economy in every generation because of American innovation, leading the globe. We are the net global exporters of innovation, of ideas, of new technology, and we need to stay on that cutting edge.

And, what frustrates me and worries me right now is when it comes to UAS and drone technology, it is now literally taking off across the globe but being stifled right here at home. We are the country that invented flight. We are the nation that led the world into the skies. But now for this incredible technology, we have a regulatory regime that is undermining innovation at home and spawning it in other places. If during the time of Wilbur and Orville Wright we had this kind of regulatory regime, we would not be flying planes today the way we are.

And, so, this is something we need to create an environment where we can explore, where we can innovate, where we can lead again, and I am very frustrated that in this area that has such profound potential, some of which Senator Vitter touched on, which, really, to me, is just the tip of the iceberg in terms of the transformational opportunities it holds for our economy.

And, this is not just our economy. It is not just dollars and cents. As a former mayor who saw the power of first responders, it can improve our search and rescue activities, and it can improve our ability to provide humanitarian aid, critical medicines. We should be making sure that we are doing this responsibly. We should make sure that we emphasize safety. But, we should do everything we can to let loose the reins of innovation and ideas.

There is an unbelievably clear economic case. This should be bringing left and right together when it comes to issues of economic growth. The Senator gave a tremendous amount of data and statistics. Already, UAS accounted for \$500 billion in revenue and represented over 600,000 jobs in the United States. And for me, it could bring efficiencies across industries, and, again, even more compelling to me is it can save lives.

In order to reap the major social and economic benefits of this technology, we must have regulations that keep pace with innovation. That is one of the frustrating things in my two years as a Senator, is that the increasing pace of innovation and change, we are just not keeping up as a government, just not creating an atmosphere in which we can really maintain our competitive edge globally.

I am very proud to be working in a bipartisan manner with Senator Hoeven, who comes from a State very similar to New Jersey, and I am working with him. We have introduced already the Commercial UAS Modernization Act, which aims to unleash commercial UAS and actually provide businesses with some of the stable footing to make investments prior to the FAA's long overdue rule-making.

I look forward to working on, with him and others, to advance this exciting technology as we move forward with the FAA reauthorization later this month. There is an urgency here, though. I really do feel an urgency, because every single day that we have a restrictive, overburdensome, unnecessary regulatory environment, we allow other nations to outpace us, we allow people to move past us, we allow lives that could be saved to be put in peril, and we undermine, again, our global dominance when it comes to innovation, when it comes to entrepreneurship, when it comes to expanding the horizons of the world.

Thank you.

Chairman VITTER. Thank you, Senator.

As we always do, we will invite any other member of the committee to submit opening statements for the record, but we always like to get right to our witnesses and hear from them and be able to interact with them.

I am going to introduce our first panel, and then, unfortunately, I am going to have to excuse myself because I need to be in the Judiciary Committee, and Senator Ayotte will take over the gavel. But, let me introduce our first panel of industry experts.

First is Mr. Brian Wynne. Mr. Wynne is President and CEO of the largest association representing the unmanned systems and robotics industries. AUVSI is the world's largest nonprofit organization dedicated to the advancement of unmanned systems and represents more than 7,500 members from 60 allied countries and 2,700 organizations involved in the fields of government, industry, and academia.

After that, we will hear from Captain Tim Canoll. Captain Canoll is the President of ALPA, which represents more than 52,000 professional airline pilots who fly for 31 airlines in the U.S. and Canada. ALPA serves as the largest non-governmental aviation safety organization in the world and has worked closely with both government and industry on the integration of unmanned aircraft to the national aviation system.

And rounding out our first panel is Mr. Eli Dourado. Mr. Dourado specializes in internet governance, intellectual property, crypto-currency, internet security, and the economics of technology. His popular writing has appeared in the New York Times, the Washington Post, Foreign Policy, the Guardian, and Wired, among many other outlets.

Welcome to all of you, and as I hand the gavel over to Senator Ayotte, I will invite Mr. Wynne to begin.

STATEMENT OF BRIAN WYNNE, PRESIDENT AND CHIEF EXECUTIVE OFFICER, ASSOCIATION FOR UNMANNED VEHICLE SYSTEMS INTERNATIONAL, ARLINGTON, VA

Mr. WYNNE. Thank you, Mr. Chairman, and thank you, Senator Booker, Senator Ayotte. It is a pleasure to be here on behalf of the Association for Unmanned Vehicle Systems International, the world's largest not-for-profit organization devoted exclusively to advancing the unmanned systems and robotics community.

UAS increase human potential, allowing us to execute dangerous or difficult tasks safely and efficiently. From inspecting pipelines to filming movies, the applications of UAS are virtually limitless.

The UAS industry is also poised to be one of the fastest growing in American history. Our economic impact study found that, during the first decade following UAS integration into the airspace, the industry will create more than 100,000 jobs and provide more than \$82 billion in economic impact, and that is just in our community alone. That does not count the value-added, some of the statistics that you were describing, Senator Booker, to the other communities that will be benefiting from the technology. Under the right regulatory environment, there is no question these numbers could go even higher.

For years, AUVSI has been urging the FAA to use all available means to establish a regulatory framework, starting with finalizing the small UAS rule. As we wait, American businesses are left sitting on the sidelines or operating under an onerous exemption process.

In May 2014, the FAA announced it would consider granting exemptions for certain low-risk commercial UAS applications under Section 333 of the 2012 FAA Modernization and Reform Act. Since then, the FAA has granted more than 3,700 exemptions, the vast majority of which are going to small businesses. For example, Louisiana-based LandBros Aerial is a start-up founded by two brothers in 2014 who use small quad copters to capture aerial images for the construction industry.

While some businesses are flying, this current system of case-by-case approvals is not a long-term solution and in many cases serves as a deterrent. Policies governing the 333 exemption process are more onerous than those contemplated in the proposed small rule. For instance, Section 333 exemptions typically require approved UAS operators to hold at least a sport pilot certificate, which requires a minimum of 20 hours of training in a manned aircraft and costs thousands of dollars to obtain. Under the proposed rule, however, commercial UAS operators will more appropriately be required to pass an aeronautical knowledge exam every two years in order to fly.

Additionally, access to some airspace is more complicated under the exemption process. Currently, approvals automatically allow commercial operators to fly up to 200 feet. Under the proposed rule, commercial operators would be allowed to fly up to 500 feet.

In addition to the bureaucratic nature of the exemption process, the patchwork of state and local laws under consideration in many jurisdictions will create additional hurdles for small business. Any operator flying in multiple states may encounter and need to comply with different laws and regulations governing commercial UAS

operations. The U.S. Code clearly states, and I quote, “The United States government has exclusive sovereignty of airspace of the United States,” unquote.

In December 2015, the FAA asserted its authority and cautioned states and municipalities against enacting conflicting UAS legislation. The FAA was right to do so, but until the agency finalizes the regulatory framework for small UAS, states and municipalities will continue to fill the void.

In addition to helping the industry thrive, finalizing the small UAS rule will provide the necessary tools and training to create a culture of safety. As more commercial operators are certificated, they will join the longstanding aviation community, which I have been a part of for more than 25 years as an instrument-rated general aviation pilot.

Safety is essential for all users. That is why AUVSI, in partnership with the Academy of Model Aeronautics and the FAA, developed a “Know Before You Fly” campaign to educate newcomers to UAS about where they should and should not fly. I am pleased to note that ALPA is also a supporter of that campaign.

While it is vital that the FAA finalize the small UAS rule, Congress also needs to pass an FAA reauthorization. This is critical for accelerating and expanding the commercial use of UAS and the most immediate way to encourage additional collaborative innovation between industry and government.

UAS technology is developing rapidly, much faster than our country’s capacity to develop the necessary regulations. We need to make sure the FAA adopts the proper framework to keep up with this technology and is sufficiently resourced to do so.

Thank you again for the opportunity to testify this morning. I look forward to your questions.

[The prepared statement of Mr. Wynne follows:]



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

**U.S. Senate
Committee on Small Business and Entrepreneurship
“Up in the Air: Examining the Commercial Applications of Unmanned Aircraft for Small Businesses”
March 10, 2016**

Chairman Vitter, Ranking Member Shaheen and members of the committee, thank you very much for the opportunity to participate in today’s hearing on unmanned aircraft systems. I’m speaking on behalf of the Association for Unmanned Vehicle Systems International, 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 many small businesses that support and supply this high-tech industry.

UAS increase human potential, allowing us to execute dangerous or difficult tasks safely and efficiently. From inspecting pipelines and surveying bridges to filming movies and providing farmers with aerial views of their crops, the applications of UAS are virtually limitless. It’s no wonder businesses – small and large – are clamoring to use this technology.

UAS will also have a significant impact on our economy, as the industry is poised to be one of the fastest-growing in American history. Our economic impact study found that during the first decade following UAS integration into the National Airspace System (NAS), the industry will create more than 100,000 high-paying jobs and provide more than \$82 billion in positive impact to the nation’s economy. Under the right regulatory environment, there’s no question these numbers could go even higher.

For years, AUVSI has been a leading advocate for the safe integration of unmanned aircraft into the NAS. While some industries may try to avoid regulation, AUVSI and its members have been urging the FAA to use all available means to establish a regulatory framework, starting with finalizing the small UAS rule, immediately and without any further delays. Last year, we were disappointed that the FAA missed the

September 30, 2015, congressionally mandated deadline for UAS integration, and the agency still has yet to finalize a small UAS rule for commercial operations. As a result, American businesses – the vast majority of them small businesses – are left sitting on the sidelines or operating under an onerous exemption process. Let me explain.

In May 2014, the FAA announced it would consider granting exemptions for certain low-risk commercial UAS applications under Section 333 of the FAA Modernization and Reform Act of 2012. Since then, the FAA has received nearly 13,000 requests¹ and granted more than 3,600² exemptions to businesses looking to use UAS for a variety of applications, including precision agriculture; inspecting infrastructure; mapping and surveying; film, photo and video production; public safety or emergency response; and environmental inspection and regulation.

After analyzing the first 3,000 commercial UAS exemptions, AUVSI found businesses in more than 35 industries, representing more than 1.18 million jobs, are now using UAS technology. These companies contributed about \$900 billion to the U.S. economy in 2015 and provide essential services to citizens across the nation.

Additionally, we found that the vast majority of companies receiving exemptions are small businesses. Just as smartphones and tablets revolutionized our economy over the past decade, UAS are transforming the way a number of industries operate, and are creating several new ones as well – from startups focused on developing new UAS platforms and components to entrepreneurs creating new business models that offer specific UAS services. Other small businesses are eager to use UAS to improve their existing services and extend their capabilities. For example:

1. Louisiana businesses have received 57 approvals to fly commercially, many of which are small businesses like LandBros Aerial. The startup was founded by two brothers in 2014, who had previously worked in the construction industry and had flown UAS recreationally. One brother is based in New Orleans while the other is based in Baton Rouge. The brothers use small remote-controlled, low-altitude quadcopters equipped with cameras to capture aerial data photos for the commercial and industrial construction industry.

¹ <http://www.regulations.gov/#/searchResults?pp=25;po=0;s=%2522section%252B333%2522%252BFAA;fp=true;ns=true>

² https://www.faa.gov/uas/legislative_programs/section_333/

2. Another business in Louisiana is New Roads-based Chustz Surveying. The company uses UAS to safely, efficiently, and economically perform aerial data collection and research throughout Louisiana and Mississippi. Its work includes supporting the U.S. Army Corps of Engineers, the Louisiana Coastal Protection and Restoration Authority and furthering the development of Louisiana's oil and gas industries.
3. In New Hampshire, 15 businesses have received approvals to fly commercially. For instance, ArgenTech Solutions is a veteran-owned small business headquartered in Newmarket. It uses UAS to assist in the evaluation and inspection of public utilities, infrastructure and forest fire monitoring. The company's technology allows it to maximize safety during high-risk and hazardous operations.

These are only a few examples, but it is easy to see the far-reaching benefits of UAS technology. But, while some businesses are flying, this current system of case-by-case approvals isn't a long-term solution and in many cases serves as a deterrent. The policies governing the exemption process are more onerous than those contemplated in the proposed small UAS rule.

For example, the Section 333 process typically requires approved UAS operators to hold at least a sport pilot certificate, which requires a minimum of 20 hours of training in a manned aircraft. A sport certificate also costs thousands of dollars to obtain, making cost a barrier to entry for some aspiring UAS operators just as it is for aspiring general aviation pilots. The best way to alleviate this burdensome requirement is for the agency to finalize the small UAS rule. Under the draft small UAS rule, commercial UAS operators will more appropriately be required to pass an aeronautical knowledge test every two years in order to fly.

The onerous requirements of the section 333 exemption process go beyond the pilot training requirements; access to some airspace is also more complicated under a 333 than it will be under the small UAS rule. Currently, a 333 approval comes with what the FAA refers to as a "blanket" certificate of authorization (COA), giving approved commercial operators immediate access to airspace under 200 feet. However, any business wanting to fly higher than 200 feet, say for a bridge inspection or flare stack inspection, will need to apply for a separate COA, which could take up to 60 days to process, according to the FAA's website. By comparison, under the proposed small UAS rule, a certificate of authorization would no longer be required and commercial operators would be allowed to fly as high as 500 feet without going through any of the

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bureaucratic red tape that exists now. Put another way, the small UAS rule will provide an additional 300 feet of altitude where commercial operators can fly without needing any special approval from the FAA.

While many of these regulations are burdensome for large corporations, they are especially challenging for small businesses that do not have full time lawyers and compliance officers to help navigate the confusing set of policies that currently govern UAS. Even the process of applying for a section 333 exemption itself is costly and difficult for small business owners.

In addition to the bureaucratic nature of the 333 exemption process, the patchwork of state and local laws under consideration in many states pose additional challenges for small businesses. In the absence of a permanent federal regulatory framework for UAS, states and municipalities are filling the void. Any small business flying in multiple states may encounter – and need to comply with – different laws and regulations governing commercial UAS operations. Complicating matters, states and municipalities don't have the authority to enforce some of the laws they are passing or considering.

Only the FAA can regulate airspace; states and municipalities cannot. According to Title 49, Part A, Section 1 of the U.S. Code, "The United States Government has exclusive sovereignty of airspace of the United States." Meanwhile, in December 2015, the FAA asserted its regulatory authority over the U.S. airspace and cautioned states and municipalities against enacting conflicting UAS legislation. In a fact sheet, the FAA stated, "Congress has vested the FAA with authority to regulate the areas of airspace use, management and efficiency, air traffic control, safety, navigational facilities, and aircraft noise at its source. A consistent regulatory system for aircraft and use of airspace has the broader effect of ensuring the highest level of safety for all aviation operations."

The FAA's message is clear. State proposals have the potential to create a complicated patchwork of laws that may erode, rather than enhance, safety. Yet, until a regulatory framework is finalized states will continue trying to fill the gap. We have seen state legislatures pursue duplicative registration and permitting systems, altitude limitations and numerous other regulations that could burden and confuse small business owners.

While my industry supports the safe, non-intrusive use of UAS technology, we're concerned about creating inconsistencies with federal law. The FAA was right to assert its authority over the airspace and it is time for

the agency to finish the job and finalize the regulatory framework for UAS. Once this happens, we will have an established framework for UAS operations that will allow anyone who follows the rules to fly. It will do away with the case-by-case system of approvals that currently exists, reducing the barriers to UAS operations for businesses large and small. A consistent, federal regulatory framework will bring clarity to the regulations governing commercial UAS operations and obviate the need for states and municipalities to enact their own laws, which have the potential to create confusion and compliance burdens for small businesses.

In addition to helping the UAS industry thrive, putting the small UAS rule in place will provide the necessary tools and training to create a culture of safety around the use of UAS. As more commercial operators are certificated, they will join the long-standing aviation community, which I have been part of for the last 20 years as an instrument-rated general aviation pilot. They will foster the aviation community's principles of airmanship and self-policing to promote safety and help thwart careless and reckless operations.

And because safety is essential for all users, AUVSI, in partnership with the Academy of Model Aeronautics and the FAA, last year developed the UAS safety campaign "Know Before You Fly" to educate newcomers to UAS, many of whom have no aviation experience, about where they should and shouldn't fly.

AUVSI also served on the Department of Transportation's task force on registration. This collaborative effort to develop an efficient process for UAS registration has led to increased accountability across the entire aviation community with hundreds of thousands of recreational operators now registered with the FAA. Under the FAA's draft small UAS rule, commercial operators would be required to register their platforms.

Building upon the successful work of the registration task force, AUVSI recently accepted an invitation to join the FAA's Micro UAS Aviation Rulemaking Committee. This process will help develop a flexible, risk-based approach to regulating UAS, something the industry has long supported. Focusing on the risk profile of a particular UAS operation instead of solely regulating the platform being flown is an approach that has been successful in other countries with growing commercial UAS industries and will provide access to the national airspace with minimal barriers for low-risk UAS operations.

Finally, we need to start looking beyond the initial phase of UAS integration and lay the groundwork for more transformational uses of UAS technology through a deeper national commitment to UAS research and development. Specifically, AUVSI has highlighted the need for a comprehensive industry-government UAS

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research plan, more resources for the federal government to coordinate UAS research and development, and a UAS traffic management network that will be operational in the foreseeable future.

We need to make sure we are doing all we can to support the UAS industry's growth and development; otherwise we risk stunting a still-nascent industry and restricting the many beneficial uses of this technology. The longer we take, the more our nation risks losing its innovation edge, along with billions in economic impact.

Given the technology's potential, we will continue to underscore that the FAA needs to finalize the small UAS rule as quickly as possible. Moreover, Congress needs to pass – and the President needs to sign into law – an FAA reauthorization measure.

This measure is critical for accelerating and expanding the commercial use of UAS and the most immediate way to encourage additional collaborative innovation between the numerous governmental and private sector stakeholders. AUVSI has been engaged with the committees and staffs leading the FAA reauthorization efforts in both chambers of Congress to address specific recommendations on how this can be accomplished.

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.

Senator AYOTTE [presiding]. Thank you, Mr. Wynne.

I would like to now call on Captain Tim Canoll, who is the President of the Air Line Pilots Association. Thank you, Mr. Canoll.

STATEMENT OF CAPTAIN TIM CANOLL, PRESIDENT, AIR LINE PILOTS ASSOCIATION, INTERNATIONAL, WASHINGTON, DC

Mr. CANOLL. Thank you, Senator Ayotte, Senator Booker, and to the committee for the opportunity to testify today.

The Air Line Pilots Association, International, has long stood in strong support of safely integrating unmanned aircraft systems, or UAS, into the national airspace. We recognize that UAS can perform specialized tasks efficiently and safely. ALPA applauds the entrepreneurs who are identifying new uses for UAS to help advance small business and the national economy. We also commend the members of Congress who have expressed an interest in UAS.

In this context, our support for innovation and growth, ALPA's greatest concern will always be safety. The U.S. airspace is the most dynamic on the planet. It is also the safest. We cannot rush UAS integration process. That must begin and end with making certain that the high level of aviation safety that exists today continues tomorrow.

We know that unsafe situations involving UAS are occurring right now. Each month, the FAA receives more than 100 reports of UAS sightings from pilots and others. In Louisiana, for example, the air traffic control tower reported that an airliner on final approach to Baton Rouge Metropolitan Airport observed a UAS at 500 feet just one mile from the runway. In Manchester, New Hampshire, the air traffic control tower received a report from an airliner of a UAS hovering at 2,800 feet about 7.5 miles northeast of the airport on the arrival path.

While it is almost certain that these events involved recreational rather than commercial UAS operators, they demonstrate the need for UAS pilot education and enhanced safety.

For airline pilots like me, UAS often literally appear out of the blue. They are much smaller than other aircraft and they move more slowly than airliners. As a result of this difference, UAS are extremely difficult to see in flight. While the FAA is making progress, it needs to address all UAS uses with a full regulatory safety framework.

ALPA's near-term action plan contains four parts. Education. Anyone flying UAS, no matter the size, should understand the aircraft and the airspace and the other aircraft that share it. ALPA maintains that commercially operated UAS should be flown by pilots who have the necessary knowledge. All U.S. transportation forms, be they marine, rail, road, or air, require commercial licenses for commercial operations. UAS should be no different. Where our resources exist, such as the "Know Before You Fly" campaign, not every UAS owner makes the effort to learn about the safety regulations. We urge the FAA to do more to reach out to small businesses and other users regarding UAS safety.

