

# TAKING FLIGHT: SMALL BUSINESS UTILIZATION OF UNMANNED AIRCRAFT

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## HEARING

BEFORE THE

COMMITTEE ON SMALL BUSINESS

UNITED STATES

HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTEENTH CONGRESS

FIRST SESSION

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HEARING HELD  
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## **TAKING FLIGHT: SMALL BUSINESS UTILIZATION OF UNMANNED AIRCRAFT**

**WEDNESDAY, JULY 15, 2015**

HOUSE OF REPRESENTATIVES,  
COMMITTEE ON SMALL BUSINESS,  
*Washington, DC.*

The Committee met, pursuant to call, at 11:00 a.m., in Room 2360, Rayburn House Office Building. Hon. Steve Chabot [chairman of the Committee] presiding.

Present: Representatives Chabot, Luetkemeyer, Hanna, Huelskamp, Brat, Radewagen, Knight, Curbelo, Bost, Hardy, Kelly, Velázquez, Meng, Lawrence, Clarke, and Moulton.

Chairman CHABOT. Good morning. The Committee will come to order.

It was at a bicycle shop in Dayton, Ohio, which is just north of my congressional district by coincidence, where two entrepreneurs dreamed up a machine that would fly people through the air. It took a bold spirit to think that big. And even bolder spirit to test it. But Orville and Wilbur Wright persevered and changed the course of history. A little more than a half century later, we would fly to the moon, and a half century after that, we are discussing an era when men and women do not even need to be in the aircraft to pilot it. Dayton, Ohio led them, and it is leading again, and one of our witnesses here today is a testament to that.

We are here today to examine the commercial usage of unmanned aircraft by small businesses, to look at the benefits of this technology, and discuss some of the concerns surrounding safe operations. Most importantly, we will have a conversation about how America can once again lead the world in a new era of flight.

The potential uses of unmanned aircraft systems or UAS is limitless. They can be used by local broadcasters to gather footage and report the news. They can be used by farmers to better manage their crops. They can be used by engineering firms to inspect bridges. And they can be used by first responders to help save lives.

At the University of Cincinnati, students are working with a fire department to develop aircraft that give real-time information to firefighters and emergency crews about where a fire is burning and where it is moving. Currently, the Federal Aviation Administration is working to integrate unmanned aircraft systems, or UAS, into the national airspace system. On a case-by-case basis, the FAA is authorizing low-risk commercial UAS operations. The FAA also has proposed a rule to allow small unmanned aircraft—those weighing 55 pounds or less—to operate in our skies. The proposed rule in-

cludes a number of operating restrictions aimed at ensuring safe operations.

I'm interested in learning from the small businesses and innovators, whom we have here today, on the frontlines about how the FAA's current process is working for them and how the proposed rule, once finalized, may affect their operations. I am also looking forward to hearing how their small businesses are utilizing this new technology and planning for the day when UAS are fully integrated into American airspace.

There are moments when we can unleash a positive force of innovation and job creation if we don't smother it with regulations. Most of the time, the government misses these moments and we are left to wonder what could have been. There is always a balance to be struck. While we must promote public safety and proper usage of unmanned aircraft, we must ensure that the regulations are carefully crafted so that they don't prevent this new industry from innovating and helping grow our economy, and most importantly, create jobs.

I am eager to hear what our witnesses have to say about their own experiences, and I look forward to seeing how this new industry grows, and as it does, creates new opportunities for small businesses to capitalize on new technology.

I would now like to recognize our ranking member for her opening statement this morning.

Ms. VELAZQUEZ. Thank you, Mr. Chairman, and thank you for holding this important hearing.

America's entrepreneurs have long played an important role in the development and growth of unmanned aerial vehicles (UAV). While the evolution of these systems has been a game changer for our military, the benefits are not limited to the battlefield. Civilian drones can be employed for a wide range of commercial uses, and some companies are experimenting with this technology to deliver products to consumers. UAVs offer a cost-effective solution for everything from agriculture, to news coverage, to mapping and surveying terrain, to the film industry.