Registration. ALPA is pleased that more than 342,000 UAS owners have already registered with the FAA. While we applaud the civil and criminal penalties for those who do not register, ALPA maintains that point-of-sale registration is essential.

Technology. If UAS operate in airspace intended for airliners, or if they could end up there, airline pilots need to be able to see them on their cockpit displays and controllers need to see them on their radar scopes. The UAS must also be equipped with active technologies to avoid a collision with manned aircraft. The FAA should identify resources to develop UAS-centric collision avoidance technologies in fiscal year 2016 and adopt them in fiscal year 2017.

In addition, if regulations restrict UAS from operating in a location, the UAS must have technology that cannot be overridden to prevent it from flying there. The FAA must also continue to evaluate technologies to identify UAS and operator location.

Penalties and enforcement. ALPA calls for the full enforcement of civil and criminal penalties regarding UAS. If the FAA intends to rely on first responders to ensure compliance, it must do more to inform local, state, and national law enforcement about their responsibilities and authority.

Let me close by underscoring that the UAS safety in the national airspace is serious business, not only for small business, but for every airline passenger and cargo shipper. This registered UAS, for example, which is in the classification of MicroUAS because it is under 4.4 pounds, can fly as high as 6,600 feet for 15 minutes. It could easily end up in the airspace I occupy when landing at Baton Rouge or Manchester, or any airport, for that matter.

With ALPA's plan and Congress providing the FAA with a long-term stable source of funding through a full reauthorization, small businesses can capitalize on the opportunities offered by UAS while maintaining our industry's extraordinary level of safety.

Thank you for the opportunity to comment.

[The prepared statement of Mr. Canoll follows:]

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STATEMENT OF
CAPTAIN TIM CANOLL, PRESIDENT
AIR LINE PILOTS ASSOCIATION, INTERNATIONAL
BEFORE THE
COMMITTEE ON SMALL BUSINESS
& ENTREPRENEURSHIP
U.S. SENATE
WASHINGTON, D.C.

UP IN THE AIR: EXAMINING THE COMMERCIAL
APPLICATIONS OF UNMANNED AIRCRAFT FOR SMALL
BUSINESSES

MARCH 10, 2016

Air Line Pilots Association, International
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**STATEMENT OF
CAPTAIN TIM CANOLL, PRESIDENT
AIR LINE PILOTS ASSOCIATION, INTERNATIONAL
BEFORE THE SMALL BUSINESS & ENTREPRENEURSHIP COMMITTEE
UNITED STATES SENATE**

THE IMPACTS OF FAA'S DRONE REGULATIONS ON SMALL BUSINESS

MARCH 10, 2016

The Air Line Pilots Association, International (ALPA) is the largest professional association representing airline pilots in the world, and represents over 52,000 pilots at 30 U.S. and Canadian airlines. Thank you for the opportunity to provide our perspective on the critical importance of safely integrating unmanned aircraft systems (UAS) into the U.S. national airspace system (NAS). The North American NAS is the most dynamic and diverse such system in the world. The remarks we submit to the committee today reflect a perspective that ALPA has maintained for quite some time. ALPA fully supports the safe integration of UAS operations into the NAS. This is not a new issue and our support for the future of UAS in the NAS, as well as our perspective on the issues associated with the safe integration, are reflected in this statement.

The safety of the NAS must be maintained to deliver the safest and most efficient air transportation services in the world. Although our focus today is the North America NAS, we must point out that the safety issues highlighted are independent of any national airspace boundary and are faced by ALPA's pilots as we operate around the globe.

Small businesses are also an important part of the UAS dialogue.

Small businesses have emerged whose focus is on the sale of UAS for commercial and recreational use, and commercial operations. Innovative small-business owners appear to be identifying many potentially beneficial uses of UAS, and are seeking FAA approval to fly UAS for any number of reasons. We also recognize that agricultural use of UAS aircraft for crop inspection and other uses are increasing. As in many other industries, small businesses are also developing innovative technologies and capabilities that can ensure safe integration of UAS into the airspace. So the small-business opportunities associated with UAS aircraft are broad and growing. We appreciate the committee's efforts to bring focus on this important subject.

UAS Risk Must Be Effectively Managed to Realize Benefits

ALPA recognizes that UAS represent a significant potential for economic and societal benefit. They are uniquely suited for performing many types of specialized flying that can keep pilots out of harm's way. ALPA supports robust development of this technology with one single overriding condition: integration of UAS into the NAS must be done safely, deliberately, thoughtfully, with full understanding of the possible risks also being introduced, and most importantly—with simultaneous development of effective mitigations for those risks. We have to do this right, or the enviable safety record we have achieved in airline operations will be at risk, and with it, the promise of employing UAS for the benefit of the population.

As we have for many years, ALPA continues to be an active partner with both government and industry in developing policies, regulations, and standards that will

lead to safe operation of UAS in the NAS. But that work is far from complete. Defining a safety framework for any new technology is a necessary process, and ALPA, along with hundreds of extremely talented representatives from across aviation, is diligently pursuing that goal.

FAA Addresses Commercial Small UAS Operations

Small businesses typically operate UAS that are categorized as small UAS (under 55 pounds), or “sUAS,” so much of our focus today is on the subject of regulating that segment of the industry. The FAA has taken meaningful steps to allow sUAS to begin operating in the airspace system with multiple restrictions intended to mitigate risk.

The FAA has established a process of sUAS operational approval for commercial operations on a case-by-case basis. This is often referred to as the “Section 333 process” because the FAA’s use of this strategy is based on that section of the most recent FAA authorization. The FAA has issued more than 3,800 Section 333 approvals. For some of the approvals, the FAA has asked for public comments on whether the public has concerns with the applicant’s operation.

ALPA has submitted comments on varying issues associated with the applicants’ intended operations. From a safety perspective, our primary concern is that the applicants for a Section 333 approval cannot provide adequate details that give ALPA the assurance that the UAS will behave predictably at all times, and that should something go wrong, adequate redundancies and protections are in place to ensure that the UAS does not somehow blunder into airspace where commercial airliners are

operating, or crash back to the ground and injure innocent bystanders and/or damage property on the ground. Part of our concern is that neither the FAA nor the applicant for the Section 333 approval provides the public with adequate data or justification to mitigate existing safety regulations that have been established by the FAA for manned aircraft operations.

In addition to the interim approval process, the FAA published a notice of proposed rulemaking (NPRM) on February 23, 2015, that addressed the commercial operations of sUAS. The NPRM, which was significantly based on the FAA's 2009 recommendations of the Small UAS Aviation Rulemaking Committee, established a proposed framework for commercial operators to operate their sUAS. The NPRM formally established the definition of a sUAS, established pilot qualifications, and created operational limitations.

The FAA is now reconciling ALPA's comments along with more than 4,000 others, and have said they will issue a final rule in the coming few months. Between the Section 333 process and the eventual sUAS rule, small-business operators who desire to use sUAS as commercial operators are well on their way to having a defined path for approved NAS operations and a path for expansion of operations while ensuring safety.

Many Say the FAA Needs to Accelerate Broad sUAS Approval Policy, but ALPA Has Concerns

In testimony and in public statements, UAS manufacturers, operators, and associations have described the current state of UAS regulations as highly restrictive and changes are moving at a slow pace. They have said that it's unacceptable that small businesses have

to wait to get an exemption to the current UAS rules by the FAA in order to operate legally. There is a strong desire by many to see the integration of UAS proceed without further delays by asking Congress and the FAA to expeditiously adopt rules for UAS operations or allow unrestricted assess.

ALPA has steadfastly participated in all UAS activities available. This includes rulemaking committees, standards committees, and advisory groups. ALPA has consistently taken the position that the efficient development of UAS has many benefits and should be supported. However, ALPA has also consistently maintained that the technology must be thoroughly evaluated to be understood, potential failures must be identified and mitigated, and there must be a proven safety case for the intended operations before they can be introduced into the comprehensive system of safety and operational requirements that exists in today's public airspace. This does not happen quickly, and it must be methodical to ensure the continued safety of the national airspace system.

Accelerating UAS implementation also adds risk that the benefits of public review and comment of proposed policies, rules, and standards would be shortchanged or eliminated altogether. With more than 50 years of involvement in the development of safety-based regulations, design standards, and operational implementation, ALPA can say with confidence that efforts to introduce technology prematurely into the aviation industry, before the data-driven safety analysis and review is accomplished, adds significant risk. In many cases, that risk far outweighs the benefits.

ALPA will continue to devote the necessary resources to ensure that we can bring decades of experience to the table, for the deliberation and dialogue with our government and industry peers. We believe that the pace of progress will continue to be driven by the maturity of the necessary technologies, as well as the quality and quantity of the data available for industry to analyze and endorse, not by financial or staff resource shortfalls.

Recent FAA Incident Report Data Outlines the Safety Issues that Must be Addressed

In August 2015, the FAA published a list of pilot reports on UAS encounters. ALPA reviewed the 764 events, which cover only the period from November 2014 through August 2015. Both the volume of events and many of the event descriptions are sobering reminders to the industry that the risk of a collision between a UAS and an airline aircraft has increased significantly. Consider these sample summaries (ALPA paraphrase):

Louisiana

- Baton Rouge, LA. Baton Rouge air traffic control tower reported that a regional jet on final approach to the Baton Rouge airport observed a UAS at 500 feet in height and 1 mile from runway.

New Hampshire

- Manchester, NH. The Manchester air traffic control tower received a report from a regional jet of a black and white four-propeller UAS hovering at 2,800 feet, about 7.5 miles northeast of the airport.

It is clear that hundreds of near mid-air collisions of UAS over such a short time frame far exceeds an acceptable level of risk to manned aircraft in the NAS. Undoubtedly there will be many perspectives and opinions on what constitutes an acceptable level of risk. If the FAA UAS event data tallied 100 instead of 764, ALPA would still insist that there are too many unexpected encounters.

Instead of discussing subjective opinions on the risk that UAS pose on manned aircraft, ALPA suggests that the FAA invite ALPA and others in the industry to work collaboratively to reach an agreement on the level of risk that is deemed acceptable, and then work to implement solutions to achieve the targeted risk levels. The rate of UAS encounters needs to be reversed. ALPA continues to promote UAS safety through our partnership in the "Know Before You Fly" initiative, through direct member communications, and through participation on numerous rulemaking and standards bodies as established by the FAA.

Noncommercial and Recreational UAS Operations Appear to Be a Major Source of Reported UAS Events

Although the FAA has made progress in attempting to educate noncommercial and/or hobby users as to the safe operation of their aircraft through its "Know Before You Fly" campaign, no regulations exist that govern the operation of the aircraft or the training and experience of the pilots. ALPA believes that the vast majority of the many "close encounters" with unmanned aircraft reported by airline flight crews are the result of users who either do not understand the potential severity of operating near airports and

aircraft, or are completely unaware that they are doing so. The massive growth of this segment has clearly outpaced the FAA's ability to effect safety standards that apply to it, yet the FAA remains responsible for the safety of all operations in the airspace. This significant gap must be addressed. The FAA must have the ability to ensure the safety of the NAS regardless of the types of unmanned operations being conducted, and it must have the resources necessary to act on that mandate. As we have said before, we simply cannot afford to quantify this hazard by analyzing the damage after an unmanned system collides with an airliner.

The FAA Needs to Address All UAS Uses

In order for small businesses to leverage the full potential of UAS, a comprehensive regulatory framework is needed. The standards for some of the key capabilities of UAS, and the recommendations for the wide variety of rules that must be changed or developed to accommodate large UAS, are still years away. As a result, for the foreseeable future and without additional FAA action, there will be no rules for the following UAS operations:

- Noncommercial operations by companies (e.g., pipeline or power line patrol by company employees)
- Recreational/hobbyist operating small and large UAS
- Large commercial UAS

ALPA recognizes that the commercial operations of large UAS are not developing as quickly as sUAS used for commercial, recreational, or corporate operations. The FAA

presently has rulemaking under way that addresses only one of these four types of UAS operations. The tremendous growth of sUAS in just the last 24 months when measured against the limited rules that the FAA has under way is inconsistent with the needs of the country for safe integration of UAS.

UAS Design: UAS Frangibility Is Questionable and Untested

ALPA is concerned about the impact of sUAS on an airline aircraft in the event of a collision. There are numerous videos of UAS crashes online; in many cases the crashes occur without major damage to the camera and the visible parts of the sUAS. It appears that the sUAS are generally designed to be relatively rugged, as one would expect for a commercially viable product. This ruggedness, however, needs to be evaluated in the context of the potential damage that a sUAS would impose on an airline aircraft should the two collide. We frequently hear the comment that most sUAS are small, lightweight, plastic aircraft. While this is the case for the sUAS airframe itself, the multiple propulsion units, batteries, and on-board cameras are hard metal with a significant density that a bird, for instance, does not have.

Airplane engines, windcreens, and other components may suffer the impact of such material without resulting in loss of the aircraft, but the damage would be nevertheless significant. Jet engines, for example, are notoriously susceptible to foreign object damage (FOD) typically caused by small, hard objects found all over airports—nuts, bolts, rocks, tools, etc. Damage of this type, while rarely noted in conjunction with an accident, costs the industry billions of dollars every year.

Similarly, we have seen just in the past few months the extensive damage done to an aircraft in flight by hail, shattering both pilots' windscreens and severely damaging every part of the airplane that was hit. Here again, catastrophe was averted by the robustness of the airplane design and the skill of the flight crew, but the seriousness of striking hard objects in flight was clearly illustrated. Based on our experience with FOD, hail, and other objects striking transport aircraft, ALPA recommends design evaluations, modeling, and testing the collision impact of some of the more popular sUAS.

UAS Conspicuity—Data Suggests That They Are Difficult to See Until Very Close

ALPA is frequently asked to explain how visible a sUAS is to a flight crew of an airline aircraft. There are medical studies about the limits of human visual acuity and some limited study data on distances at which a pilot perceives other aircraft. However, because UAS can be of essentially an infinite variety of sizes, shapes, and colors, studies regarding traditional aircraft do not provide a good guide. Factors such as size, shape, contrast with background, and movement relative to the observer all complicate a pilot's ability to see a UAS until it is extremely close and often too late to safely take evasive action. It is important to note that, from a safety perspective, a pilot simply seeing an object in the airspace is only part of the process. The object must be seen with enough clarity and at such a distance that a pilot has the ability to identify it and determine if evasive maneuvering is necessary to avoid a collision. To our knowledge, no specific quantifiable data on observing UAS from an aircraft moving nearly 200 mph in time to avoid collision exist.

Airline Encounters with UAS: Geographical and Altitude Limiting Technology for UAS

Technology exists to limit the geographical and vertical limits of unmanned aircraft operations, independent of the performance capability of the aircraft itself. This feature should be required for all UAS that are not intended to “mix” with conventional aircraft or in the vicinity of airports and other sensitive areas, regardless of whether the UAS is flown for business or recreation. Until the FAA mandates the use of such technology, the effectiveness of this solution will be somewhat limited.

Unfortunately, a geographical and vertical fencing would likely be subject to hackers, or those intent on defying the regulations. Attempts to defeat such technology must be viewed as a deliberate act intended to create a hazard in the NAS and dealt with accordingly. Intentionally operating any aircraft, whether manned or unmanned, in an unsafe manner is not a hazard to be mitigated—it is a deliberately unsafe act that, like intentionally shining a laser at an aircraft, cannot be tolerated and must result in an appropriate civil and/or criminal penalty.

ALPA’s View on UAS Design, Certification, and Operations

The pressure for rapid integration of UAS into the NAS must not result in incomplete safety analyses or technologies prior to any authorization approvals to operate. The urgency to allow UAS into the NAS with immature technologies and lack of appropriate standards and certifications at this time should not encumber other NAS users with additional safety burdens. Standards and technologies for UAS must be in place to

ensure the same high level of safety as is currently present in the NAS before a UAS can be authorized to occupy the same airspace as airlines, or operate in areas where UAS might inadvertently stray into airspace used by commercial flights. It is critical that the decisions being made about UAS airworthiness and operational requirements fully address safety implications and complete interoperability functionalities (e.g., detect-and-avoid capability) of these aircraft flying in, around, or over the same airspace as manned aircraft or, more importantly, airline aircraft.

A well-trained and experienced pilot is the most important safety component of the airline system. The role of the pilot is a major area of concern within the UAS—and within the piloted-aircraft communities. UAS pilots should not be allowed to operate UAS commercially using nonlicensed or private pilots.

It is impossible for a UAS pilot to react to anything other than an explicitly annunciated malfunction. Conversely, a pilot on board an aircraft can see, feel, smell, and hear many indications of an impending problem and begin to formulate a course of action before even sophisticated sensors and indicators provide positive indications of trouble. This capability is necessarily lost without a pilot on board, so the margin of safety the pilot represents must be replaced by other means. UAS pilots should be trained, qualified, and monitored to meet the equivalent standards of pilots who operate manned aircraft in either private or commercial operations.

ALPA Recommendations Pertaining to UAS Design and Operations

1. Just like manned aircraft, a comprehensive, proactive UAS integration program should incorporate consensus technology standards, safety analyses, certifications, and flight standards to ensure that introduction of UAS into the NAS will not degrade the existing NAS target level of safety.
2. Federal aviation regulations that specifically address UAS operators, operations, aircraft, and pilots must be developed. Any UAS-unique or UAS-specific regulations must be comparable and compatible with other existing regulations for other airspace users.
3. UAS are inherently different from manned aircraft and should be required to be equipped with safety-based technologies designed with both well-clear and active collision-avoidance functionalities at the heart of their system architectures to operate in normal and abnormal modes and conditions to maintain the current level of safety in the NAS.
4. Commercially operated UAS should be flown by pilots who hold a commercial certificate and an instrument rating to ensure the continuity of safety that now exists in the NAS. Every form of transportation in the United States—marine, rail, roads, and air—requires commercial licenses for commercial operations. Commercial UAS operations should be no different.
5. Any person or persons in direct control of a UAS must be limited to the control of a single aircraft unless operations are conducted in special-use airspace.

Near-Term Call for Action: A Four-Part Solution

ALPA believes that a significant step toward the eventual solution to safely integrating UAS into the NAS includes four fundamental elements:

1. *Education:* Anyone who plans to fly UAS must understand the aircraft, the airspace, and the other aircraft that could be encountered while flying.

In the case of UAS that might be commercially flown for compensation or hire, the pilot must hold a commercial pilot certificate to ensure that he or she possesses the appropriate skill and experience to meet safety standards designed to protect the flying public.

Those flying UAS for recreational purposes must adhere to the FAA guidelines, keeping the UAS within line of sight, at heights under 500 feet, away from airports.

ALPA urges Congress to provide definitive authority and remove any ambiguity about the extent to which the FAA has the authority to regulate sUAS operated for recreation, modeling, and hobby. However, in the absence of congressional clarification, we believe the FAA may be able to utilize its authority to ensure the safety of the NAS by regulating all aircraft operations. ALPA stands ready to assist the agency in the swift development of these regulations and help achieve our shared goal of ensuring the safety of air transportation.

Based on what the FAA has documented to date, the ongoing educational efforts under way by the FAA and recreational UAS segment are woefully inadequate.

Near-term action: With warmer weather on the horizon, sUAS operations will likely increase. ALPA recommends that the FAA develop an outreach initiative, encouraging manufacturers, businesses, and volunteer organizations with a vested interest in safe UAS operations to aggressively promote safe UAS operations, which include avoiding encounters with airline aircraft.

2. *Registration:* ALPA endorsed the FAA's rapid implementation of a UAS registration requirement for all but the smallest aircraft. Gathering basic information about the identity of the individual purchasing the UAS not only allows law enforcement authorities to identify the owner if the UAS were to encounter a problem, but it helps make clear the serious nature of operating a UAS in the NAS and the responsibility to safeguard public safety.

Near-term action: ALPA recommends that the FAA implement registration of UAS at the point of sale. Except for a small number of home-built UAS, this method will ensure the greatest possible compliance with the registration requirements.

3. *Technology:* If UAS are operated either intentionally or unintentionally in airspace that airliners use, airline pilots need to be able to see them on cockpit displays, controllers need the ability to see them on their radar scopes, and UAS must be equipped with active technologies that ensure that the UAS is capable of

avoiding collision with manned aircraft. In these types of operations, technology must enable the pilots to control and interact with them in the same manner as if the pilot were on board.

If a UAS is restricted by regulations from operating in a particular geographic area and/or altitude, it must have technology that cannot be overridden that limits the geographic areas and altitude in which it can operate. This may include permanent locations such as the White House and all public airports, as well as temporary restrictions such as for wildfires or natural disaster areas.

Near-term action: The FAA should expand its ongoing evaluation of technologies that are capable of identifying UAS and operator locations. The FAA should ensure that resources for the remainder of FY 2016 are adequate for the development of UAS-centric collision-avoidance technologies, with standards in place for their adoption in FY 2017.

4. *Penalties and enforcement:* UAS pilots must be properly trained and understand the consequences of possible malfunctions. Anyone flying a UAS that is a hazard to other aircraft in the airspace, especially those who choose to do so recklessly near airports, must be identified and appropriately prosecuted. We support the criminalizing of intentionally unsafe operation of UAS and penalties for unintentional unsafe UAS operations. If additional funding is needed for this purpose, Congress should provide the resources needed without delay.

Near-term action: If the FAA intends to rely on first responders to ensure UAS regulatory compliance, the FAA should better inform local, regional, state, and national law-enforcement officials. Providing law-enforcement officials with information that defines unlawful operations, provides peer-to-peer contact information, clarifies their regulatory authority, and other pertinent information is critical for an effective use of first responders to ensure UAS regulatory compliance.

Conclusions

ALPA supports the ongoing efforts to safely integrate UAS into the North American airspace system, and we realize that UAS create many important opportunities to small businesses. However, the integration needs to be done so in a way that ensures that aviation safety is not compromised and so that the target level of safety for commercial air travel in the NAS is proactively, not reactively, protected. We are fully aware that there is a strong desire by UAS proponents, and those who wish to become operators, to begin flying in the NAS as quickly as possible. Clearly, there are commercial, social, business, and international competitive advantages to a strong UAS industry. However, government and industry must take a longer view of this present state of technology to ensure that robust safety systems, in tandem with FAA-certified redundant systems of UAS, are developed that completely integrate with commercial airline operations and, above all, do so safely. An imprudent rush to create and implement minimum standards

will not only harm safety, but potentially produce a setback for the future expansion of UAS operations for years to come.

On behalf of the more than 52,000 pilots whose top priority is safe transportation, we thank the committee for the opportunity to testify on this important subject and look forward to working together to ensure the safety of our air transportation system.

Senator AYOTTE. Thank you, Captain Canoll.

I want to now call on Mr. Eli Dourado, the Director of Technology Policy Program at the Mercatus Center at the George Mason University.

Mr. Dourado.

STATEMENT OF ELI DOURADO, DIRECTOR, TECHNOLOGY POLICY PROGRAM, MERCATUS CENTER, GEORGE MASON UNIVERSITY, ARLINGTON, VA

Mr. DOURADO. Thank you, Senator Ayotte and Senator Booker, for the opportunity to come here and testify and comment on commercial applications of unmanned aircraft for small businesses.

My name is Eli Dourado, and I am a Research Fellow at the Mercatus Center at George Mason University, where I study the regulation of emerging technologies and direct Mercatus' Technology Policy Program.

We are at an exciting point in the history of unmanned aircraft. I think of drones as occupying a similar position now as the internet did in the 1980s. As members of this committee know, until 1989, use of the internet for commercial purposes was generally prohibited. The removal of that prohibition resulted in an explosion of innovation, much of it completely unanticipated, that has persisted until today.

As with the internet in 1989, commercial use of drones is highly restricted, but will soon become generally available, and as with the internet in 1989, we have only the vaguest idea of how drones will be used in daily life in the future. That vague picture does include some applications that we already understand—using drones for photography and inspecting equipment, for evaluating the health of crops, for transporting goods with a high value-to-weight ratio. The improvements in logistics generated by unmanned aircraft will allow new business models, doing for local and small businesses what the shipping container and services like UPS and FedEx did for global trade.

But, I want to stress that what are likely to be the most important applications of unmanned aerial systems remain unknown, just as the most important internet applications were unknown when the internet first became commercialized.

We must, to the maximum extent possible, treat airspace with a very light regulatory touch. A regime of permissionless innovation in which there is a default position of innovation allowed will allow us to reap the greatest gains from unmanned systems. I urge every member of this committee to set aside the fearmongering that accompanies every new technology and embrace the possibilities for innovation and economic growth that commercial drones provide.

To be sure, permissionless innovation is a much more controversial proposition for the physical world of commercial drones than for abstract information on the internet. What if a drone collides with a passenger jet and takes down everybody on board? Fortunately, the best evidence shows that commercial drones do not pose a serious risk to the airspace.

To evaluate the danger that drones might pose to traditional aviation, my Mercatus colleague Sam Hammond and I examined 25 years' worth of wildlife strike data from the FAA. This dataset pro-

vides an excellent lens through which to view the possible danger that drones create for other aircraft.

U.S. national airspace is home to an estimated ten billion birds, and the FAA has reported over 160,000 wildlife strikes since 1990. Of those 160,000, only 12 strikes have resulted in human fatalities, and of those 12, only one incident involved a commercial flight and that incident involved not a bird, but a pair of white tailed deer loitering on a runway.

We estimate that a drone is likely to collide with other aircraft about once every 374,000 years of continuous operation, and using statistical analysis on the risk that birds of different weight pose to humans onboard aircraft, we estimate that a two kilogram, or 4.4 pound, drone will cause an injury to a human passenger every 187 million years of operation. This is well within the realm of acceptable risk.

Given that drones pose little risk to the airspace, the FAA's proposed drone regulations do not adequately protect the need for experimentation and innovation. For example, in its proposed regulations, the FAA does not allow drones to carry external loads. This means that operators may be prohibited from delivering items that do not fit within the drone's fuselage.

The FAA does not allow operators to exercise their see and avoid responsibilities through technological means, such as onboard cameras. This limits drone operations to the operator's line of sight, which will needlessly cripple drones' ability to operate over longer distances.

The FAA will not allow drones to operate outside the hours of sunrise and sunset.

The FAA has said that no one will be allowed to transport property for compensation via drone without filing for an Air Carrier Operating Certificate. This may be prohibitively expensive for companies that wish to create small local delivery services using drones.

The FAA has proposed a one drone per operator rule. This rule drastically raises the cost for small businesses of operating multiple drones.

Finally, the FAA has so far prohibited drone operation over populated areas. Some of the most promising applications of drones, such as local delivery services that improve the logistical capabilities of small businesses, may only make sense in populated areas. This prohibition will simply rule out those business opportunities.

As this committee considers how best to prepare for a future in which drones create new opportunities for small business, I urge you to insist upon a light touch regulatory environment for commercial drones.

Thank you for your interest in this issue and for the opportunity to testify.

[The prepared statement of Mr. Dourado follows:]



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TESTIMONY

CREATING AN ENVIRONMENT OF PERMISSIONLESS INNOVATION FOR UNMANNED AIRCRAFT

ELI DOURADO

Director, Technology Policy Program, Mercatus Center at George Mason University

Senate Committee on Small Business and Entrepreneurship

Hearing: Up in the Air: Examining the Commercial Applications of Unmanned Aircraft for Small Businesses

March 10, 2016

Mr. Chairman and members of the committee, thank you for inviting me here today to comment on commercial applications of unmanned aircraft for small businesses. My name is Eli Dourado and I am a research fellow at the Mercatus Center at George Mason University, where I study the regulation of emerging technologies and direct Mercatus's Technology Policy Program.

PERMISSIONLESS INNOVATION IN AIRSPACE

We are at an exciting point in the history of unmanned aircraft. I think of drones as occupying a similar position now as the Internet did in the late 1980s. As members of this committee know, until 1989, use of the Internet for commercial purposes was generally prohibited. The removal of that prohibition resulted in an explosion of innovation, much of it completely unanticipated, that has persisted until today.

As with the Internet in 1989, commercial use of drones is highly restricted, but will soon become generally available. And as with the Internet in 1989, we have only the vaguest idea of how drones will be used in daily life in the future.

That vague picture does include some applications that we already understand: using drones for photography and inspecting equipment, for evaluating the health of crops, for transporting goods with a high value-to-weight ratio. The improvements in logistics generated by unmanned aircraft will allow new business models, doing for local and small businesses what the shipping container and services like UPS and FedEx did for global trade.

But I want to stress that what are likely to be the most important applications of unmanned aerial systems remain unknown, just as the most important Internet applications were unknown when the Internet first became commercialized.

For more information or to meet with the scholar, contact
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The ideas presented in this document do not represent official positions of the Mercatus Center or George Mason University.

We must, to the maximum extent possible, treat airspace with a very light regulatory touch. A regime of “permissionless innovation,” in which there is a default position of “innovation allowed,” will allow us to reap the greatest gains from unmanned systems.¹ I urge every member of this committee to set aside the fearmongering that accompanies every new technology and embrace the possibilities for innovation and economic growth that commercial drones provide.

COMMERCIAL DRONES ARE NOT DANGEROUS

To be sure, permissionless innovation is a much more controversial proposition for the physical world of commercial drones than for abstract information on the Internet. What if a drone collides with a passenger jet and takes down everybody on board?

Fortunately, the best evidence shows that commercial drones do not pose a serious risk to the airspace. To evaluate the danger that drones might pose to traditional aviation, my Mercatus colleague Sam Hammond and I examined 25 years’ worth of wildlife strike data from the FAA.² This dataset provides an excellent lens through which to view the possible danger that drones create for other aircraft.

US national airspace is home to an estimated 10 billion birds, and the FAA has recorded over 160,000 wildlife strikes since 1990. Of those 160,000, only 12 strikes have resulted in human fatalities. And of those 12, only one incident involved a commercial flight—and that involved not a bird, but a pair of white-tailed deer loitering on a runway.

We estimate that a drone is likely to collide with other aircraft about once every 374,000 years of continuous operation. And using statistical analysis on the risk that birds of different weight pose to humans onboard aircraft, we estimate that a 2kg (4.4 pound) drone will cause an injury to a human passenger every 187 million years of operation. This is well within the realm of acceptable risk.

PROPOSED DRONE REGULATIONS REMAIN UNDULY RESTRICTIVE

Given that drones pose little risk to the airspace, the FAA’s proposed drone regulations do not adequately protect the need for experimentation and innovation.³

For example, in its proposed regulations, the FAA does not allow drones to carry external loads. This means that operators may be prohibited from delivering items that do not fit within the drone’s fuselage.

The FAA does not allow operators to exercise their see-and-avoid responsibilities through technological means, such as onboard cameras. This limits drone operations to the operator’s line of sight, which will needlessly cripple drones’ ability to operate over longer distances.

The FAA will not allow drones to operate outside the hours of sunrise and sunset. There are numerous possible drone applications that might benefit from nighttime operation. For example, consider the use of thermal imaging in a search-and-rescue operation. This would be more useful at night, when the ambient temperature is most different from human body temperature.

1. Adam Thierer, *Permissionless Innovation* (Arlington, VA: Mercatus Center at George Mason University, 2014).

2. Eli Dourado and Samuel Hammond, “Do Consumer Drones Endanger the National Airspace? Evidence from Wildlife Strike Data” (Mercatus on Policy, Mercatus Center at George Mason University, Arlington, VA, March 2016).

3. Eli Dourado, Ryan Hagemann, and Adam Thierer, “Operation and Certification of Small Unmanned Aircraft Systems” (Public Interest Comment, Mercatus Center at George Mason University, Arlington, VA, April 24, 2015). (This public interest comment is attached below.) Separately from the proposed commercial drone regulations, the FAA has instituted an unprecedented and illegal registration requirement for model aircraft operators. In addition to subverting the clear intent of Congress, I fear that the agency will discourage potential new drone operators from getting hands-on experience with this exciting technology. Eli Dourado and Samuel Hammond, “Registration and Marking Requirements for Small Unmanned Aircraft” (Public Interest Comment, Mercatus Center at George Mason University, Arlington, VA, January 15, 2016).

The FAA has said that no one will be allowed to transport property for compensation via drone without filing for an air carrier operating certificate. This may be prohibitively expensive for companies that wish to create small, local delivery services using drones.

The FAA has proposed a “one drone per operator” rule, essentially rejecting the idea that onboard computers might be used to pilot drones in general, with a human operator ready to intervene if any one of, say, a dozen drones encounters an unexpected situation. This rule drastically raises the cost for small businesses of operating multiple drones.

Finally, the FAA has so far prohibited drone operation over populated areas. Some of the most promising applications of drones, such as local delivery services that improve the logistical capabilities of small businesses, may only make sense in populated areas. This prohibition will simply rule out those business opportunities.

CONCLUSION

As this committee considers how best to prepare for a future in which drones create new opportunities for small business, I urge you to insist upon a light-touch regulatory environment for commercial drones. Thank you for your interest in this issue and for the opportunity to testify.



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PUBLIC INTEREST COMMENT

OPERATION AND CERTIFICATION OF SMALL UNMANNED AIRCRAFT SYSTEMS

Eli Dourado, Ryan Hagemann, and Adam Thierer

Agency: Federal Aviation Administration

Proposed: February 23, 2015

Comment period closes: April 24, 2015

Submitted: April 24, 2015

RIN: 2120-AJ60; Docket No.: FAA-2015-0150; Notice No. 15-01

As part of the FAA Modernization and Reform Act of 2012 (FMRA), Congress ordered the Federal Aviation Administration (FAA) to integrate unmanned aircraft systems (UASs)—sometimes referred to as drones—into the National Airspace System (NAS) by September 2015.

The Technology Policy Program (TPP) of the Mercatus Center at George Mason University is dedicated to advancing knowledge of the impact of regulation on society. It conducts careful and independent analyses employing contemporary economic scholarship to assess rulemaking proposals from the perspective of the public interest. As such, this comment on the FAA's proposed UAS rule does not represent the views of any particular affected party or special interest group but is designed to assist the administration as it carries out Congress's mandate to safely integrate UASs into the National Airspace System.

SUMMARY

In this notice of proposed rulemaking (NPRM), the FAA proposes to adopt rules to integrate some small UASs into the national airspace. While this action is welcome, we believe it is unduly cautious in some respects. As far as possible, we advocate an environment of “permissionless innovation” to reap the greatest benefit from our airspace. The FAA's rules do

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not foster this environment. In addition, we believe the FAA has fallen short of its obligations under Executive Order 12866 to provide thorough benefit-cost analysis. We point out some shortcomings in the FAA's regulatory evaluation. Finally, we conclude with assorted comments on the FAA's proposed rules, including areas in which we support the FAA's approach.

PERMISSIONLESS INNOVATION AS A GENERAL APPROACH

We are currently living in an age of wondrous innovation. Among the most promising developments is commercial UAS technologies, which have captured the public interest for their potentially life-altering prospects. The entire economy stands to benefit in some capacity from this rapidly developing field of technology.

The FAA's proposed rules for UAS integration and commercialization place significant restrictions on some of the most beneficial aspects of this new and exciting technology. If the United States is to be a world leader in unmanned technologies, the FAA must adopt a flexible regulatory approach to this field. An overly precautionary approach will discourage the many benefits associated with this rapidly evolving class of aerial technologies.

As Mercatus scholars noted in an April 2013 filing to the FAA, "Like the Internet, airspace is a platform for commercial and social innovation."¹ Indeed, some of America's most innovative Internet companies, including Google,² Amazon,³ and Facebook⁴ are already experimenting with UASs. But it is impossible to know now what additional creative applications await. Only time and the freedom to experiment with new and better ways of using these technologies will provide an answer to that question. Unfortunately, these companies have so far been exporting their development of these technologies abroad because of the uncertainty of the regulatory environment here in the United States.⁵

That is why humility and flexibility must be the touchstones of the FAA's approach to these issues. A recent book by Adam Thierer highlighted the benefits of adopting a policy disposition

1. Jerry Brito, Eli Dourado, and Adam Thierer, "Comments of the Mercatus Center to Federal Aviation Administration in the matter of Unmanned Aircraft System Test Site Program," Public Interest Comment, Mercatus Center at George Mason University, Docket No: FAA-2013-0061, April 23, 2013, <http://mercatus.org/publication/federal-aviation-administration-unmanned-aircraft-system-test-site-program>; Eli Dourado, "The Next Internet-Like Platform for Innovation? Airspace. (Think Drones)," *Wired*, April 23, 2013, <http://www.wired.com/opinion/2013/04/then-internet-now-airspace-dont-stifle-innovation-on-the-next-great-platform>.

2. Alistair Barr and Greg Bensinger, "Google Is Testing Delivery Drone System," *Wall Street Journal*, August 29, 2014, <http://online.wsj.com/articles/google-reveals-delivery-drone-project-1409274480>; Thomas Claburn, "Google Has Plans For Titan Drones," *Information Week*, April 15, 2014, <http://www.informationweek.com/mobile/mobile-devices/google-has-plans-for-titan-drones/d/d-id/1204456>.

3. Harrison Weber, "Amazon Seeks Approval to Test Drone Deliveries in 30 Minutes or Less," *Venture Beat*, July 11, 2014, <http://venturebeat.com/2014/07/11/amazon-seeks-approval-to-test-prime-air-drone-deliveries-in-30-minutes-or-less>.

4. Issie Lapowsky, "Facebook Lays Out Its Roadmap for Creating Internet-Connected Drones," *Wired*, September 23, 2014, <http://www.wired.com/2014/09/facebook-drones-2/>.

5. Adam Thierer, "Global Innovation Arbitrage: Commercial Drones and Sharing Economy Edition," *Technology Liberation Front*, December 9, 2014, <http://techliberation.com/2014/12/09/global-innovation-arbitrage-commercial-drones-sharing-economy-edition>.

of “permissionless innovation” in this and other areas.⁶ This phrase refers to the notion that experimentation with new technologies and business models should generally be permitted by default.⁷

Permissionless innovation has been the primary driver of entrepreneurialism and economic growth in many sectors of the economy, most notably the Internet and the digital economy.⁸ As an open and lightly regulated platform, the Internet allows entrepreneurs to experiment with new business models and offer new services without seeking the blessing of regulators beforehand.

Generally speaking, this same model can and should guide policy decisions in other sectors, including the nation’s airspace.⁹ While safety-related considerations can merit some precautionary policies, it is important that those regulations leave ample space for unpredictable innovation opportunities. In light of this imperative, our comments focus on whether several of the restrictions in the proposed rule pass benefit-cost analysis, particularly when the unpredictable nature of innovation is taken into account.

INADEQUATE COST-BENEFIT ANALYSIS

Executive Order 12866 §1(a) states:

Federal agencies should promulgate only such regulations as are required by law, are necessary to interpret the law, or are made necessary by compelling public need, such as material failures of private markets to protect or improve the health and safety of the public, the environment, or the well-being of the American people. In deciding whether and how to regulate, *agencies should assess all costs and benefits of available regulatory alternatives*, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and *qualitative measures of costs and benefits that are difficult to quantify*, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches, agencies should *select those approaches that maximize net benefits* (including potential

6. Adam Thierer, *Permissionless Innovation: The Continuing Case for Comprehensive Technological Freedom* (Arlington, VA: Mercatus Center at George Mason University, 2014).

7. Adam Thierer, “Why Permissionless Innovation Matters,” *Medium*, April 24, 2014, <https://medium.com/challenging-the-status-quo/257e3d605b63>.

8. Vinton Cerf, “Keep the Internet Open,” *New York Times*, May 24, 2012, <http://www.nytimes.com/2012/05/25/opinion/keep-the-internet-open.html>.

9. L. Gordon Crovitz, “Drones Cleared for Takeoff,” *Wall Street Journal*, <http://online.wsj.com/news/articles/SB10001424052702304914904579441052310129582>, March 16, 2014, (“Washington’s refusal to allow drones to take off is a reminder that most industries in the U.S. remain hostage to slow-moving, risk-averse regulators. The freedom to innovate without asking permission should become the rule for all U.S. industries, not the rare exception.”); Eli Dourado, “‘Permissionless Innovation’ Offline as Well as On,” *Umlaut*, February 6, 2013, <http://theumlaut.com/2013/02/06/permissionless-innovation-offline-as-well-as-on/>. (“Advocates of the Internet are right to extol the permissionless innovation model—but they are wrong to believe that it need be unique to the Internet. We can legalize innovation in the physical world, too. All it takes is a recognition that real-world innovators should not have to ask permission either.”)

economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach. [emphasis added]

While the FAA's NPRM is accompanied by a regulatory evaluation that includes benefit-cost analysis, the analysis does not meet the standard required by Executive Order 12866. In particular, it fails to consider *all* costs and benefits of available regulatory alternatives.