For our overall economy to remain competitive, it is important that the United States continue researching and developing this technology. Should we wait, other countries will likely pass us by in this emerging market. Japan has already moved forward aggressively to address safety and airspace regulation issues. Europe is expected to account for 15 percent of procurement of unmanned aerial vehicles, while European companies will produce nearly 4 percent of UAVs.

As we work to ensure the United States remains on the forefront of developing this technology, small businesses must continue playing a critical role. The Small Business Innovation Research Program and the Small Technology Transfer Program have been an important public-private partnership that has harnessed entrepreneurs' ingenuity to move UAV technology forward. This committee can play an important oversight role in helping ensure those initiatives operate as Congress intended and help ensure small companies remain involved in drone development.

Beyond the small business participation in UAV research, a number of other important policy issues must be addressed in order

for commercial drone technology to fully blossom. The FAA's recent proposed rulemaking on licensing of drones and regulations of speed and altitude appears to be a good step in the right direction. It is my hope that today we can obtain a better understanding of how small companies, both as developers of drone technology and potential users will be impacted by the rulemaking.

In addition, there are significant privacy concerns associated with unmanned aerial systems. As always, the challenge will be balancing the need to protect the public from potential abuse, while allowing room for this new technology to take root, grow, and help fuel commerce.

Mr. Chairman, entrepreneurs have a significant stake in how our nation proceeds with the regulation and development of UAV technology. It is my hope that by working together with the industry, our nation can harness the full potential of this nascent technology, providing an exciting new sector for small businesses and creating opportunity for new jobs and economic growth.

With that, let me thank the witnesses for coming here to testify, and especially I want to welcome a small business owner from my district, Mr. Stroom. And it is a business that is changing the face of the film industry. Welcome.

Chairman CHABOT. Thank you very much.

Ms. VELAZQUEZ. I yield back the balance of my time.

Chairman CHABOT. Thank you.

If Committee members have opening statements, I would ask that they submit them for the record.

And I will take just a moment to explain our five-minute rule, which is basically you get five minutes to speak. And there is a lighting system there to assist you. The green light will be on for about four minutes, the yellow light will come on to let you know you have got about a minute to wrap up, and the red light will come on and we would ask you to try to stay within that as much as possible. We will give you a little leeway but not a whole lot. So we thank you for being here.

And our first witness I will introduce now is Brian Wynne. Mr. Wynne is the president and CEO of the Association for Unmanned Vehicle Systems International. AUVSI is the largest trade association representing the unmanned systems and robotics industry. Mr. Wynne has significant transportation and technology experience. He has served in executive positions at the Electric Drive Transportation Association, the Intelligent Transportation Society of America, and the Association for Automatic Identification and Mobility. Mr. Wynne holds a bachelor's degree from the University of Scranton, and a master's degree from the School of Advanced International Studies at Johns Hopkins University.

Our next witness will be Mike Gilkey, who is the CEO and Director of Flight Operations for 3D Aerial Solutions LLC, a Dayton, Ohio unmanned aircraft systems start-up company. Mr. Gilkey has over 30 years of experience working on national security programs, primarily for the Air Force Research Laboratory at Wright Patterson Air Force Base in Ohio. He has worked on airborne sensors research and development, as well as advanced projects for unmanned military. Or excuse me, unmanned military aircraft. Mr. Gilkey and some colleagues from the defense industry founded 3D

Aerial Solutions in 2013. It was the second company in Ohio to be granted a Section 333 exemption by the FAA and is now performing commercial operations for the agriculture industry in the Midwest. Mr. Gilkey earned both a Bachelor of Science and Master of Science in Electrical Engineering.