ALTERNATIVES THE FAA CONSIDERED

- In Alternative 1, the FAA considered and rejected the possibility of allowing small unmanned aircraft to conduct **external-load operations**. The FAA states that the flight characteristics of aircraft carrying external loads pose additional risks and “may require” airworthiness certification. However, the FAA supplies no discussion of the benefits of allowing small unmanned aircraft to conduct external-load operations (without airworthiness certification).

We believe that UASs carrying external loads would displace those loads from being transported by automobiles and trucks, and could therefore transform a multi-billion-dollar industry. While the FAA is concerned about the risks of parcels being jettisoned by UASs, additional automobile traffic on our roads has safety costs as well. Consequently, it is a benefit to society that UASs carrying external loads would reduce the rate of automobile accidents.

Nationwide there are 1.11 motor vehicle fatalities per 100 million vehicle miles traveled.¹⁰ To date, there have not been any reports of fatalities due to jettisoned parcels from UASs. Accordingly, parcel-for-parcel, it may be safer to transport goods via UAS external-load operations than to do so in the current manner on delivery trucks.

On our reading of Executive Order 12866, the FAA is required to explicitly make this comparison (“assess all costs and benefits”). Furthermore, as UASs are already being used in other jurisdictions, such as Germany, to transport goods, the FAA should take advantage of the experience in those jurisdictions to inform its analysis.¹¹ It seems unlikely that other governments are putting their populations in unbearable danger from jettisoning parcels.

- In Alternative 4, the FAA considered and rejected permitting a UAS operator “to exercise his or her **see-and-avoid responsibilities through technological means**, such as onboard cameras.” The FAA determined that the technology required to substitute for human vision does not yet exist. Proposed Rule 107.31

10. <http://www.iihs.org/iihs/topics/t/general-statistics/fatalityfacts/state-by-state-overview>.

11. Alex Hern, “DHL Launches First Commercial Drone ‘Parcelcopter’ Delivery Service,” *The Guardian*, September 25, 2014, <http://www.theguardian.com/technology/2014/sep/25/german-dhl-launches-first-commercial-drone-delivery-service>.

would therefore require an operator or observer “to see the unmanned aircraft throughout the entire flight.”

Washington Post reports that during the present rule-making period, “[i]t’s likely that . . . companies will make significant advances in sense-and-avoid technologies, which could make flying outside of a pilot’s line-of-sight safe.”¹² Intel demonstrated technology at CES 2015 that enabled their unmanned aircraft to avoid obstacles and other unmanned aircraft.¹³ Other companies are working on artificial intelligence that will provide the drones with the ability to “process visual data in real-time to avoid a tree, bird or building in their path.”¹⁴ By the time this rulemaking is complete, it is likely that technology will be available to commercial UAS operators to safely integrate their aircraft into the airspace without a visual line-of-sight (VLOS) requirement.

If the rules require UASs to operate within VLOS constraints, some of the greatest benefits of this technology will never materialize. For example, it will be impracticable to use UASs for delivery via line of sight. If the operator must move along with the payload, then the operator might as well carry the payload himself and dispense with the UAS. The FAA has not considered the benefits of allowing UASs to operate beyond line-of-sight, only the risks. Consequently, we believe that here, too, the FAA is operating outside of the requirements of Executive Order 12866.

- In Alternative 5, the FAA considered and rejected allowing small UASs to operate outside the **hours of official sunrise and sunset**, and Proposed Rule 107.29 would forbid operating “a small unmanned aircraft system except between the hours of official sunrise and sunset.” Daylight-only operational constraints do not take account of the ability for advanced sensor suites to compensate, even in dark conditions, for diminished line-of-sight. Regulations dictating the need for fluorescent markers or blinking lights—much the same as one would find on moored balloons and kites operating at night under FAA regulations (14 CFR 101.17)—would likely suffice to ensure adequate safety during night operations.

Again, the FAA did not explicitly consider the benefits of allowing nighttime operation of UASs. Thermal imaging could make UASs more useful for search-and-rescue operations during the night, when the ambient temperature is most different from human body temperature. There may be other cases, such as agricultural use, where nighttime operation is preferable. We believe the FAA is required by law to consider these benefits.

12. Matt McFarland, “Why Drone Enthusiasts Can Be Optimistic about the FAA’s Proposed Rule on Line of Sight,” *Washington Post*, February 17, 2015, <http://www.washingtonpost.com/blogs/innovations/wp/2015/02/17/why-drone-enthusiasts-can-be-optimistic-about-the-faas-proposed-rule-on-line-of-sight>.

13. *Ibid.*

14. *Ibid.*

ALTERNATIVES THE FAA DID NOT CONSIDER

- The FAA asserts that UASs are “aircraft” under 49 U.S.C. 40102(a)(6)’s definition of “any contrivance invented, used, or designed to navigate or fly in the air.” As 49 U.S.C. 44101(a) provides that “a person may operate an aircraft only when the aircraft is registered,” the FAA asserts that **registration of UASs** is required by statute.

We question whether this is really necessary under the law. For example, despite the fact that ultralight vehicles are contraptions used to fly in the air, 14 CFR 103.7(c) holds: “Notwithstanding any other section pertaining to registration and marking of aircraft, ultralight vehicles are not required to be registered or to bear markings of any type.” If the FAA may authorize an exemption from this requirement for ultralight vehicles, then it might also consider whether similar treatment is possible for UASs. We note that the FAA’s reading of the statute in this NPRM appears to also ban unmarked and unregistered paper airplanes.

If the FAA determines that it has more flexibility with regard to registration than it initially stated, then it must consider all the benefits and costs of requiring registration of UASs. We note especially the costs in terms of discriminating against foreign operators and investment in the US UAS marketplace. The requirement to register aircraft in the United States has the effect of limiting “the scope of this rulemaking to U.S.-registered aircraft” (NPRM at 43-44). To the extent the United States hopes to become a hub for UAS research and investment—as it has been for the Internet and other modern technologies—these restrictions must be relaxed. Elimination of the registration requirement, therefore, would increase foreign participation in the domestic UAS market, a clear economic benefit.

- The FAA asserts that federal statute prohibits the transportation of property by air for compensation without an **air carrier operating certificate**, citing 49 U.S.C. 44711(a)(4). The FAA notes that related sections of the law, such as 49 U.S.C. 44711(a)(1), which requires an airworthiness certificate, and 49 U.S.C. 44711(a)(2)(A), which requires an airman certificate, “do not take into account the considerations associated with civil small UAS” (NPRM at 24), occasioning the FAA Modernization and Reform Act and this rulemaking. In footnote 8, the FAA baldly asserts that the requirements of 49 U.S.C. 44711(a)(4) are nevertheless outside of the scope of this rulemaking.

We question this interpretation. If 49 U.S.C. 44711(a)(1) and 49 U.S.C. 44711(a)(2)(A) are open for modernization and reform through this rulemaking as authorized by the FMRA, then so ought to be the adjacent 49 U.S.C. 44711(a)(4). Therefore, the FAA should consider the benefits and costs of continuing its practice of applying the air carrier designation to UASs that transport property for compensation.

We do not believe there are significant benefits to this practice. The costs are substantial: the continued delay of the integration of UAS delivery services into

the airspace. As noted above, these services operate safely and profitably in other jurisdictions, such as Germany. Therefore, we urge the FAA to modernize this practice by not requiring air carrier certification for UAS-based services for commercial transportation.

- Proposed § 107.35 requires that “A person may not act as an operator or visual observer in the operation of **more than one unmanned aircraft system at the same time.**” The FAA does not consider the benefits of allowing fully or partially autonomous UASs to operate on the basis of a single operator for multiple aircraft. Such a rule would drastically lower the cost of operating a large fleet of unmanned aircraft. Existing and developing technologies can more than compensate for the diminished concentration that operators might apply to each individual aircraft.
- Proposed § 107.39 prohibits the **operation of small unmanned aircraft over people not involved in the operation.** The FAA does not consider the benefits of allowing UAS operations over persons not involved in the operation. We anticipate that many creative and valuable uses of UASs will develop in urban areas, where greater density enables higher benefits from drone-based transportation of goods.

Moreover, the FAA overstates the risks of operation in populated areas. Upon loss of positive control, unmanned aircraft can be programmed to safely return to a base, or to simply hover in place. The risk to bystanders can therefore be mitigated without a ban on operation over uninvolved persons. The FAA should therefore consider an alternative where operations over nonparticipants is allowed.

The FAA has also failed to conduct another important requirement of federally mandated cost-benefit analysis. Pursuant to OMB’s *Circular A-4*, issued in September 2003 to operationalize Executive Order 12866,¹⁵ “[a] clear identification of a range of regulatory approaches” is required “including the option of not regulating.”¹⁶ Agencies must also consider other alternatives to federal regulation, such as “State or local regulation, voluntary action on the part of the private sector, antitrust enforcement, consumer-initiated litigation in the product liability system, and administrative compensation systems.”¹⁷

The FAA has ignored such alternatives. For example, the agency should consider whether tort liability is sufficient to ensure that operations over non-participants are conducted with efficient levels of safety. UAS operators could simply be held liable in court for damages that they cause through accidents, much as automobile drivers can be held liable for their damages. Traditionally, the common law has dealt with products liability and accident compensation in an evolutionary

15. See Office of Management and Budget, *Circular A-4* (2003), available at <http://www.whitehouse.gov/sites/default/files/omb/assets/omb/circulars/a004/a-4.pdf>.

16. *Ibid.*

17. *Ibid.*

way through a variety of mechanisms, including strict liability, negligence, design defects law, failure to warn, and breach of warranty.¹⁸ There is no reason to think that new legal standards for UAS-related controversies cannot evolve gradually through a body of common law cases, as they have for many other technologies.¹⁹

OTHER MATTERS

- We support the FAA's proposed **micro UAS classification scheme**. However, we believe that it is unnecessarily conservative in some aspects. For example, under the FAA's current proposal, operation would be limited entirely to Class G airspace, more than 5 miles away from an airport. As the FAA states, this limitation "would significantly reduce the risk of collision with another aircraft" (NPRM at 58). If the FAA also allowed operation at lower altitudes in other airspaces and closer to airports, there would be minimal added risk of in-air collisions.

For example, operation below 100 feet above ground level (AGL) even 1 mile away from an airport would pose little additional risk. Assuming that aircraft use an approach slope of or greater than 1.085 degrees, this less-conservative restriction would avoid any chance of a collision. As approach slopes are usually around 3 degrees, it seems possible to safely integrate micro UASs into airspaces less than 5 miles from an airport.

In addition, the restriction on the use of automation for micro UASs, although recommended by ARC and in place in Canada, seems short-sighted. We anticipate that autonomous UASs will be safer than human-piloted UASs and that the economic benefits associated with future automated systems will be significant. Therefore, we would urge the FAA to reconsider this restriction.

- We support the Secretary's determination that small UASs should not be subject to **airworthiness certification**.
- We support the FAA's proposal not to require UAS operators to obtain a **commercial pilot certificate**. We fully agree with the statement that "requiring persons wishing to operate a small UAS to obtain a private or commercial pilot certificate imposes the cost of certification on those persons, but does not result in a

18. See John Villasenor, "Products Liability and Driverless Cars: Issues and Guiding Principles for Legislation," Brookings Institution, 2014, at 7-14, <http://www.brookings.edu/research/papers/2014/04/products-liability-driverless-cars-villasenor>, archived at <http://perma.cc/UH34-9C4R>.

19. John Villasenor, "Who Is at Fault When a Driverless Car Gets in an Accident?," *The Atlantic*, April 25, 2014, <http://www.theatlantic.com/business/archive/2014/04/who-is-at-fault-when-a-driverless-car-gets-in-an-accident/361250>, archived at <http://perma.cc/NWV9-2RWR>. ("[W]hen confronted with new, often complex, questions involving products liability, courts have generally gotten things right. . . . Products liability law has been highly adaptive to the many new technologies that have emerged in recent decades, and it will be quite capable of adapting to emerging autonomous vehicle technologies as the need arises.")

significant safety benefit because the process of obtaining the certificate does not equip those persons with the tools necessary to mitigate the public risk posed by small UAS operations” (NPRM at 27-28).

- We were surprised to see that the proposed rules are being put forward **pursuant to § 333, and not § 332**, of the FMRA. Section 332(b)(1) refers to § 333 as enabling “expedited operational authorization.” Meanwhile, it is § 332 that directs the FAA to conduct a rulemaking.

The FAA has a statutory obligation to permanently integrate civil UASs into the airspace by September 30, 2015, pursuant to § 332. We question whether the FAA is moving fast enough to meet this obligation.

- The NPRM fails to provide clear **guidance on UAS activities of an academic, noncommercial, and humanitarian nature**. Drones have already been widely used for a wide variety of such activities, including search-and-rescue efforts, newsgathering, and even political activism. Such activities have clear life-enriching benefits that the agency fails to identify. Worse yet, by leaving their legal status uncertain, it could discourage such activities in the future. In the case of noncommercial newsgathering operations, we would remind the agency that First Amendment values might be implicated by overly restrictive regulations on such activities.²⁰

CONCLUSION

Until now, the vast majority of innovation in the UAS space has been occurring overseas. UASs could be one of the first emerging technologies in decades in which the United States does not possess a global competitive advantage in innovation and deployment. In many other countries around the world, including France, Germany, Australia, and Japan, blanket permission is granted to small drones weighing less than five pounds. These countries are already reaping the economic benefits of commercial drones.²¹

The FAA must carefully consider the potential effect of UASs on the US economy. If it does not, innovation and technological advancement in the commercial UAS space will find a home elsewhere in the world. Many of the most innovative UAS advances are already happening abroad, not in the United States. If the United States is to be a leader in the development of UAS technologies, the FAA must open the American skies to innovation.

20. Cynthia Love, Sean Lawson, and Avery Holton, “News from Above: First Amendment Implications of the Federal Aviation Administration Ban on Commercial Drones,” *Boston University Journal of Science & Technology Law*, forthcoming.

21. Joan Lowy, “Other Countries Are Surpassing the US in Commercial Drone Flights,” Associated Press, PBS.org, 10 December 2014, <http://www.pbs.org/newshour/rundown/countries-surpassing-us-commercial-drone-flights/>.

Senator AYOTTE. Thank you, Mr. Dourado.

I want to thank all of you for being here. I chair the Aviation Subcommittee in the Commerce Committee, and this has been an issue that we are very interested in addressing and, in fact, just yesterday dropped a draft of the FAA reauthorization that includes in it some, I think, some important ways to integrate unmanned aircraft systems into our national airspace system, and I want to thank Senator Booker, because he has been very focused on this issue and making sure that we continue to reform our framework for handling UAS to spur innovation while also we need to make sure that we protect safety and privacy. So, I really appreciate your leadership on this issue, and we were able to incorporate several of your ideas, and I am sure there is more that we can do as we move forward with the FAA reauthorization.

So, I wanted to ask all of you if you have had a chance yet to review our draft that has been proposed legislation, or if you are still analyzing it, and what your thoughts are.

Mr. WYNNE. I will go first. We are still analyzing it, Senator. Thank you very much. But, we were very pleased, and I put out a statement yesterday saying we were pleased to see that—I mean, there are many things in the bill. But, the pieces that we, in particular, have been asking for from AUVSI's perspective, the unmanned systems community's perspective, we believe are there, and we are speaking specifically of a risk-based technology neutral regulatory framework, addressing of UTM, for example, unmanned aircraft systems traffic management, as an opportunity, trying to pull together the research that is going on in disparate areas of the government into a more concentrated effort so that we can increase the collaboration with industry and get the most for the taxpayers' dollar.

So, we think it is a really good initiative and we urge you to move forward with that.

Senator AYOTTE. Yeah. I mean, one of the things that I am concerned about is that there are some really terrific technologies that I have seen, including crash avoidance technology that is being developed, and we need to have opportunities to continue to spur that innovation, because you can incorporate the safety concerns with some of the technological developments.

Captain, I wanted to get your thoughts.

Mr. CANOLL. Thanks, Senator. We are still reviewing the bill, but our initial view is we view this as a safety forward bill and we are very pleased that it is out.

Senator AYOTTE. Good.

Mr. CANOLL. We are very encouraged by what we have read so far, and particularly the commitment to doing all the safety initiatives, or starting the way down the road on a lot of these safety initiatives, and it is particularly the UAS. We think there is some good information there, as well. So, we will continue to review—

Senator AYOTTE. Great. Well, we appreciate it, and I know that it just came out, so you are still continuing to review the details. But, this is something we want to address. We are worried that delaying on it really will continue to keep these issues outstanding for UAS in terms of the innovation piece, because as Mr. Dourado

has pointed out, the framework currently in place is not workable on innovation, but also a lot of safety issues. So, working on both.

Mr. Dourado, do you have any comments?

Mr. DOURADO. Yes. Thank you, Senator. I have reviewed the bill very, very briefly. I was gratified to see that it is extending the 333 exemption process and also making clear that the FAA does have authority to extend authorization for beyond line of sight and outside the hours of sunrise and sunset.

I would note that in addition to the 333 process, there is a 332 process that the FAA has avoided, and even their current proposed commercial rules that were due last September, Congress had ordered them to be done under Section 332 and the FAA is promulgating those—continues to promulgate those only under Section 333. So, asking the FAA to move forward more quickly on 332 authorization would be important, in my view, as well.

Senator AYOTTE. Okay. Thank you for the feedback. I appreciate it very much.

One of the things that, you know, I have been hearing, and I know that Senator Booker raised this, is that we hear that other countries are ahead of us in providing a regulatory environment for UAS innovation. So, that is one of the priorities, I think, that we have, obviously, ensuring that we are protecting safety at the same time. So, can you tell me—Mr. Wynne, can you comment on where other countries are vis-à-vis the United States of America, and, you know, what opportunities we have if we can move forward with the right framework here.

Mr. WYNNE. Well, ultimately, we do want global harmonization of rules. That will be particularly important for larger platforms that are going to travel across international borders, of course, and so far, these are the kinds of platforms that are getting the vast majority of the attention. But, we have many different types of platforms that we need to be thinking about, and that is why we are talking about a regulatory framework. Some of our platforms are enormous and fly above 60,000 feet for days on end, for example, and may be able to deliver the internet to the Third World in a much more efficient manner than trying to use wires.

So, there is a lot of different innovation that is going to go on here. I, too, am very concerned about competitiveness. We watch this issue very, very carefully. There are clearly anecdotes—there are anecdotal places around the world where there is less regulation or they have moved forward with regulation a little bit faster than we have.

I think if we can move forward with the same kind of cadence that we saw with the registration process, which AUVSI participated in—both Captain Canoll and I were there with Secretary Fox when that was announced, and we urged the FAA to move very, very quickly, and they did. If we can increase the pace of regulation, I think we can catch back up, and this is the largest market for unmanned systems, so I like our chances of remaining competitive.

Senator AYOTTE. Does anyone else want to comment on that issue?

Mr. DOURADO. I would like to, Senator. I think that Canada is governing circles around us right now. In Canada, up to a 25 kilo-

gram drone you can fly without any special authorization for commercial purposes if you simply notify Transport Canada of your intention to do so. So, you simply give them notice that you are operating within a certain range of exemptions and you can operate. So, it is a much more simplified, pro-innovation stance from the Canadian government.

Mr. CANOLL. The only thing I would add, Senator, is our members are seeing—are reporting and encountering the same problems at other high-density population centers around the globe as they do in the United States. In the low-density population areas, like Canada, we do not see it as much because they are just not as prevalent and the aircraft operations are far fewer. So, we do see problems in London, Paris, around the globe.

Senator AYOTTE. Thank you.

I would like to call on Senator Booker.

Senator BOOKER. So, a perfect—first of all, Senator Ayotte, I am grateful for your kind words and I just think that for the record I want to say that yesterday morning was a perfect metaphor for the United States versus the rest of the world. As I was running past you on the Mall, I was the United States, slow, sluggish, barely moving off the ground—

[Laughter.]

You were obviously the innovative countries around the globe, because you flew past me at a speed—

[Laughter.]

Senator AYOTTE. Okay, but in fairness, he had what looked like a heavy backpack on his back, which I did not.

Senator BOOKER. So, the backpack is empty just so I get people to assume that I am running so slow for a reason.

[Laughter.]

So, I have outed myself, but please understand that. It was a very humiliating moment for me yesterday. I did not want to be seen, and I was outed by my fellow Senator.

Gentlemen, I am grateful for you being here, and I actually do not think there is much, Captain Canoll, which as a New Jerseyan, which has an incredibly great Italian community, to let your name be one vowel short of one of my favorite desserts.

[Laughter.]

I am very, very grateful that you are here, and I actually do not think there is any—there is much conflict between what you are saying. I think all the panelists here believe that we should be a nation that makes sure that we are safe. And, the Air Line Pilots Association, I work with quite a bit, and just revere the men and women that do—many of them former military people who have made a tremendous sacrifice and commitment to our country. So, I am just grateful for everybody being here.

I just want to dive in real quick. First of all, Mr. Dourado, what you said is one of the most important points in my understanding of the cycle of innovation, is that we routinely underestimate the impact, the economic impact, when we have a new innovation. We really never see the true potential of that impact. Everybody wants to start talking about what this new innovation can do, but nobody gets, from the automobile to the television to—if you look at the things that were said in those early technologies, they had no clue

about how transformative they would be and how much economic growth would be.

So, your metaphor in comparing this to the internet, to me, is spot-on, and not an exaggeration. Am I right?

Mr. DOURADO. Yes, Senator, and I would note even Paul Krugman, who is a great economist, as late as 1998 was predicting that the internet would have no more economic impact than the fax machine.

Senator BOOKER. Right.

Mr. DOURADO. And, it is not—you know, he is a great economist, deserved of his Nobel Prize, and he even as late as 1998 was unable to see everything that the internet would be able to provide, so——

Senator BOOKER. You are a braver man than me. I would never smack talk a Nobel Prize winner——

[Laughter.]

So, let us just go where you are right now. I think Captain Canoll said it clearly, that other European high-density airports are seeing the same problems, not more. They have better regulatory regimes for innovation. They are not seeing an increased problem. They are seeing basically the same problems we are having.

Mr. CANOLL. I am not sure if the statistics would prove that out, because we are not sharing information as much as we should. That is a great point, that we should be looking across other regulatory agencies to gather their information and do some comparison.

Senator BOOKER. Right, and so that is a really good point and I think that is important. We should collect data. As you agree, data is important.

But, what I really want to jump into is even what the other countries are doing so much better than us, and even in our FAA legislation we just introduced, is we are burdening businesses with multiple—each and every different use case, they are going to have to run to the government to get yet another exception, while what other countries are doing, and it is not just Canada—which we should speak nicely about because I hear Trudeau is close by—but it is not just Canada. It is France, dense country, big cities. They are doing one time going to the government, creating a use case. But they are not creating the differentiations we are between weight. Is that not so much easier and still allows us to have the kind of governmental scrutiny on safety that we want?

And, in the last minute that I have, I would like, Mr. Wynne, Mr. Dourado to comment, please.

Mr. WYNNE. Well, I completely agree, Senator, and it is clear. I started—I stopped trying to figure out what new applications for this technology a long time ago and I started trying to think of how it would not be utilized and what segments of the U.S. economy would not benefit from unmanned systems.

And, again, we are talking about all manner of things. Some of them can be created on 3-D printers very, very rapidly. So, we need to have a system that allows for us to move forward with that. But, at the same time, we are integrating into an airspace which has a very low margin of safety——

Senator BOOKER. So, if I may interrupt——

Mr. WYNNE. Please.

Senator BOOKER [continuing]. Because I have got 20 seconds left, and the Chairman is very rough. So, real quick. Why do we have to have multiple check-ins for every new case use as opposed to other countries which do it once, far less burdensome, far less systems, and far less restriction to small businesses?

Mr. DOURADO. I think that is a great question, Senator, and I would like to see more done on an ex post basis. So, obviously, there will be accidents occasionally with unmanned systems, but we can handle them the same way we handle car accidents, with cases potentially being litigated in court rather than with ex ante precautionary regulation. So, I would like to see us moving more towards that ex ante dispute resolution mechanism rather than ex pose—or, I am sorry, ex post dispute resolution mechanism rather than ex ante prohibitions and regulatory prohibitions.

Senator BOOKER. Thank you. Thank you very much.

Thank you, Chairman.

Senator AYOTTE. Thank you, Senator Booker.

Senator Heitkamp.

Senator HEITKAMP. Thank you, Madam Chairwoman. It is good to see you here.

I think many people on this panel understand the contribution that North Dakota is making to this entire industry. In fact, the New York Times, I think, called us the Silicon Valley of unmanned systems because we have that perfect marriage of an airbase that has a number of these systems based out of that airbase, a university that basically is one of the great aviation universities in the country, and a community that is wholly embracing and supporting, along with our extended use lease, building out these technologies. So, this is a very important industry potential for the State of North Dakota.

But, we also know how important it can be to precision agriculture, how important it can be to monitoring infrastructure, whether it is a pipeline leak or whether it is a power line failure. So, we see these uses in only that big of a lens.

But, I want to confirm what Mr. Dourado said about Canada. I recently met with a researcher from UND. She was researching wildlife, could have done it in North Dakota, ended up going to Canada because she was using unmanned aircraft to do the monitoring and it was much easier to get the permissions and the authorizations in Canada.

And, so, we need to remember that it is not just building out this technology of the platform, but we are also losing the innovation of the utilization of this platform for all of these other uses, and so we have got to catch up.

With that said, there has been a lot of focus today on safety, which obviously has to be job one. I asked what the FAA's resistance is, why do we wait and wait and wait for integration, and I think that no one wants to be the person who authorizes something that leads to a catastrophe, and so there is a natural pulling back or inability to kind of think about it more broadly.

But, I want to talk about another challenge with this technology and that is privacy. You know, we had the very high profile case

of somebody who shot down a remotely piloted aircraft or an unmanned aircraft. Obviously, I think that if they shot it down, it probably was flying lower than what the person who owned it was saying it was flying. But, we have got to not only catch up in terms of the regulatory world, but the legal world in terms of who owns the airspace, what is an appropriate distance for this aircraft, and how do we make the world comfortable, and certainly in the United States, my farmers and ranchers comfortable with this utilization.

Where do you see that? I guess I would ask Mr. Dourado, where do you see the privacy implications evolving to the point where this technology will be more accepted?

Mr. DOURADO. Well, Senator, I think that the privacy issues are different in degree than the privacy issues we have seen in the past, but they are not different in kind. So, there were privacy concerns when cameras first became available. There is a famous law review article in 1890 from the Harvard Law Review on the right to privacy and fearmongering about cameras, and now we all have cameras and we somehow get along.

But, it is an important—privacy is an important issue, and I think it will be resolved through court cases. The Supreme Court in 1946 issued a very important ruling when regular aviation was taking off establishing the property rights—

Senator HEITKAMP. To airspace.

Mr. DOURADO. To airspace, saying that you could not interfere with the use of a property. So, I think that applying that same precedent from 1946, which was very flexible, to the modern world, as long as you are not interfering with a person's use of their property, then you are not interfering. And that could be interpreted to include privacy harms, as well. It already exists under the law.

Senator HEITKAMP. I think we are going to have a really hard time with that kind of vague definition of what is airspace ownership. You know, obviously, if someone believes that they have a commercial right to privacy in terms of what they are growing, in terms of what they are raising, and someone thinks, no, I am the USDA and I am going to fly—I mean, I am going to test what is happening on the ground, and I am going to tell you what your crop looks like, that is a problem for a lot of ranchers and farmers.

And, so, what I am suggesting is that we need to broaden the dialogue here beyond safety, and we need to talk about how we manage this new technology in that privacy space. And, I think that is something that we have not done all that well.

In North Dakota, one of the things that we have been able to do is put together a committee that not only talks about when should you be able to basically deploy this resource, but what do you do with the data afterwards, and the for instance is, we send one up to monitor traffic out of the hockey arena, which is a big deal. I know you guys do not believe that, but it is a big deal.

[Laughter.]

Monitor traffic out of the hockey arena and then you do not need that information, so that information gets deleted out of the system and not stored. And, so, those are the challenging questions that are being asked in terms of data collection and in terms of information, and I think we need to have a broader discussion beyond safety about how this resource is used in America to protect the pri-

vacy rights of landowners, but also not irrationally restricting utilization of the resource.

So, I am out of time, but——

Senator RISCH [presiding]. Senator Ernst, you are up.

Senator ERNST. Thank you, Mr. Chair.

I would just like to echo—and, first, thank you for being here today. I do appreciate it. And, this is a topic that is very interesting and we do need further discussions on. And, I would agree with some of the comments that are made already, especially as it applies to agriculture in a state like Iowa or North Dakota, it is a great tool for our farmers to use if they are doing that precision-type agriculture and monitoring, and it does eventually save on labor costs, and it makes our environment that much the better because we are targeting specific weeds in specific areas, not entire fields.

So, I think there is a lot of great application that we can find from these systems, but I wanted to echo the privacy concerns that we have, as well, because even in the rural areas, it may be a great tool for farming, but you certainly do not want somebody else's remotely piloted aircraft or drone flying overhead taking pictures of your family as they are in the backyard or whatever other methods are being done out there. So, those are some concerns.

Much of Iowa is rural farm ground. I mean, it goes without saying. Just like so many of our states, it is so rural. Many of these UAS are being operated for agricultural purposes, far from the nearest town let alone from the nearest airport. So, what do we do to ensure that we are not overburdening some of the folks that are utilizing this technology in those types of areas? Any thoughts on that?

Mr. CANOLL. Well, Senator, I think there are a couple of areas that we can make advances. The technology exists today, it is just not fully deployed by the manufacturers—I know they are working on getting it into the platforms—called geo-fencing. So, if it is truly a platform used only for agriculture, a very low altitude surveillance, then we have to find a way to geo-fence that vehicle from stumbling or trundling into airspace. It probably has the capability if it is a vehicle strong enough to carry a camera like this one to fly very high, 6,000, 7,000 feet.

So, that technological platform has to be restricted from ever operating there, and then we can really mitigate the risk to the national airspace and to airliners, for example, or general aviation, which we have a very large portion in this country, largest general aviation operations in the world by far that operate not near airports, they are just puddle jumping around, and they have a risk to running into one of these vehicles, as well. So, I think technology is the most profound way to protect it.

Senator ERNST. Okay. Any other thoughts, gentlemen?

Mr. WYNNE. Well, Senator, agriculture is probably the lion's share of the numbers in our forecast because it is low-risk flying. In many respects, it is rural, as you say, and it is away from people and it is away from other aircraft for the most part, unless it is aerial applicators, and we are in a very robust discussion with them. So, I think agriculture is where we actually expected this technology to take hold very, very rapidly, and it is. There is no

question that many of the exemptions that have been granted by the FAA are for agricultural applications.

Interestingly, it is still early, and because we have not gotten to scale yet, because we are flying under exemption, agriculture being a low-margin business, it is probably not going to take off in the early stages as quickly as we thought. But, meanwhile, there are many other applications where we have seen tremendous adoption and uptake for the technology.

The sooner we have got more people flying under rules, the sooner we will have datasets, and in aviation, we use datasets to figure out what is equivalent level of safety. No question, we are going to have the occasional conflict, and that is a bad thing in the air-space. But, we will learn from that, as Mr. Dourado has pointed out, and I like agriculture because it offers us a very low-risk profile, and again, we are looking for a regulatory framework that is risk based, because if it is technology based, we will never keep up with it from a regulatory point of view.

Mr. DOURADO. Senator, I would add that Japan is doing very interesting things with drone-based agriculture, and so I think that looking to their example and seeing how they are handling these issues is also very useful.

Senator ERNST. Very good. And, I know the FAA has been very slow about getting these rules and regulations in place. But, if you are an average Iowa farmer, how do you know what those rules are, or how are you notified that you need to be registering your unmanned aerial system? How do you know that? How are they going to know? Is there some sort of registry that takes place when they purchase a system?

Mr. WYNNE. A very robust effort. As I said, our “Know Before You Fly” campaign is pointing people at the resources that they need. There are over 80 supporters of that campaign, and increasingly, we are reaching out to our colleagues, the American Farm Bureau Federation, et cetera, to get information in their channels so that it is readily available, not complicated information.

Senator ERNST. Okay.

Mr. CANOLL. Essentially, when you purchase it, you open it up, there it is. The information is presented.

Senator ERNST. Okay. Good. Thank you very much, gentlemen. Thank you, Mr. Chair.

Senator RISCH. Thank you, Senator Ernst.

Senator Markey.

Senator MARKEY. Thank you, Mr. Chairman, very much.

Senator Ernst has put her finger on it. It is the best of technologies and the worst of technologies simultaneously. There is a Dickensian quality to this technology. It can enable and ennoble farmers and Homeland Security officials to protect our country, but it can also be used to fly drones over people's backyards and photograph children or families in very sensitive situations, and we need rules in order to make sure that it is clearly understood what these drones can be used for. But, we also have to have clear rules in terms of where these drones can be flown.

So, there have been several recent drone sightings near airports in Massachusetts, and I am becoming increasingly concerned about the threat of a drone colliding with a plane. It only takes one drone

to fly into the path of one passenger plane in order to create one of the worst disasters in American aviation history.

On New Year's Day, a commercial plane spotted a drone flying 800 feet in the air nearly one mile from Logan Airport. Just days earlier, another drone was reported two miles from Logan's runways, also flying at about 800 feet in the air. Last month, I sent a letter to the FAA to find out what concrete steps the FAA is taking to prevent and respond to drones flying in sensitive airspace.

Captain Canoll, can you lay out for the committee what the dangers are, from your perspective, if we do not have real rules and these drones continue to insinuate themselves into the airspace of commercial aircraft.

Mr. CANOLL. Yes, Senator. The biggest problem is, and it was mentioned in the opening remarks, that we have had a lot of wild-life bird strikes. Aircraft are pretty rugged things. I have hit many birds in my operations, both when I was flying in the Navy and in commercial aircraft. Aircraft pretty much can sustain it.

But, there is a big difference between a bird and a drone with a heavy, lithium metal battery, motors, cabling. That is going to—this will do significant damage to an aircraft if it hits it. A quarter can destroy a jet engine if it goes down the intake—destroy it. So, we have both the threat of that and then the proliferation, which is an issue for us, as we have seen these hundreds of thousands sold in this last holiday season.

So, I think it is important to note, though, that my members who are flying around reporting these sightings, we all firmly believe that it is not the commercial operator or even the serious hobbyist that we are running into. This is the hobbyist or the non-commercial operator who really does not know what they are doing. So, we need to enhance enforcement. We need to enhance enforcement.

Senator MARKEY. And, so, what is the area that you think should be built around an airport, like LaGuardia or Newark or Boston—

Mr. CANOLL. I think—

Senator MARKEY [continuing]. Where the air traffic is just absolutely massive? How wide a radius should be created?

Mr. CANOLL. The FAA has established five miles, and that is a good place to start—

Senator MARKEY. But it is not being enforced, is that what—

Mr. CANOLL. Well, the problem is, it is hard to enforce it because someone can walk into that area with a drone this size and just take off and start flying—

Senator MARKEY. Yeah.

Mr. CANOLL [continuing]. And you do not know it is there until you have had a couple of near misses.

Senator MARKEY. And, to what do you attribute the lack of enforcement? Is it that the local officials, the state officials, the federal officials are not properly signaling to all these new drone owners that there is a penalty they have to pay?

Mr. CANOLL. I think there is—yes, I think there is a coordination issue through the FAA to the law enforcement agencies. The other thing I think that we could think about from a technology standpoint is we have the “Know Before You Fly” campaign, and it is presented, as we told Senator Ernst before, is you open up the box.

You see this pamphlet there that you should go to this website and look at it.

The technology exists to make it so, just like when you open up a version of Microsoft Office, you have to enter a key code before it will operate. We could do that with our recreational drones so that you have to go pass an online test which informs you that you cannot operate within five miles of an airport, enter that key code before the vehicle will turn on.

Senator MARKEY. And, I agree with you. We need standards and the FAA has to put in place policies that will prevent and respond to these new risks and to do so in a way that all new drone operators—we are going to have ten million of these, 15, 20 million of these, and they will be—a lot of them will be in major metropolitan areas with so many planes, that without clear standards, a catastrophe is just going to happen. There are just no two ways about it, like you are saying.

Thank you, Mr. Chairman, very much.

Senator RISCH. Thank you, Senator Markey.

Thank you to the panel for taking the time to come visit with us today. This is certainly a critical issue that I am sure, as with a lot of things with technology, it is in its infancy and we are going to learn a lot, and as we move forward, hopefully, we will get a lot better at doing this, just as we have with the camera, as was mentioned earlier. So, thank you so much again. Thank you for coming.

We will now move to our second panel.

[Pause.]

Gentlemen, thank you so much for joining us today. We are going to hear from each of you, and I am going to introduce both of you and then go from one to the other.

For the committee, for the witnesses and everyone else, as usual around here, we are on a short string. We have a vote that starts in 28 minutes, so we will try to be, as usual, efficient, but certainly as thorough as we can be.

Dr. Thomas Vaneck is the Vice President of Disruptive Technologies for Physical Sciences Inc. As a small business, PSI has been at the forefront of drone technology development for years, working on both military and civilian commercial applications. Dr. Vaneck leads a team of technologists focused on the development and application of multipurpose small unmanned aircraft systems called InstantEye.

Our last witness is Dr. Gregory McNeal. Dr. McNeal is an expert on drones and topics related to technology law and policy. He is a nationally recognized commentator for Forbes and a frequent keynote speaker at industry events and academic conferences related to drones, technology, law, and public policy.

So, we will give you each about five minutes to address the committee, and then I have no doubt we will have deep and probing questions for you.

So, starting with Dr. Vaneck, if you would, please.

STATEMENT OF THOMAS W. VANECK, VICE PRESIDENT, DISRUPTIVE TECHNOLOGIES, PHYSICAL SCIENCES INC., ANDOVER, MA

Mr. VANECK. Distinguished members of the committee, thank you so much for giving me the opportunity to testify today about our experience in commercial UAS development and operations and working with the FAA.

At Physical Sciences, a small business, I have the privilege of leading a group of talented technologists focused on the development and applications of the multipurpose small unmanned aircraft system we call InstantEye, and I have actually brought InstantEye with me so you can see the size.

While at first we solely supported the military, today our customers include not only the military, but also law enforcement, first responders, and a growing list of commercial users. Working with military, we broke new ground to push the technology to those most in need of it, the individual warfighter. This required significant innovation to make the system easy to operate, extremely rugged, adaptable to mission needs, and low cost. We also created a two-day program of instruction to train operators in the use of the system, including emergency procedures, and how to service and maintain the equipment.

Much of the technology developed and experience gained during this SBIR-supported product development effort has successfully been transitioned to the commercial sector. Today, supporting commercial customers is one of our greatest growth areas. As we expand into these markets, we work closely with the FAA to obtain the necessary certifications to conduct commercial operations.

Teamed with a commercial customer in the power and gas industry, we applied for and received a Special Airworthiness Certificate for InstantEye so we could test its efficacy as an inspection tool. We and others have applied for and have been granted Section 333 exemptions allowing InstantEye to be used for commercial operations. Today, our systems are used to inspect power lines, pipelines, wind turbines, solar arrays, endangered species habitats, and many others. The list grows weekly.

The process used by the FAA for both the Special Airworthiness Certificate and the 333 exemption was to take regulations developed for manned aircraft and apply them to our unmanned system. When regulations did not quite fit, we applied for and were granted exemptions, which kept the safety intent of the rule but modified its implementation so that it made sense for our small UAS. While the process was tedious, it was always apparent that the FAA wanted us to succeed. They also did not want to do anything that would break the system. Safety always came first.

We understand that today the FAA is seeking to develop rules that are specific to UAS and their operations instead of continuing the approach of taking existing manned aircraft regulations and modifying them through exemptions. We applaud these efforts.