Our third witness, Brian Stroom, is a filmmaker and entrepreneur as the ranking member mentioned. He is the CEO and Co-founder of AeroCine, a commercial unmanned aircraft systems designer, builder, and operator located in the ranking member's district, as I mentioned, in New York. Mr. Stroom has produced five feature films, including Sundance Film Festival winner "James White." He also produced television commercials for Uber, Gatorade, Ralph Lauren, Toyota, Nokia, and Samsung. Mr. Stroom is a graduate of the NYU Tisch School of Arts, where he studied filmmaking with a focus in art and technology. In 2013, Mr. Stroom founded AeroCine with fellow NYU Tisch graduate and filmmaker, Jeff Brink. And AeroCine was one of the first companies in the United States to receive permission to operate from the FAA.

And I will now yield to Ms. Velázquez to introduce Dr. McLain.

Ms. VELÁZQUEZ. It is my pleasure to introduce Dr. Tim McLain. Professor McLain is the director of the National Science Foundation Sponsor Center for Unmanned Aircraft System, which in conjunction with a number of universities performs industry-sponsored research related to unmanned aircraft systems. He has over 15 years of research experience in this technology and has even been a cofounder of two USA startup companies. In addition to his duties at the Center for Unmanned Aircraft Systems, Professor McLain also teaches in the Mechanical Engineering Department of Brigham Young University.

Welcome. Thank you for being here today.

Chairman CHABOT. Thank you. We thank you all for being here.

Mr. Wynne, you are recognized for five minutes.

**STATEMENTS OF BRIAN WYNNE, PRESIDENT & CEO, ASSOCIATION FOR UNMANNED VEHICLE SYSTEMS INTERNATIONAL; MIKE GILKEY, CEO AND DIRECTOR OF FLIGHT OPERATIONS, 3D AERIAL SOLUTIONS LLC; BRIAN STROOM, CEO/FOUNDER, AEROCINE; TIM MCLAIN, PROFESSOR OF MECHANICAL ENGINEERING & DIRECTOR OF THE CENTER FOR UNMANNED AIRCRAFT SYSTEMS, BRIGHAM YOUNG UNIVERSITY**

**STATEMENT OF BRIAN WYNNE**

Mr. WYNNE. Thank you, Chairman Chabot, Ranking Member Velázquez, and members of the Committee. I appreciate the opportunity to be here today to talk about unmanned aerial systems—I mean, aircraft systems, excuse me.

I am speaking on behalf of the Association for Unmanned Vehicle Systems International, the world's largest nonprofit organization devoted exclusively to advancing the unmanned systems and robotics community. AUVSI has been 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.

Unmanned aircraft systems increase human potential, allowing us to execute dangerous or difficult tasks safely and efficiently. From inspecting pipelines and surveying bridges, to filming movies, and crops, the applications of UAS are virtually limitless and offer a superior way to see what needs to be seen in less time at less expense.

For years, AUVSI has been the leading advocate for the safe integration of UAS in the national airspace system. We were delighted earlier this year when the Federal Aviation Administration published its long-awaited proposed rules for commercial and civil operations of small UAS, which are systems that weigh 55 pounds or less. These proposed rules are a critical milestone in the UAS integration process and bring us closer to realizing the tremendous societal and economic benefits of this technology.

As the FAA has worked on these rules, much has already changed in the industry. Since Congress tasked the FAA with creating UAS regulations in 2012, the technology has gone from a specialized tool to a must-have business asset. The flood of commercial exemption requests to the FAA shows that a mature UAS commercial market is waiting to be unleashed. Of the more than 700 exemptions—and I am given to understand 800 now—the website is still catching up with the number of exemptions that have been issued, the vast majority 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.

Let me provide some examples. North Carolina-based Precision Hawk is a startup that manufactures UAS and Cloud-based data collection software. Its platform is helping farmers survey crops and assisting insurance companies with claims following natural disasters. The company is also helping the FAA and industry research extended visual line of sight operations in rural areas. Precision Hawk started in 2010 with six employees and now has more than 70 with multiple offices in the U.S. and around the world.