We firmly believe that, for this process to move quickly and to ensure that safety is not compromised, it needs to be a collaborative effort between the FAA and the UAS industry. Over the last 90 years, the FAA and its predecessor organizations have created an airspace architecture that is today the safest it has ever been.

That experience will be invaluable as we enter this next era in aviation.

Equally important is the knowledge and experience of the UAS industry. We know our systems and their limitations. We are forever finding new applications for the technology. And we can use this knowledge to help suggest regulations that are appropriate for this industry, maintain safety, and allow it to grow and thrive.

We also believe in developing UAS regulations, one size does not fit all. Rules and operator requirements must be appropriate for the system being used and operations being conducted. An approach based on the engineering risk model will likely be the most successful methodology. Evaluating risk encompasses a number of items, including failure analysis, probability of injury, probability of property damage, et cetera. This will allow us to collect combinations of system type and intended commercial activity into groups which we can apply safety requirements to and ultimately derive rules.

Lower-risk activities will require fewer rules on the operator and the system, while higher-risk operations will require the operator to have greater demonstrated skills and the system to have additional capabilities to ensure that an equivalent level of safety is met.

Not only does this approach build on the existing FAA rule architecture for manned aircraft—a sport pilot flying a sport aircraft does not have to have the same rule burden as does an airline transport pilot flying a commercial airliner—it will also drive innovation. Clear rules, thoughtfully developed and applied, will allow healthy competition by virtue of a level playing field and will encourage creative companies to invent innovative solutions that both adhere to the rules and also create a better mousetrap.

In summary, the commercial UAS industry represents an immense opportunity for our country. It is creating jobs. It is driving innovation. And each day we discover yet another application for the technology. To realize its full potential and to ensure that the United States is a world leader in this area will require a close collaboration between the FAA and the UAS industry. The rules and operator requirements that are put in place must ensure safety and protect privacy to garner public trust. This is essential for success.

Mr. Chairman, members of the committee, thank you for your time.

[The prepared statement of Mr. Vaneck follows:]

Chairman Vitter, Ranking Member Shaheen, and distinguished Members of the Committee, thank you for the opportunity to testify today about our experiences in Commercial UAS development and operations, and working with the FAA.

At Physical Sciences Inc., which is a small business, I have the privilege of leading a group of talented technologists focused on the development and application of a multipurpose small unmanned aircraft system we call InstantEye®. While initially we solely supported the military, today our customers include not only the military but also: law enforcement, first responders and a growing list of commercial users.

Working with the military we broke new ground to push the technology to those most in need of it - the individual warfighter. This required significant innovation to make the system easy to operate, extremely rugged, adaptable to mission needs, and low cost. This technology was developed under SBIR sponsorship. It is being used by our military, in the theatre, providing game-changing situational awareness to our warfighters. This technology and many other SBIR technologies are contributing to our national security, and hope you will make this great program permanent. We created a Program of Instruction to train operators in the use of InstantEye®, including emergency procedures, and how to service the equipment. Operators who pass the two-day course are able to effectively use and maintain the system. Much of the

technology developed, and experience gained-has been successfully transitioned to the commercial sector.

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FAA was anxious for us to succeed, but they did not want to do anything that would break the system – safety came first.

We understand that today the FAA is seeking to develop rules that are specific to UAS and their operations instead of continuing the approach of taking existing manned aircraft regulations and modifying them through exemptions – we applaud these efforts. We firmly believe that for this process to move quickly, and to ensure that safety is not compromised, it needs to be a collaborative effort between the FAA and the UAS industry. Over the last 90 years the FAA and its predecessor organizations have created an airspace architecture that today is the safest we have ever known – that experience will be invaluable as we enter this next era of aviation. Equally important is the knowledge and experience of the UAS industry. We know our systems and their limitations, we are forever finding new applications for the technology, and we can use this knowledge to help suggest regulations that are appropriate for this industry, maintain safety, and allow it to grow and thrive.

We also believe that in developing UAS regulations - one size does not fit all. Rules and operator requirements must be appropriate for the system being used and operations being conducted. An approach based on the engineering “risk” model will likely be the most successful methodology. Evaluating “risk” encompasses a number of items including: failure analysis, probability of injury, and probability of property damage. This will allow us to collect combinations of system type and intended commercial activity into groups to

which we can apply safety requirements, and ultimately derive rules. Lower “risk” activities will require fewer rules on the operator and the system while higher “risk” operations will require the operator to have greater demonstrated skills and the system to have additional capabilities to ensure that an “equivalent level of safety” is met.

Not only does this approach build on the existing FAA rule architecture for manned aircraft – a sport pilot flying a sport aircraft does not have the same rule burden placed on their activities as does an Airline Transport Pilot flying a commercial airliner – it will also drive innovation. Clear rules, thoughtfully developed and applied, will allow healthy competition by virtue of a level playing field, and will encourage creative companies to invent innovative solutions that both adhere to the rules and also create the “better mouse trap.”

In summary, the commercial UAS industry represents an immense opportunity for our country. It is creating jobs, it is driving innovation, and each day we discover yet another application for the technology. To realize its full potential, and to ensure that the United States is a world leader in this area, will require a close collaboration between the FAA and the UAS industry. The rules and operator requirements that are put in place must ensure safety and protect privacy to garner public trust – this is essential for success! Chairman Vitter, Ranking Member Shaheen, Members of the Committee, thank you for your time.

Senator RISCH. Thank you, Dr. Vaneck.
Dr. McNeal.

**STATEMENT OF GREGORY S. McNEAL, J.D., Ph.D., PROFESSOR
OF LAW AND PUBLIC POLICY, PEPPERDINE UNIVERSITY,
AND CO-FOUNDER, AIRMAP, SANTA MONICA, CA**

Mr. McNEAL. Senator Risch, Senator Booker, members of the committee, thank you very much for the opportunity to participate in today's hearing on unmanned aircraft systems.

My name is Greg McNeal. I am a professor at Pepperdine University, where my research focuses on unmanned aircraft. I served on the FAA's Aviation Rulemaking Committee for UAS registration, and I currently serve on the FAA's MicroUAS Rulemaking Committee.

I am also the co-founder of AirMap, a small business that provides safety-related software to UAS manufacturers, operators, software developers, and key stakeholders like airports and universities. We provide the airspace safety map for the "Know Before You Fly" campaign and approximately 85 percent of the non-toy, non-military UAS sold today use or will use our software, and more than 250 software developers use our SDA to integrate our safety software into their own programs and into their own UAS.

From my vantage point as a professor and as a small business founder who works directly with UAS businesses ranging from one employee to 1,500 employees, I can tell you that these individuals are being held back, and it is not just American entrepreneurs. Students, educators, journalists, and volunteers are ready to use unmanned aircraft to save lives, generate significant economic activity, yet they have been held back, unable to operate even the smallest of devices because they want to use these devices for a purpose that is not strictly recreational or hobby.

Every moment spent without freeing these individuals to use unmanned aircraft results in unavoidable deaths and injuries from people falling from towers, missed moments to educate students about technology, foregone moments of free expression, and lost chances to find missing people.

Since the FAA Modernization and Reform Act of 2012, one thing has been clear. Only Congressional action has ensured individuals were able to use unmanned aircraft. In Section 332, Congress called for UAS operations in the Arctic, and we have seen those operations take place.

In Section 333, Congress created a process for categorical exemptions, and we have seen those exemptions and operations take place pursuant to those rules, but those exemptions were granted on a case-by-case basis rather than categorically, as Congress directed.

In Section 334, Congress directed that public safety officials may operate unmanned aircraft weighing 4.4 pounds and less, and we have seen those operations take place thanks to Congressional action.

And in Section 336, Congress carved out protections for hobby and recreational use of unmanned aircraft weighing up to 55 pounds, and we have seen such hobby and recreational uses take place.

The trend line is clear. When Congress acts, innovation takes flight.

But despite the Congressionally directed progress of 2012, there is more work to be done. Entrepreneurs, students and educators, journalists and volunteers have been left on the sidelines, and it appears they will continue to be left on the sidelines. The only way to secure the benefits of unmanned aircraft flight for these important constituents is to create a micro classification that prioritizes safety while promoting open innovation.

That is why I am here today to ask Congress and the members here to support a MicroUAS classification that empowers those who have been left out of the process. The MicroUAS category should be focused on simple and straightforward requirements that are minimally burdensome and streamlined.

Specifically, the MicroUAS category should be for registered devices that weigh 4.4 pounds or less, that are operated within line of sight of the operator, less than 400 feet above the ground, and which provide notice to the airport prior to operating within five miles of that airport.

By eliminating the distinction between recreational and commercial use for the smallest and safest classification of UAS, it cuts red tape for entrepreneurs, encourages a safety culture based on rules that are easy to follow. It also relieves the FAA from the burden of licensing and exempting grants for low-risk operations, allowing them to focus on important initiatives, like unmanned traffic management.

Moreover, people strive for compliance when rules make sense. However, overly burdensome requirements, including pilot certification, aeronautical knowledge testing, traveling to test facilities, and retesting every two years will create high barriers for low-risk users, increasing the potential for non-compliance.

A MicroUAS classification is a reform that will allow for operations on terms similar to those already allowed for recreational operators, but it would allow entrepreneurs, educators, and volunteers to operate unmanned aircraft by removing the restrictive recreational or hobbyist purpose limitation, focusing instead on the already accepted safety standards that Congress put into place in 2012.

American entrepreneurs, students and educators, journalists and volunteers need the support of Congress. History has proven that the best way to foster innovation is for Congress to take action to empower innovation and protect entrepreneurs. Now is the time for Congress to act by creating a MicroUAS classification, and I am hopeful that you will be able to support that initiative.

Thank you.

[The prepared statement of Mr. McNeal follows:]

Testimony of Dr. Gregory S. McNeal:
*"Up in the Air: Examining the Commercial Applications of
Unmanned Aircraft for Small Businesses"*

***Up in the Air: Examining the Commercial Applications of
Unmanned Aircraft for Small Businesses***

Testimony by Gregory S. McNeal, JD/PhD
Associate Professor of Law and Public Policy
Pepperdine University
Co-Founder, AirMap

Before the

United States Senate
Committee on Small Business & Entrepreneurship
March 8, 2016

Testimony of Dr. Gregory S. McNeal:
***“Up in the Air: Examining the Commercial Applications of
Unmanned Aircraft for Small Businesses”***

INTRODUCTION

American entrepreneurs, students & educators, journalists, and volunteers are ready to use unmanned aircraft to save lives and generate significant economic activity, yet they have been held back, unable to operate even the smallest of devices because they are not considered hobbyists. Every moment spent without freeing these individuals to use unmanned aircraft results in avoidable deaths and injuries from falls, missed moments to educate students about technology, foregone moments of free expression, and lost chances to find missing people.

Since the FAA Modernization and Reform Act of 2012, one thing has been clear, only Congressional action ensured individuals were able to use unmanned aircraft.

- In Section 332, Congress called for UAS operations in the Arctic and we have seen those operations take place.
- In Section 333 Congress created an exemption process and we have seen some operations take place (albeit limited by the burdens of airman certification and other restrictive regulations).
- In Section 334 Congress directed that public safety officials may operate unmanned aircraft weighing 4.4 lbs and less and we have seen those operations take place.
- In Section 336 Congress carved out protections for hobby and recreational use of unmanned aircraft weighing up to 55 pounds, and we have seen such hobby and recreational uses.

The trend line is clear, when Congress acts innovation takes flight. But despite the Congressionally directed progress of 2012, there is more work to be done. Entrepreneurs, students & educators, journalists and volunteers have been left on the sidelines, and it appears they will continue to be left out. The only way to secure the benefits of unmanned aircraft flight for these important constituents is to create a micro classification that prioritizes safety while promoting open innovation.

RECOMMENDATIONS

1) CONGRESS SHOULD CREATE A MICRO UAS CLASSIFICATION:

Congress should create a MicroUAS classification that empowers those who have been left out of the process. The MicroUAS category should be focused on simple and straightforward requirements that are minimally burdensome and streamlined. Specifically, the MicroUAS category should be for:

- registered devices,
- weighing 4.4 pounds or less,
- which are operated within line of sight,
- less than 400 feet above the ground, and
- which coordinate prior to operating within 5 miles of airports.

Testimony of Dr. Gregory S. McNeal:
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2) CONGRESS SHOULD BUILD UPON ITS RECORD OF SUCCESS FROM PRIOR CONGRESSIONAL ACTION:

When Congress has acted to promote unmanned aircraft, innovation has taken flight. But where Congress has been silent, we have seen little to no progress. Congress can prioritize safety, promote innovation, and cut through bureaucratic red tape by creating a common sense MicroUAS classification. By eliminating the distinction between recreational and commercial use for the smallest and safest classification of UAS, it cuts red tape for entrepreneurs and encourages a safety culture based on rules that all users can easily understand. It also relieves the FAA from the burden of licensing and exemption grants for low risk operations, allowing the agency to focus its resources on more challenging UAS integration efforts

3) CONGRESS SHOULD PROMOTE COMPLIANCE AND A CULTURE OF SAFETY BY PROMOTING EASY TO UNDERSTAND RULES:

Fostering a Culture of Safety: Easy-to-understand micro rules would promote safety better than the current exemption framework or the proposed sUAS commercial rule. Under a micro classification, compliance would be easy to promote and easy to achieve. People strive for compliance when rules make sense. However, overly burdensome requirements including pilot certification, aeronautical knowledge testing, traveling to test facilities, and re-testing every two years will create high barriers for low-risk users, increasing the potential for non-compliance.

4) A MICRO UAS CLASSIFICATION IS A SIMPLE AND NARROW REFORM

A MicroUAS classification is a narrow reform that would allow for operations on terms similar to those already allowed for recreational and hobbyist uses. It would allow entrepreneurs, educators, and volunteers to operate unmanned aircraft by removing the restrictive “recreational or hobbyist” purpose limitation, focusing instead on the already accepted limitations enacted in 2012. FAA data indicates that there has never been a fatal aircraft bird strike involving a bird comparable in size to a micro UAS (4 pounds) more than five miles from an airport and below 400 feet. Research indicates that the odds of a collision in this location are extraordinarily low, and the consequences are limited. Furthermore, in the estimated tens of millions of operational hours around the world by hobbyists operating the smallest systems in these specified locations, there has never been a single reported fatality.

CONCLUSION

American entrepreneurs, students & educators, journalists, and volunteers need the support of Congress. History has proven that the best way to foster innovation is for Congress to take action to empower innovation and protect entrepreneurs. Now is the time for Congress to act again by creating a MicroUAS classification.

Testimony of Dr. Gregory S. McNeal:
***“Up in the Air: Examining the Commercial Applications of
 Unmanned Aircraft for Small Businesses”***

PROPOSED MICRO UAS LANGUAGE

(a) MICRO UAS CLASSIFICATION.—There is hereby established a micro UAS classification of unmanned aircraft systems, the aircraft component of which may not weigh more than 4.4 pounds, including payload.

(b) MICRO UAS OPERATIONAL RULES.—A micro UAS and its operator qualify for the exemptions described under subsection (c) if such micro UAS is operated—

- (1) below 400 feet above ground level;
- (2) at an airspeed of not greater than 40 knots;
- (3) within the visual line of sight of the operator;
- (4) between the hours of sunrise and sunset; and
- (5) at least 5 statute miles from the geographic center of a tower-controlled airport or airport denoted on a current FAA-published aeronautical chart, except that a micro UAS may be operated closer than 5 statute miles to the airport if the operator—
 - (A) provides prior notice to the airport operator; and
 - (B) receives, for a tower-controlled airport, prior approval from the air traffic control facility located at the airport.

(c) EXEMPTIONS FOR MICRO UAS.—

- (1) Notwithstanding sections 44703 and 44711 of title 49, United States Code, part 61 of title 14, Code of Federal Regulations, and any other law, rule, or regulation pertaining to airman certification, an operator of a micro UAS operated in accordance with subsection (b) of this section is not required to pass any aeronautical knowledge test or meet any age or experience requirement or to have airman or medical certificates.
- (2) Notwithstanding any other law, rule, or regulation pertaining to the certification of an aircraft or aircraft parts or equipment, a micro UAS and the component parts and equipment of such micro UAS are not required to meet airworthiness certification standards or to obtain certificates of airworthiness.
- (3) The operator of a micro UAS operated in accordance with subsection (b) of this section is exempt from sections 91.7(a), 91.119(c), 91.121, 91.151(a)(1), 91.405(a), 91.407(a)(1), 91.409(a)(1) and (2), 91.417(a) and (b) of title 14, Code of Federal Regulations, and does not require a certificate of authorization or waiver from the Federal Aviation Administration.
- (4) A micro UAS operated in accordance with subsection (b) of this section, and its operator, shall be exempt from any additional requirements that may be promulgated pursuant to Subtitle B of the FAA Modernization and Reform Act of 2012 (Public Law 112–95). A micro UAS may alternatively be operated pursuant to any form of authorization, operational rules or exemptions pertaining to unmanned aircraft systems legislated by the Congress or promulgated by the Administrator, except that a micro UAS and its operator shall be exempt from any airman or medical certificate requirement.

Senator RISCH. Gentlemen, thank you very much.

Let me start with the questions. Mr. McNeal, do you feel that the—this outfit is not very good at passing corrective legislation. It is totally unlike the states, that if they make a mistake, they revisit it the next year and correct it. This outfit almost never does that. I cannot answer why. Do not kill the messenger. I am just saying that is the way it is here.

So, the question I have for you is, can these be corrected by agency rule and regulation, which is obviously much more flexible, or does the actual Act need to be revisited?

Mr. MCNEAL. Senator, that is a great question. Give yourself more credit. Three-thirty-two, 333, 334, and 336, I think the body did a pretty good job at crafting a framework.

But, with regard to your specific question, in my written testimony, I suggest some language that would allow for Congress to create this very lightweight category, something as small as that, or that would fit in the palm of your hands up to 4.4 pounds, and then the operator could operate under that category, or if a more permissive category is developed by the FAA after some additional analysis, they would have the option to operate under that. So, it preserves the flexibility while giving Congress the ability to act on innovation.

Senator RISCH. That actually sounds like an excellent idea, but the question I have is could that be done by rule and regulation as opposed to legislation, or is the legislation going to have to be revisited?

Mr. MCNEAL. So, I actually walked over here from—or I took a taxi over from the Department of Transportation, where we were talking about the MicroUAS category, and to put that in perspective, Senator, we are on a fast timeline to complete our recommendation by April 1. And then once that rulemaking process begins at the FAA, that rule, if the FAA hits every single deadline, simply cannot be enacted until next summer. Just, if you just take the timeline of 60 days of—

Senator RISCH. This coming summer or the following—

Mr. MCNEAL. The following summer, Senator.

Senator RISCH. We do not move much faster up here.

Let me ask you this. Being an attorney, I would like to get your take on what the state of the law is on this privacy, and I understand it is in a state of flux, and I understand that common law takes a while to develop. But, I think—I read stories all the time, as does everybody else. Some guy walked out in his backyard and saw a drone and shot it down because his daughter was out there doing whatever. What is the state of the law on that right now? Are there sideboards? Have they developed standards, or is this still—is there any rule of thumb?

Mr. MCNEAL. So, I think with any new technology, there is obvious sort of apprehension. We can just think back ten years when cell phones came out, and the immediate response was, these devices should beep every time they take a photo because everyone is carrying a camera, and eventually, people got accustomed to the technology.

I think with regard to the laws that are being promulgated, we are seeing very different laws coming up in the states. I think in

the states, existing law really does address a lot of the concerns that people have, and we are starting also to see that industry is coming together and meeting with those state legislators to say, why do we not look to those existing laws that might need to be amended rather than creating UAS-specific rules. I think that is the right path forward.

I think the challenge for this body, if it were to legislate in this area, is that Montana is not Philadelphia, right, and New York City is not Nebraska—

Senator RISCH. How well we know.

Mr. MCNEAL [continuing]. And I think we really want to make sure that, on the privacy rules, that we do not try to over-legislate here in a way that would stifle innovation, that we entrust the states to handle those types of things under existing state law, Senator.

Senator RISCH. Is there any effort by the Uniform Code Commission to adopt something like the UCC or something like that that—

Mr. MCNEAL. There is—

Senator RISCH [continuing]. That states can look at?

Mr. MCNEAL. There is an initiative. It is not the Uniform Code Commission, I think it is an ALI group that is meeting to create a harmonized set of rules. There is also a similar group that is trying to create a harmonized set of rules across the states for a variety of the other things that we are talking about with regard to trespass, privacy, and nuisance, to try and ameliorate the concerns about a patchwork of rules and regulations cropping up across the states.

Senator RISCH. Thank you very much.

Senator Gardner.

Senator GARDNER. Thank you, Mr. Chairman, and thank you to the witnesses for being here today and your testimony.

I had the privilege of traveling to where I attended law school, the University of Colorado Law School, and a couple of years ago, they got a new law school, and so I went and visited the old law building, which was still there, and inside the old law library is a, I guess a UAS test and flying facility. They had this—it looked like a batting cage net up where they were flying around UAS, doing all kinds of things. It was the best use of a law library I think I have ever seen. At least, I wish they were doing that when I was studying there.

[Laughter.]

But, I mean, they were doing tremendous work.

Do we have any idea—do either of you have any idea about how much money is right now being put toward research and development at various universities' engineering laboratories across the country on UAV systems, those kinds of things?

Mr. MCNEAL. I do not know the specific dollar amount, Senator, but I know that many universities are looking to get involved in it. Actually, to tie this back to my testimony, one of the challenges that I face is that I want to educate my law students about technology, and if I were to take a drone and bring my students outside and start flying that drone, I would need to get a 333 exemption. I would need to go to flight school and become a pilot, all to be able

to show my students how to use that. And if they were to use it as part of their education, that would be deemed non-recreational, non-hobbyist, not in conformity with the set of community-based guidelines, those students would have to go through a similar process. And, so, I have taken to not bothering to show them how UAS work in the classroom because of these prohibitions.

And, so, I think it is Senator Peters that has an act that he has proposed to try and free up universities. I think that dovetails nicely with the MicroUAS proposal, to free up universities to be able to conduct this type of research, to help expand STEM education and even reach down into high schools and intermediate schools to do the same thing.

Senator GARDNER. Absolutely. And last summer in Colorado and across the country, we saw wildfires throughout the Western United States, a number of incursions between drones and fire-fighting operations. You have recommended a ceiling of 400 feet for the MicroUAS classification, but retardant drops are usually made from heights of 150 to 200 feet. So, in your opinion, what should we be doing to make sure that the likely proliferation of micro drones does not further imperil that kind of an emergency response situation?

Mr. MCNEAL. Yes, Senator. So, these devices would similarly be subject to the same hazard restrictions that are already in under my proposal, that are already in place. And, so, flight within a temporary flight restriction would be a violation of the law.

Additionally, just to tie it back to AirMap and tell you a story, a year ago, AirMap started as a company believe that unmanned aircraft operators needed accurate and up to date information about airspace information, and now approximately 85 percent of the market gets a live update about where temporary flight restrictions are. One of our partners, DJI, will geo-fence that temporary flight restriction so that you cannot fly into it. Another one of our partners, 3D Robotics, provides an alert to the operator, letting them know this is an area where you cannot operate.

And, so, that gives you an idea of the pace of innovation when we allow the industry to act quickly in response to problems, perhaps to avoid the—because they see the threat of legislation or regulation coming, trying to stay ahead of that trend, whereas if we get overly prescriptive, what ends up happening is we slow them down because they have to meet regulations, instead of allowing innovation to address the public policy problems.

Senator GARDNER. How does that alert work that you just talked about? You said—how would that work to the user, the operator?

Mr. MCNEAL. Sure. The user, upon opening their system up, is immediately provided accurate information about the airspace in which they are operating and they would get a pop-up notification on the screen letting them know that they are in a temporary flight restriction and they are unable to fly in that area, and it would give them the exact detailed rationale behind why that temporary flight restriction was there, be it POTUS movement or a stadium event or a wildfire or any other significant event.

Senator GARDNER. Thank you. Thank you, Mr. Chairman.

Senator RISCH. Thank you.

Dr. McNeal, for those of us that are from the Western states—I see a few of us here, four of us here anyway—this fire issue has become a real issue. This last summer, we had a number of fires. I am sure you had the same thing in Colorado. And the firefighters are concerned, and they are having a lot of issues with the drones, because it is a natural thing if you are a hobbyist or what have you. You want to go out and take a picture of that. So, common sense is going to play a role here somewhere.

Well, I have just been ignominiously chastised by the Ranking Member for ignoring her and not allowing her to make an opening statement. Unfortunately——

Senator GARDNER. Mr. Chairman, that was as much my fault as anybody's. I am sorry to the Ranking Member——

Senator RISCH. Well, in my defense, I did not start this shindig and I thought you had been here——

[Laughter.]

Senator SHAHEEN. And I did not, either.

Senator RISCH. So, in any event, Senator Shaheen for your deep, probing, important remarks.

Senator SHAHEEN. Thank you, Senator Risch. It is so nice to chastise you.

Senator RISCH. Yes. It is not the first time, I might add.

[Laughter.]

OPENING STATEMENT OF HON. JEANNE SHAHEEN, RANKING MEMBER, AND A U.S. SENATOR FROM NEW HAMPSHIRE

Senator SHAHEEN. Well, thank you very much, and I am going to submit my statement for the record, but I would point out a couple of things.

One is that, as both of our witnesses have testified, and we thank you very much for being here, unmanned aviation presents new opportunities for innovation and for delivering services, but it also raises a number of new and serious safety concerns. And, as the discussion has pointed out, we need to address those safety concerns very thoughtfully and with an understanding of what the ramifications of that would be.

And, I would just point out with respect to wildfires, this is something that has been called to our attention in New Hampshire, even though we are not a Western state, and I have introduced the Wildfire and Emergency Airspace Protection Act, which would make it a federal crime to knowingly operate a recreational drone that interferes with disaster response efforts. So, I do think that is a very serious issue.

I also want to recognize Dr. Vaneck from Physical Sciences Inc., which is a business that is located in Massachusetts, but they do some of their work with drones in New Hampshire, so we are delighted to have PSI represented here. I had the opportunity to discuss with representatives of PSI the importance of the SBIR program and what we need to do to reauthorize it and, I hope, make it permanent. So, thank you for being here.

[The prepared statement of Senator Shaheen follows:]

Opening Statement by Senator Jeanne Shaheen:

“Up in the Air: Examining the Commercial Applications of Unmanned Aircraft for Small Businesses”

Senate Committee on Small Business and Entrepreneurship
March 10, 2016

Good morning. Thank you, Chairman Vitter, for convening this hearing, and thank you all for being here today.

The United States has always been a leader in aerospace technology. We operate the busiest yet safest aviation system in the world. Our remarkable record in this industry is due in part to our ability to adapt and change with a growing market, while maintaining an unwavering focus on safety oversight.

Today, unmanned aviation represents the next frontier in flight. Rapid advancement in technology has brought about the development of unmanned aviation vehicles – or drones – that are capable of revolutionizing how we do business within countless industries.

Drones also serve as a force for improved public safety in many ways as operators have demonstrated how drones can be utilized to monitor safety conditions and to mitigate risk in otherwise life threatening operations. These new and promising applications include the use of drones to conduct bridge and pipeline inspections, survey dangerous terrain and monitor workplace safety.

However, we cannot ignore that, while drone operations can help promote public safety, their increased presence in our airspace has also brought about a number of new and serious safety concerns. We’ve seen a dramatic increase of reports of near collisions by pilots and air traffic controllers. Last summer, recreational drones garnered significant attention for their interference with efforts to fight the devastating wildfires in California – endangering the lives of emergency personnel and delaying urgent response efforts.

That is why I introduced the Wildfire and Emergency Airspace Protection Act, which makes it a federal crime to knowingly operate a recreational drone that interferes with fire or disaster response efforts. My legislation is aimed at recreational drones because of the FAA’s limited authority over that category of unmanned aircraft. But concerns about the safe operation of drones are not limited to those flown by hobbyists, which is why the FAA has undertaken a comprehensive rulemaking focused on the safe integration of commercial drones into our airspace system.

During today's discussion, I look forward to hearing the viewpoint of the small business community which has been a major contributor to the success of the UAV industry and is uniquely positioned to benefit from its continued advancement.

I am also grateful to two of our witnesses for accepting my invitation to testify today. Both are well-versed in the intricacies of our national aviation system and can speak firsthand to how small businesses have benefited from drone innovation and to the challenges we're facing as we work to incorporate this new technology into our airspace.

Captain Tim Canoll was elected President of the Air Line Pilots Association in 2014 and as such, he represents more than 52,000 pilots in the United States and Canada. His organization serves as is the largest nongovernmental aviation safety organization in the world and his membership is uniquely positioned to speak to the importance maintaining a strong focus on safety as we move forward with the integration of unmanned aircraft.

Dr. Thomas Vaneck serves as the Vice President of Disruptive Technologies for Physical Sciences Inc., a small business that has been at the forefront of drone technology development for years, first in the military arena and now in the civilian commercial industry as well. Dr. Vaneck's team is responsible for the success of the multipurpose, small unmanned aircraft system InstantEye®-- which helps our military, law enforcement, first responders and commercial users.

It should come as no surprise to this Committee that PSI developed this technology to serve our warfighters under the SBIR program. It's yet another example of the contributions that the SBIR program makes to our national security, as well as our economic competitiveness. I want to thank PSI for their strong advocacy in support of the SBIR program, and the important work they have done to develop technologies for our warfighters.

I want to thank them both for joining us today and I look forward to hearing from all of our witnesses. Thank you, Mr. Chairman.

Senator SHAHEEN. My question—I am going to start with you, Dr. Vaneck, because I wonder if you could walk us through the experience that PSI has had to date with getting involved in the commercial drone sector and how the costs and constraints have affected your business.

Mr. VANECK. Thank you. Certainly. When we first started getting into the commercial activities, I want to step back and say that, initially, we primarily focused on the military and we have a large number of these systems that are in theater supporting our military quite successfully.

It was a logical step to take that to the commercial sector. We worked with several commercial companies that wanted to use the system for inspection. First, they wanted to understand, was it useful for inspection, and then if it was, that they wanted to actually put it into operation. We worked with an energy company that, through working with the FAA, we were able to get a special type certificate for the system that allowed us to operate it in the experimental category, and that was simply to go and look at the efficacy of using the system for those kinds of inspections.

The process was tedious. The FAA applied manned rules to unmanned, but in our viewpoint, they could not do anything else because they had a rule set that worked really well. This was thrust on them. They had to do something. It took a long time. We were able to be successful in getting that type certificate, and the system has been used commercially by that company to do power line inspections.

The 333 was a good step, not the last step, I hope, in getting to a point where we can now use these commercially. I have to say that the process that we went through was not that onerous. The FAA emphasized safety. It was on a case-by-case basis. We made our pitch to them, and were able to receive the 333.

It led us to believe that this risk model is the proper approach, and I believe that is the model that the FAA is proposing. I will say that categorizing both the risk and the type of operation, you get micro systems that will have one set of rules. You will have other systems that perhaps want to go beyond line of sight, will have a different set of rules. And then you will have rules for very large systems, and I think that is what makes sense. Thank you.

Senator SHAHEEN. Can you also—maybe both of you could talk a little bit about the degree of training that should be required for drone operators, because on the previous panel—I missed it, but I understand that the President of the Air Line Pilots Association was here, and that he raised some of the concerns around safety and training requirements that the FAA is looking at. So, can you speak to that, and then perhaps—

Mr. VANECK. I will quickly comment on that. For our military customers, it is a two-day approved training course that they go through to fully be able to operate the system and maintain it. We believe that for the commercial side, anyone who is going to operate the system commercially should have some degree of training. That could be as simple as an online training that you would take and then pass an exam so you understand what the airspace is that you are going to be operating in and what the rule architecture is. So, we are fully in support of that.

Senator SHAHEEN. Would you like to comment?

Mr. MCNEAL. Yes, Senator. So, I do think that we should take a cue from other countries. I just sat through a presentation yesterday. The Canadians have segmented up based on the weight class and the risk category of the operation whether or not someone needs training, and at the low end of the spectrum, basically that 4.4 pound and below area, I think it would be prudent for us to not require substantial training.

To put it in perspective, Captain Canoll—I keep wanting to say Captain Cannoli, Senator Booker—he put a DJI Phantom on the desk. My five-year-old operates that with my supervision. It is not a complex device. And if you think about if you were trying to sell your home today and you had that, or it was your kid's DJI and you wanted to fly up and take a picture of your home so you could sell your home, that would be a commercial operation.

Do we expect that that person is going to go through that educational process? Probably not. And, so, what we end up having is people who are skirting the rules and not complying, in the same way that I could have skirted the rules and used the device to educate my students, but because I am a law professor, I felt it would probably be wrong for me to violate the law while educating my students. So, I do think we need to key it to the type of operation as opposed to having a blanket rule that everyone must go through some formal training.

Senator SHAHEEN. Thank you both.

Mr. MCNEAL. Thank you, Senator.

Senator SHAHEEN. My time is up.

Senator RISCH. Yes, it is.

Senator Booker.

Senator BOOKER. I realize there is a vote coming up, Mr. Chairman, and I know Senator Cantwell has not had a chance to ask any questions, so I would defer to her.

Senator RISCH. Oh, I am sorry.

Senator BOOKER. Okay. Then, I will instead continue with questioning. Thank you.

So, real quick, I have a lot of concerns, as you heard in the last panel, about what we are doing to choke innovation and through overly burdensome regulation that does not seem to be in any way keeping pace with what other countries are doing who have the same safety concerns but have an ability to spawn innovation that has now seemed to be taking off, no pun intended, in other countries, but not taking off here.

But, I actually want to shift for a second, because this is the Small Business Committee, and I would like to know that beyond the discussions of what the FAA is doing, how can other government agencies actually help small businesses, such as the SBA, foster a culture of innovation around UAS, particularly for these commercial users? And, I open it up for both of you.

Mr. MCNEAL. I think there are a few things that can happen. One of the things that we struggled with as a company was just being able to access certain types of data and communication protocols at the FAA, where the FAA had an approach to allowing people to create innovation and participate with the National Airspace System in a way where they basically sort of selected single con-

tractors who were the only people who could provide certain types of approved solutions, rather than creating standards to which everyone else could develop.

So, an example of that was rather than creating standards for aeronautical apps that would allow individuals to provide information to end users, they instead created their own app, which did not get a lot of adoption. And, so, I think flipping that focus, calling on agencies to say, here are the standards to which we want people to create new software, or here are the standards around which we want people to innovate, and then free those individuals to innovate and then maybe they get the stamp of approval if they have met those broad developmental standards. So, that is speaking just to the software category, Senator.

Senator BOOKER. Great. Any other thoughts?

Mr. VANECK. Very quickly, two quick thoughts. One is, I did want to go back and talk a bit about the SBIR, very briefly. This system would not be in existence today had it not been for an SBIR program that got it started. We were able to develop it to a point that we had larger agencies providing funding to continue on and actually get it into military operations.

The other is this is an ITAR-restricted piece of equipment. Part of our market is going international, as well. There are tremendous burdens, and the rule structure is not as clear as it could be for us to understand how we push this technology out internationally. If we want to compete on the international stage, I have to be able to put my technology into the international market, and I think we need some—a look at the ITAR restrictions that are placed on these types of technologies to ensure that we are not burdening it—overly burdening it so it does open those markets up.

Senator BOOKER. And it puts you at a competitive disadvantage to other companies that might be—

Mr. VANECK. Yes, Senator, it does.

Senator BOOKER [continuing]. Other countries. And, again, this goes to that point about how we are really undermining innovation, economic growth, jobs, because we are doing things to our businesses and innovators that other countries are not, and they are not having these horrible safety disasters, and they are taking a focus on safety, but they are not creating these regulatory burdens.

And, so, just for an example, either of you, how long does it take for a typical small business—not the people who—the individual users who crash into the White House lawn and things like that, but I am talking about for a business that is trying to use and innovate an application, how long does it take for a small business to apply for an exemption through the FAA? I am just curious, just for the record.

Mr. MCNEAL. Well, worse than the exemption process, Senator, would be the fact that if we just decided to start today, it would take 120 days at the long end, but they have really narrowed that gap down to about 60 days, to approve the exemption. But, then you would have a piece of paper—

Senator BOOKER. Wait—

Mr. MCNEAL. You would need to learn how to fly. You would need to go fly a Cessna and fly for 20 hours before you could fly

that—what is it, 200 grams—that tiny 200-gram device. You would need to know how to land a manned aircraft.

Senator BOOKER. Right. And, right now, there is a backlog at the FAA—

Mr. MCNEAL. There is a backlog, right, and now people—and, so, I think people are sitting on the sidelines, too, hoping that—the people that last summer were sitting, expecting that Congress would hit the deadline—I mean, the FAA would hit the deadline Congress gave them. They did not file for their exemption. Then they heard there would be a delay. They did not file for their exemption. And now, some of them are probably kicking themselves for having not filed the exemption. The regulatory process takes a long time because the agency has to run all of its traps.

Senator BOOKER. And, let us just be clear. Right now in America, we are killing innovation as a result of this. We are killing jobs. We are undermining the life-saving potential that this technology could have for our own communities. And this is just a regulatory regime that desperately needs to be changed.

Mr. MCNEAL. I one hundred percent agree, Senator.

Senator BOOKER. Thank you very much.

Senator GARDNER [presiding]. Thank you, Senator Booker.

Had I known that we were bringing some of these visuals, I have a Millennium Falcon drone in my office I could have brought here, too, so—

[Laughter.]

Mr. MCNEAL. Do not fly it commercially, Senator.

Senator GARDNER. No, no, no. After some experiences, I am pretty sure nobody would want me to do that.

[Laughter.]

I guess Senator Markey is next.

Senator MARKEY. Okay. Thank you, Mr. Chairman, very much.

PSI is a perfect example of why we have Small Business Innovation Research grants. It is an amazing number, just for Massachusetts, but there have been 20,000 SBIR grants to Massachusetts companies totaling \$5 billion. That is the program that has been authorized by this committee year after year, and those 20,000 grants have helped to create, just to Massachusetts companies like PSI, and PSI, Physical Science Incorporated, to be distinguished from PSI, pounds per square inch, where Bill Belichick is the expert—

[Laughter.]

Notwithstanding what anyone who comes from any other state might believe is accurate.

So, we thank you, Dr. Vaneck, for your incredible innovation at your company.

Can I turn just for a second, then, to the privacy issues. Obviously, right now, there are no rules in terms of the gathering of information and how they can use it, how they can sell it, and clearly, there have to be rules. You just cannot allow these drones to be hovering over people's backyards and taking pictures. You know, it is one thing to say it is great for Amazon to be able to deliver a package, but what about the film now that is in there as they are hovering around the home? What is the rule for the reuse or

resale of all of that information, especially if it is related to children in the family?

So, in a way, for the purposes of public safety or the purposes of helping the agriculture sector to better monitor what is occurring, there are eyes in the sky, and that is great, but there is also a spies in the sky aspect to all of this that, clearly, we have to talk about, as well.

And, last year, I actually introduced the Drone Aircraft Privacy and Transparency Act, which establishes safeguards to protect the privacy of individuals from the expanded use of drones. We need guidelines, especially with regard to information gathered about children in our society.

So, could you, Dr. Vaneck, talk a little bit about how PSI ensures that drones are protecting the privacy of those on the ground.

Mr. VANECK. Certainly. Thank you, Senator Markey.

Actually, the privacy concerns, I share them, as well. When we worked with the power and gas company, I will tell you that certain operations that they conducted, inspecting these power lines, they would only inspect from one direction, because if they inspected from the other direction, in the view would be a farm, and they knew that that farmer was very concerned about privacy. So, they conducted their operations so as to not to impinge.

I think it actually can drive innovation. If you pull up Google Maps, you will see that license plates are blurred. Faces are blurred. Even signs on buildings, which, unfortunately, when I am trying to find that building make it a little difficult, but they are blurred.

We have a lot of the technology already starting to be in place that we can apply to this as far as the video feeds and even other data that we collect. So, I think it can drive innovation. We are actually——

Senator MARKEY. You think the solution to the problem lies in innovation itself.

Mr. VANECK. Yes, absolutely.