Another example is California-based Aerial MOB. The film company was one of the first to receive a commercial exemption from the FAA. It has since performed the first-ever FAA-approved film production project with a major Hollywood studio and a number of promos among others. My colleagues will give additional examples of real-world small business applications of UAS.

The FAA continues to approve about 50 new commercial operations a week, a process that has recently been streamlined. However, this current system of case-by-case approvals, whether streamlined or not, is not a long-term solution for the many small businesses wanting to fly.

As an industry, we want to see the integration of UAS proceed and without any further delays. It is important that the FAA finalize the small UAS rules as quickly as possible. Once this happens, we will have an established framework for UAS operators that will allow anyone who follows the rules to fly.

Equally important, Congress needs to pass, and the president needs to sign into law an FAA reauthorization measure before the current authorization expires on September 30, 2015. This measure is critical in the most immediate way to achieve the necessary

steps to encourage innovation and ensure the continued safety of the national airspace while accelerating the commercial use of UAS.

It is not just the many uses of this technology that are at stake, but also the 100,000 jobs and 82 billion in economic impact that the UAS industry is expected to create in its first decade following integration. With the right regulatory environment, there is no question these numbers could go even higher. But the longer we take, the more our nation risks losing its innovation edge, along with billions in economic impact.

Thank you for the opportunity to speak today and I look forward to answering any questions.

Chairman CHABOT. Thank you very much.

Mr. Gilkey, you are recognized for five minutes.

#### **STATEMENT OF MIKE GILKEY**

Mr. GILKEY. Good morning, Chairman Chabot, Ranking Member Velázquez, and members of the Committee. It is a pleasure to be here today to discuss an entrepreneur's perspective of the emerging unmanned aircraft systems industry.

Unmanned systems hold the potential to truly revolutionize our economy and way of life. Unmanned aircraft systems provide innovative new tools for the common man, which are being employed in uncommon ways. A new industry is being born, resulting in the creation of many new small businesses.

Small business people like me are slugging their way through the obstacles and bureaucracy to fulfill our dreams of creating this new industry. We are pioneers determined to succeed and believe the country and the world will be beneficiaries.

I welcome the opportunity to be here today to inform the Committee of our story and explore how Congress can foster a more accommodating environment for small business, which ensures safe operations and protects privacy.

My colleagues and I created 3D Aerial Solutions in 2013 to leverage our expertise working with military unmanned aircraft and transition advanced technology know-how to civilian problems. We self-funded 3D Aerial through an initial round of owner investment and began buying aircraft and equipment. We purchased a senseFly eBee aircraft, which I have here today, because it is highly automated, easy to use, and precise.

We are now sales agent for this product line. We began flying under the Academy of Model Aeronautics Hobbyist rules and became experts on the use of this equipment. 3D Aerial became an affiliate member of the Entrepreneur Center, a technology business incubator in Dayton, Ohio, to gain access to business advice and meeting facilities.

3D Aerial believes we in the UAS industry have a responsibility to reach out and educate the public, and to this end, we started the Dayton Drone Users Group for community outreach. Our private business was not eligible to apply for a certificate of authorization in order to fly commercially. We collaborated with the Ohio-Indiana UAS Center and Test Complex and were able to fly on a COA they established.

For the most part, however, we spent a year and a half in a holding pattern awaiting for the authority to make money flying aircraft. 3D Aerial submitted our request for a Section 333 exemption on October 14, 2014, and was granted an exemption on March 3, 2015. We were the second company in Ohio to be granted this exemption. 3D Aerial received the corresponding COA on March 23rd and completed registration of our aircraft on May 7th.

With these steps complete, we are now authorized to legally perform commercial flying services limited only to flights of the eBee aircraft and only for agricultural applications. The blanket COA allows us to operate throughout the United States but is subject to a large number of significant restrictions.

3D Aerial is now providing UAS flight services to perform aerial imaging of crops using the eBee. We also process the imagery into a variety of desired image products which we provide to the farmer. We are in the process of hiring more pilots and buying more aircraft. Small UAS, like our eBee, can fly much lower than manned aircraft and can offer extremely high image resolution less than one inch per pixel. They also can be operated very inexpensively and virtually on demand.

The FAA issued its Notice of Proposed Rulemaking for operation and certification of small UAS on February 23rd. Implementation of final rules is not expected until mid-2016 at the earliest. While there are still many restrictions, the current rules as proposed will represent a step forward for the small UAS industry.

3D Aerial's primary concerns with the new rules as a small business operator are the cost to gain FAA operator certification, the phase-in period for compliance with new rules, impact of state and local rules restricting UAS operations, and enforcement of regulations.

In closing, it is an exciting time to be in the emerging commercial UAS industry. If fostered through a reasonable balance of regulations to protect national airspace and accommodating economic policy, small business will be a significant engine of growth delivering on the promise of new jobs and expanded tax base that will benefit our economy. Furthermore, the advanced technology capability we offer today will continue to improve and provide growing value to our society.

On behalf of my colleagues at 3D Aerial Solutions, I thank you for allowing me to speak to you today.

Chairman CHABOT. Thank you very much.

Mr. Stroom, you are recognized for five minutes.

#### **STATEMENT OF BRIAN STROOM**

Mr. STROOM. Thank you.

Chairman Chabot, Ranking Member Velázquez, and members of the Committee, my name is Brian Stroom, and I am the cofounder and CEO of AeroCine, a drone company that uses unmanned aerial vehicles to fly Hollywood cameras for movies, television, advertising, and real estate, among other things. Thank you for having me here today and for holding this critical hearing. Ranking Member Velázquez, we are proud to be constituents of your district. It is my honor to be here before all of you.

I wish I could tell you that I am one of the world's foremost roboticists or rocket scientists, but for a hearing such as this—  
Chairman CHABOT. Let me interrupt you just one second.

Mr. STREEM. Sure.

Chairman CHABOT. In case anybody has not noticed, as you see on the screen, listen but watch.

Mr. STREEM. Do more watching than listening.

I wish I was one of the world's foremost rocket scientists or roboticists, but for a hearing such as this, my experience as an artist and NYU film school graduate is really the story. It also just so happens I am building my own drones and consider this part of the new American dream.

The unmanned aerial system industry worldwide has created a new generation of entrepreneurs who are innovating with small businesses that will reshape the global economy. Safe and responsible use of UAS will be ubiquitous across every sector of the economy. Unfortunately, this worldwide phenomenon is in jeopardy here at home in the United States due to the current state of regulation that prohibits commercial operations absent an exemption.

I consider myself lucky, as AeroCine was among the very first U.S. companies and the very first New York company to receive the FAA exemption to operate commercially, but to continue to have to seek permission to adapt and change to a client's need is expensive, it is time consuming, and it is frustrating. And yet my passion for the industry has not waned.

Three years ago, witnessing a helicopter flying a miniature camera capturing breathtaking video, I was astonished, and I realized that this new technology would introduce the world to a new creative frontier, in addition to hundreds, if not thousands of additional efficient and paradigm-shifting innovations, the implications for filmmaking were readily apparent. Film producers make extensive use of cranes, camera cars, helicopters, all in an elaborate effort to get the best shot. This is sufficient and still viable in some cases, but drones are more cost effective when operated responsibly and can greatly reduce potential risk to human lives. A drone has the capability to replace all of these on film sets while reducing the risk to human life and enhancing the artistic pursuit. What excited me about drones three years ago is the same thing that excites me today. At their very core, drones present a way to easily place a sensor anywhere in three-dimensional space; what could once only be dreamed can now be produced.