Senator MARKEY. Like Google Maps.

Mr. VANECK. Absolutely, and I think we can begin to apply that. I think there needs to be rules in place that say this has to occur——

Senator MARKEY. Yes.

Mr. VANECK [continuing]. And that will drive innovation. It will get the three guys in a garage who come up with a great idea that then will deploy across the entire industry.

Senator MARKEY. And, so, that then basically says that the FAA could say that this technology, such as Google Maps, which blurs faces, blurs that kind of personal information, should then be applied here, and once it is adopted, then you have got a balance between the innovation and the use of the technology, but also in the protection of the privacy of individuals.

Mr. VANECK. I would say that I am not sure the FAA is the organization to do that——

Senator MARKEY. Yes.

Mr. VANECK [continuing]. Because they are safety-related. But, I believe that there are rules that can be put in place by organizations to ensure that that takes places.

Senator MARKEY. Yes, and I agree with you a hundred percent. And, again, we thank you. We are proud of having PSI up in Massachusetts. Thank you.

Mr. VANECK. Thank you.

Senator GARDNER. Thank you, Senator Markey.

Senator Cantwell.

Senator CANTWELL. Thank you, Mr. Chairman.

Dr. Vaneck, I wanted to ask you, NASA has been working on a drone transportation system to basically monitor the ability to fly safely on altitudes under 500 feet, and yesterday, the Senate introduced a FAA bill that had a pilot program on that. So, do you think that a traffic management system can be safely put in place for drones so that they can—we can get that network operating?

Mr. VANECK. I believe it can. There are already activities now for micro radars that are able to, not today, but very soon will be able to track aircraft as small as our aircraft. The other advantage to something like that is it can track individual birds around airports. You have heard from pilots of bird strikes. If that radar were to exist, they could alert pilots of individual birds.

Of the management system, commercial airliners today have a system on board where the aircraft themselves talk to other aircraft. It is called TCAS. Those kinds of technologies will be available for these small aircraft, I think, in the future. Again, it drives innovation. We are going to have the necessity to have those kinds of technology in place, and we will have to develop the technologies to do it.

Below a certain size limit and the operation type, it may not make sense, it may be too much of a burden for line of sight, because you have an operator and an observer who are keeping clear of other traffic. But, for example, beyond line of sight, we certainly need a technology like that.

Senator CANTWELL. Well, if you could—I mean, obviously, with a digitized system, everything could be monitored. I think my colleague, Senator Risch brought up this issue as it related to fire, which is a perfect example. We definitely believe that drones could be a huge asset in helping us track and monitor fire starts. At the same time, literally, we had aircraft who were fighting the fires having to physically suspend and set down because hobbyists' drones were flying in the area, and they could not risk the safety.

So, that is a perfect example of the need for a traffic management system, if you will, and a communications system. Not everybody probably understood where every fire was, given that they were so immense across our state, anyway. So, it was pretty hard to go and identify and tell everybody, you know, a drone APB. Do not fly. We have firefighters flying their missions. But, so, if you had a system, you obviously could see that system and identify and communicate with it.

Mr. VANECK. Absolutely. We are actually developing technologies now so that this system can be used by smoke jumpers for fighting wildfires, for looking for hot spots using thermal cameras, for having just an SOS that the firefighters are in trouble and you can send up an SOS. Right now, it is humans deconflicting the airspace. We need to move that to a technological solution to take the human out of the loop and have that information both sent

throughout the infrastructure that is fighting the fire, but to everyone else, as well, with geo-fencing and other things to prevent the other users from being in that airspace.

Senator CANTWELL. So, do you believe the FAA's 333 is fostering this environment of voluntarily compliance, and do you think that that works to achieve that goal?

Mr. VANECK. The—as I said, the 333 was not an onerous task for us. It did take a long time. It was about 160 days for us to receive our 333. The real issue, and it has been mentioned by others, having someone have to be a pilot, a manned aircraft pilot, to be able to operate this is a burden that is just too far.

Senator CANTWELL. That is not where our international counterparts are.

Mr. VANECK. That is not where our military is. Most of the operators that we have in the military are not pilots. They have other jobs to do, but this is a technology that they use for life saving, for other things.

Senator CANTWELL. So, are we losing ground to international competitors because we are not—

Mr. VANECK. Yes, Senator. Absolutely.

Senator CANTWELL. Well, I definitely believe that we need to fix and address that. We need—this is unbelievable applications, life saving applications, information saving applications. I just think about what we need to do with fire and fire-wise, making sure that we attack fire starts right away. This kind of data and information would give us a perspective that is just invaluable. So, I hope we can figure out how to move faster as the U.S. and not be left behind the international marketplace. Thank you.

Senator GARDNER. Thank you, Senator Cantwell.

Senator Shaheen.

Senator SHAHEEN. I just wanted to make a final comment, and that is, as we talk about the challenges at the FAA, one of the things that would help a lot to allowing them to move forward more expeditiously is to reauthorize the FAA so they do not have to worry about what is going on with their life span. And, just as we need to reauthorize the SBIR program, we need to make sure that the FAA is operating, that they know what they are expecting, and that this is critical. As we talk about innovation, we should not be doing things here in Congress that hinder the innovation that we need in the country.

So, thank you both very much for your testimony.

Senator GARDNER. Thank you both for your contribution and testimony today. We are in the middle of a vote, so we are going to go ahead and conclude the hearing. Very informative and, obviously, important to balance the safety, the safe integration of unmanned aircraft into our nation's airspace without stifling small business growth and innovation.

Thank you very much for being here, and this hearing is adjourned.

[Whereupon, at 11:45 a.m., the committee was adjourned.]

APPENDIX MATERIAL SUBMITTED

**Motion Picture Association of America
Statement for the Record in the Senate Committee on Small Business Hearing
“Up in the Air: Examining the Commercial Applications of Unmanned Aircraft for Small
Businesses”**

March 10, 2016

The Motion Picture Association of America is excited to be on the forefront of small unmanned aircraft system innovation. The MPAA has worked closely with the Federal Aviation Administration and sUAS operators to secure cinematography as the first approved commercial application of unmanned aircraft in the United States. Incorporating sUAS in domestic film and television production is not only safely advancing aerial photography and helping tell stories in new and exciting ways. It is also starting to generate the economic benefits that the technology can bring our country by reducing costs and advancing the domestic aviation industry. And the sUAS operators that our industry turns to for this new and exciting application of technology are invariably small businesses. Such reliance on small businesses is typical for the film and television industry. Of the 99,000 businesses located in every state of the Union that make up the industry, 85 percent employ 10 or fewer people.

As the voice of the motion picture, home video and television industries, the MPAA submits this statement on behalf of its members: Paramount Pictures Corp., Sony Pictures Entertainment Inc., Twentieth Century Fox Film Corp., Universal City Studios LLC, Walt Disney Studios Motion Pictures, and Warner Bros. Entertainment Inc. The film and television industry is currently employing sUAS under exemptions the FAA granted vendors to use the aircraft in scripted, closed-set filming. The controlled nature of our sUAS use greatly limits exposure to the general public, minimizing any safety or privacy concerns.

When the first handful of sUAS operators received exemption approval from the FAA, Senator Dodd, MPAA’s Chairman and CEO, called the announcement “a victory for audiences everywhere as it gives filmmakers yet another way to push creative boundaries and create the kinds of scenes and shots we could only imagine a few years ago.” The MPAA and its members look forward to the continued development of this budding sector of the film industry as we work with the FAA to establish formal rules allowing use of sUAS in domestic movie and television production.

Filming with sUAS is already authorized abroad and we have now built a positive track record here at home, having completed a growing number of successful flights. One of the small businesses we work with that received an exemption from the FAA in September 2014, Aerial MOB, has already completed more than 60 film projects to date totaling more than 1,200 successful flights. Advancing such domestic use will help keep production revenues from leaving our shores, promote jobs, expand the U.S. aviation industry, and provide real-world experiences in controlled environments to help pave the way for other uses of sUAS.

Looking ahead, we asked the FAA last year in the formal rulemaking proceeding to allow additional flexibility, such as night flying, for filming in controlled environments as technology advances. We are in the initial stages of sUAS cinematography in the United States and, as use grows, the capabilities of the systems will likely evolve rapidly.

We thank Chairman Vitter and Ranking Member Shaheen for holding this hearing. We look forward to continuing our work to further integrate the use of sUAS into domestic film and television productions, and are eager to see how the creative minds of our industry use the technology to the benefit of audiences around the world.

Senate Committee on Small Business and Entrepreneurship Hearing

“Up in the Air: Examining the Commercial Applications of Unmanned

Aircraft for Small Businesses”

March 10, 2016

Follow-Up Questions for the Record

Mr. Brian Wynne, President and CEO,

Association for Unmanned Vehicle Systems International (AUVSI)

Question submitted by Senator Fischer

1. As you all know, unmanned aircraft systems (UAS) are having a profound effect on sectors across the entire economy. In my home state of Nebraska, one out of every three jobs is tied to Agriculture, and our agriculture producers could see substantial benefits from the use of UAS. A recent estimate from the University of Nebraska-Lincoln found that agriculture could eventually account for 70 percent of their business use.

How can we ensure that legitimate concerns regarding safety, privacy, and security of UAS can be addressed without stifling the continued innovation and efficiencies that are being created by these tremendous machines? Specifically, are there any reforms to the section 333 process that you all can agree would improve the current regulatory framework?

UAS are at an exciting and pivotal stage and they are indeed having a profound effect on sectors across the entire economy, including in agriculture. AUVSI recently conducted an analysis of the first 3,136 Section 333 exemptions granted by the FAA for certain low-risk commercial UAS operations. We found that 1,180 exemptions were granted for agriculture-related operations, representing nearly 38% of the total exemptions across the nation. Nebraska businesses have 17 exemptions, with 10 granted specifically for agriculture use. UAS are helping to make the Nebraska's farm industry more efficient and profitable.

The Section 333 process is allowing some businesses to fly, and the FAA has made some important reforms since it first started granting exemptions in September 2014 that have streamlined the process. However, regulating on a case-by-case basis – whether streamlined or not – is not a long-term solution and in many ways serves as a deterrent. To improve the current regulatory framework, the FAA needs to finalize the small UAS rule as directed by Congress in the FAA Reauthorization Act of 2012. The FAA has yet to do so, despite having years to put rules in place.

Until then, businesses interested in using UAS still need to apply for a Section 333 exemption to fly, which has more onerous requirements for UAS operators than those outlined in the proposed rule. For instance, Section 333 exemptions typically require UAS operators to have a private or sport pilot certificate, while the proposed rule would allow operators to fly by passing an aeronautical knowledge test every two years.

The best way to alleviate this and other burdensome requirements under Section 333 is for the Agency to finalize the small UAS rule. This will create a clear regulatory framework and allow companies that follow the rules to fly. Accelerating commercial UAS will not only help businesses harness its tremendous potential, it will also help unlock the economic impact and job creation potential of the technology. But the longer it takes to finalize the small UAS rule, the more our nation risks losing its innovation edge, along with billions in economic impact and thousands of jobs.

For the final small UAS rule, AUVSI has called for the FAA to create a risk-based, technology-neutral approach, focusing on the risk profile of a particular UAS operation instead of solely regulating the platform being flown. This would mean, for example, that low-risk operations such as aerial surveys above rural farmland would be regarded as “safe” and granted access to the airspace with minimal regulatory barriers, regardless of the specific technology used. This flexible framework will accommodate innovations rather than require new rules each time a new technology emerges.

Safety through education is also essential for UAS operations. That’s why AUVSI, along with the Academy of Model Aeronautics and in partnership with the FAA, launched Know Before You Fly in December 2014. The goal of the education campaign is to spread awareness about safe and responsible use of unmanned aircraft systems. The campaign has nearly 90 official supporters, ranging from UAS manufacturers, retailers, academic institutions, and trade associations, including those representing manned aviation, all of whom have committed to educating their members, customers and others in their communities on safe UAS use.

Finally, with regard to concerns about privacy and security, industry and government collaboration are critical. A vast majority of people want to use this technology for good. AUVSI has been engaged with the National Telecommunications and Information Administration (NTIA) multi-stakeholder process since its inception to “develop and communicate best practices for privacy, accountability, and transparency regarding commercial and private UAS use in the NAS.” While this presidentially directed effort is still ongoing, we are confident that the wide-ranging participants are getting close to reaching consensus on best practices for UAS users. We are in similar dialogues with federal, state and local law enforcement entities about security issues.

Questions submitted by Senator Heitkamp

1. Mr. Wynne, in your testimony, you highlighted the importance of safely integrating UAS into the National airspace. In North Dakota, the Northern Plains UAS Test Site is making huge contributions to the research needed to do just that. It is clear that six FAA-designated test sites nationally bring significant research and commercial value should be authorized to operate beyond the current authorization of 2017. Shouldn't the test sites be extended to allow them to continue their work in unmanned traffic management and other areas?

We agree that UAS test sites, not only in North Dakota, but also Alaska, Nevada, New York, Texas, and Virginia, are providing valuable research that will inform how best to safely integrate UAS into the national airspace. The work to achieve that goal is by no means complete, and we would wholeheartedly support extending the test sites' research in UAS traffic management (UTM) and other areas beyond the current authorization of 2017.

But in order for this to happen, the test sites need to be properly funded. That is why AUVSI has long advocated for Congress to make the UAS test sites eligible for federal funding under current FAA offices and programs that are engaged with UAS activities. This funding would help the test sites perform the valuable research needed for UTM and other areas. 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.

2. Time and time again, I hear from small businesses in North Dakota eager to see advancements in research and development that allows for safe beyond visual-line-of site operations. They view that as the key for unlocking so many commercial uses of unmanned aircraft. What can we do to help spur that research and development and what can we do to make sure the FAA keeps pace with rapid technological advancement in this field?

As we look to beyond-line-of-sight operations and plan to allow more transformational uses of the technology, there are technological challenges that exist, and which require more research and development now. We need to develop standards for sense and avoid. We need to figure out how UAS will interact with air traffic control systems. We need to determine the appropriate command and control standards to ensure the security of the communications links between UAS platforms and ground stations.

All of these technological issues are resolvable and the industry is leading the way to develop solutions. The FAA's Pathfinder Program, announced in May 2015, is an industry-government research initiative to gather more data on these operations. But we also need a deeper national commitment to UAS R&D that includes more government resources to coordinate UAS R&D and intellectual property protections for the companies that are at the forefront of UAS innovations.

One of the best ways that the FAA and Congress could keep pace with rapid technological advancement is to adopt a "risk-based, technology neutral" framework for UAS

regulations. What this means is having the FAA and/or Congress establish a regulatory environment that is able to accommodate UAS innovation via flexible responsibility, reliability, security, and compliance standards, rather than continually putting new rules forward for different UAS platforms and operations, which can stifle and hinder innovation.

Questions submitted by Senator Scott

1. I understand that private companies are hoping to utilize UAS technology in a number of different ways. For them to currently do so, I know that they must qualify for an exemption, yet the rules seem to still be unclear. Can you clarify exactly what the rules are for private companies to qualify for such an exemption?

In order to qualify for an exemption, the UAS operator must hold an airline transport, commercial, private, recreational, or sport pilot certificate. The operator must also hold an airman medical certificate or a valid U.S. driver's license. If a company wishes to operate its UAS outside of the blanket Certificate of Authorization (COA), it must apply separately for a COA in addition to applying for its exemption. In addition, the company must explain how the exemption would be in the public interest, as well as provide information about the specific platform(s) they are flying, how they will be flying, and the regulations from which they will be exempt. Exemption requests may take longer than 120 days to process, depriving companies of months of flight time and associated income.

2. As a former small business owner in the insurance industry, I understand the need for small businesses around the country to take advantage of technology to be able to best serve customers. Drones have shown some potential for commercial benefit to improving customer service and product delivery, and even contributing to the claims adjustment process. Yet most companies that I hear from are unable to fully engage drone programs commercially due to unclear and undeveloped rules and regulations. Does the government share some of the blame for failing to innovate in this area by failing to issue regulations or guidance?

Yes. Companies and individuals around the country are discovering the many opportunities that UAS can bring to their businesses. But those opportunities will only come if the federal government makes UAS integration a top priority. In 2012, Congress directed the FAA to integrate UAS into the National Airspace System by Sept. 30, 2015. That deadline has now come and gone, and the FAA has yet to finalize the small UAS rule, let alone facilitate the full integration of UAS that Congress contemplated in 2012.

As such, the FAA needs to swiftly finalize its long-awaited small UAS rule and proceed with the full UAS integration, which will create a clear regulatory framework and allow companies that follow the rules to fly. Accelerating commercial UAS will not only help businesses harness the tremendous potential of the technology, it will also help unlock its economic impact and job creation potential.

AUVSI's study on "*The Economic Impact of Unmanned Aircraft Systems Integration in the United States*" found that the unmanned aircraft industry is poised to create in the U.S. more than 100,000 new jobs and more than \$82 billion in economic impact in the first decade following the integration of UAS into the national airspace. Under the right regulatory environment, there is no question that these economic numbers could go even higher.

**Follow-Up Questions for the Record
Submitted to Eli Dourado
From Senator David Vitter on behalf of Senator Deb Fischer and Senator Heidi
Heitkamp**

**“Up in the Air: Examining the Commercial Applications of Unmanned Aircraft for
Small Businesses”
March 10, 2016**

Question from Senator Fischer:

As you all know, unmanned aircraft systems (UAS) are having a profound effect on sectors across the entire economy. In my home state of Nebraska, one out of every three jobs is tied to Agriculture, and our agriculture producers could see substantial benefits from the use of UAS. A recent estimate from the University of Nebraska-Lincoln found that agriculture could eventually account for 70 percent of their business use.

How can we ensure that legitimate concerns regarding safety, privacy, and security of UAS can be addressed without stifling the continued innovation and efficiencies that are being created by these tremendous machines? Specifically, are there any reforms to the section 333 process that you all can agree would improve the current regulatory framework?

As a general matter, we can capture the greatest benefits from innovation in UAS if we adopt a commitment to address safety, privacy, and security concerns after they arise rather than preemptively. My research suggests that many of the safety concerns are overstated,¹ and there are already state and local laws on the books, such as Peeping Tom laws, that address privacy. By allowing any harms that do arise from the use of UAS to be addressed through the courts in response to actual cases and controversies rather than preemptively by the FAA, we can ensure that UAS development is not slowed down by hypothetical fears that never materialize.

With respect to FMRA section 333 specifically, it is worth noting that Congress intended the 333 rules to be temporary until such time, no later than September 2015, as the FAA promulgates permanent rules under section 332. The agency has so far completely ignored its statutory obligation to articulate 332 rules. Inexplicably, the sUAS rule the FAA proposed last year was promulgated under 333, not under 332. Congress should reiterate its demand that the FAA propose 332 rules that would allow UAS to fly under a broad range of operational parameters.

¹ Eli Dourado and Samuel Hammond, “Do Consumer Drones Endanger the National Airspace? Evidence from Wildlife Strike Data” (Mercatus on Policy, Mercatus Center at George Mason University, Arlington, VA, March 2016).

Question from Senator Heitkamp:

Time and time again, I hear from small businesses in North Dakota eager to see advancements in research and development that allows for safe beyond visual-line-of-site operations. They view that as the key for unlocking so many commercial uses of unmanned aircraft. What can we do to help spur that research and development and what can we do to make sure that the FAA keeps pace with rapid technological advancement in this field?

Quite simply, the best way to spur research and development on BVLOS operations is to legalize them. So far, the FAA has been unreasonably cautious in authorizing such operations. Commercial operators have every incentive through tort law to operate responsibly and incrementally if authorized to operate beyond line-of-sight.

In order to ensure that the FAA keeps pace with technological advancement, Congress should continue to exercise close oversight. FAA reauthorization periods should be short in order to allow Congress to frequently revisit the FAA's performance, both in terms of its compliance with statutory requirements and its willingness to liberalize its rules as technology improves.

In the long run, there needs to be cultural change at the FAA. The agency presently operates under a safety mandate, and too often, safety is sought at the expense of innovation. Ideally, Congress would give the FAA a mandate to seek safety balanced against the gains from innovation. FAA employees should be rewarded when they appropriately allow operations that are innovative yet risky at the margin. The agency's overly cautious approach is holding back the rate of global innovation in aviation.