When my partner, Jeff Brink, and I started AeroCine, we planned to simply purchase a drone to carry large cinema cameras. Finding no suitable system on the market, we drew from academic and aerospace circles to build a team of engineers and set out to create an aerial-robotic system of our own. Today, our work ranges from designing custom UAVs to operating UAVs for big budget films, television shows, live programs, and special events. We are proud to be bringing to consumers image and video that has never been created.

The FAA's efforts to integrate UAVs into the national airspace are commendable in the face of extraordinary challenges. One notable step is the increased speed with which the FAA is awarding Section 333 exemptions. The publication of Proposed Rule for Small

Drones is also promising, but we understand we may be a year or more away from a final rule. And even so, the proposed rule is in many respects too restrictive, evidenced by many companies' move to test in Canada and elsewhere. If we do not scramble to bring our regulations up to speed, our innovators will be eclipsed by entrepreneurs and other countries that have an established legal framework.

Before we conclude, we would like to invite the members of the Committee to visit our website, AeroCine.com, to view some of our captivating cinematography that this new technology has allowed us to capture. We would like to also thank the small UAV coalition for its leadership in promoting the UAV industry. AeroCine stands ready to assist this Committee and the U.S. Congress in bringing this exciting technology to consumers, and we thank you for your leadership in holding this hearing.

Mr. Chairman, Ranking Member Velázquez, and members of the Committee, this concludes my opening statement. I look forward to answering any questions from the Committee. Thank you.

Chairman CHABOT. Thank you very much.

Dr. McLain, you are recognized for five minutes.

#### **STATEMENT OF TIM MCLAIN**

Mr. MCLAIN. Thank you, Chairman Chabot, Ranking Member Velázquez, and members of the Committee, for inviting me to speak today. I will provide the perspective of a professor who has been involved in unmanned aircraft systems research for over 15 years and who has interacted with small businesses in a variety of ways.

I am a professor of mechanical engineering at Brigham Young University and currently direct a National Science Foundation sponsored research consortium called the Center for Unmanned Aircraft Systems. The center brings together researchers from industry and academia to collaborate on research challenges facing the UAS industry. Our research universities include BYU, the University of Colorado, and Virginia Tech.

From my perspective, small businesses have played a vital role in the creation and growth of the UAS industry in the United States. Without doubt, a significant portion of the innovation in the UAS industry has come from entrepreneurial startup companies.

During the last decade, as unmanned aircraft have had a transformational impact on military operations, and as the promise of regulatory change has increased their viability for commercial applications, larger companies have taken greater interest in small UAS. Illustrating the importance of small business to the UAS industry, a common approach for large companies to enter or become more competitive in the UAS marketplace has been for them to acquire small, innovative companies.

As regulations are put in place to allow commercial flights of UAS, there will be a shift away from defense applications and an acceleration of market opportunities. This is particularly true for small UAS due to their accessibility and relatively low costs. Applications that have been envisioned for small UAS include agricultural monitoring, infrastructure inspection, wildlife monitoring, package delivery, aerial mapping, and many more. As Mr. Wynne

has testified, AUVSI projects that the 10-year economic impact of UAS in the United States will be \$82 billion, with over 100,000 new high-tech jobs created.

Because many UAS application markets are undeveloped and high risk, it is likely that small, innovative businesses will be the first to enter these markets, to build them, and to prove their viability and value. More than ever, small business is essential to the growth and maturation of the UAS industry. These businesses will include both developers of UAS products and providers of UAS services.

Current UAS market estimates are based on specific applications that have already been identified. From my perspective, even more exciting than these known applications are those that have not yet been conceived. Much like the Internet of the 1990s, the potential of unmanned aircraft to enhance our lives is in its infancy and we do not yet have a full sense of the impact of this technology.

To enable and accelerate growth in the UAS industry and facilitate the participation of small businesses, the regulatory barriers to entry must be kept low. If the cost of obtaining authorization to fly are too high, then these UAS markets of opportunity will be closed to all but larger companies that are well capitalized. Smaller companies will not be able to participate and bring their creative products to market. Costs for UAS technologies and services will remain high, innovation and progress will be hampered, and the U.S. will lose its competitive leadership position in an industry that it pioneered.

The progress of UAS research and commercialization in the United States has been inhibited by the lack of a regulatory framework that allows unmanned aircraft flights to take place. The FAA's small UAS Notice of Proposed Rulemaking is a good step forward that will help accelerate growth in many UAS application areas and allow viable UAS businesses to be established. The small UAS rule, however, only allows flight within visual line of sight of the operator. For many important applications, such as oil pipeline monitoring and package delivery, beyond line-of-sight capabilities are essential. Regulations permitting safe beyond line-of-sight flight are needed to allow the benefits of UAS technology to be fully realized.

In summary, small businesses have played a vital role in the development of the U.S. unmanned aircraft industry by way of their vision, innovation, and willingness to take risks in emerging technology markets. As we move into the future of commercial UAS applications, small businesses will continue to make critical contributions to the success of this important industry.

Thank you again for the opportunity to address the Committee. I look forward to any questions that you may have.

Chairman CHABOT. Thank you very much.

And to be fair, we apply the same five-minute rule to ourselves that we applied to you, so we will all stay within five minutes ourselves. And I will recognize myself for that purpose at this time.

Mr. Wynne, I will begin with you. Aging infrastructure, as I am sure you know, is a significant issue all across the United States. In my own district, we have the Brent Spence Bridge, which we are struggling with trying to find a way to replace it. It is considered

functionally obsolete. What are the benefits of using UAS to inspect aging infrastructure around the country? And if you want to give examples, that is fine.

Mr. WYNNE. I think they are very significant, Mr. Chairman. Typically, when you are inspecting a bridge, you have to close that bridge. People have to potentially hang off the bridge in harnesses and look. We have enormously sophisticated sensors today that can be mounted on these platforms that can actually do that job, in some instances better than the "mark one eyeball." So being able to actually fly a UAS under a bridge, rather than putting a human under it, can actually not only increase the safety of that operation but also increase the effectiveness of it.

Chairman CHABOT. And obviously, I mean, UAS can have different forms. This one is a fixed wing. Now, if you were inspecting a bridge, I assume it would be more of a helicopter?

Mr. WYNNE. Rotary based.

Chairman CHABOT. Yeah. Okay. Thank you.

All right. Mr. Gilkey, let me turn to you, if I can. And it is great to have an Ohio company that is a trailblazer for this new industry appear before the Committee. You have described the challenge of the evolving regulatory environment for a small business like 3D Aerial Solutions. What are some of the other challenges that you have encountered or are currently encountering?

Mr. GILKEY. One of the biggest challenges we have is with public perception. People are afraid of drones who are not educated on what they can do and the safety aspects of it. That is something that challenges us and that is why we feel a responsibility to do community outreach, which we are doing with the Dayton Drone Users Group. That is one of the biggest. And state economic development funding is flowing in the state to support work in this area. It is not coming to companies like ours. It is disproportionately going to public institutions and research institutions that do not provide benefit to companies like 3D Aerial.

Chairman CHABOT. When you say some people are afraid of drones, what are they afraid of?

Mr. GILKEY. Privacy rights violations is the primary concern, and then safety is a second.

Chairman CHABOT. Okay. Thank you.

Mr. Stroom, I will turn to you now. In your testimony, you noted that the proposed rule for UAS, I believe, is too restrictive. What are your concerns with the operating restrictions that the FAA has proposed?

Mr. STROOM. One of them is the ability to fly at night. There have been several instances where on closed set filmmaking, we have been asked by Hollywood productions to use a drone at night and we were unable to do the operation. We believe we can do it safely, and not being able to do it, it means, quite frankly, we did not get the job.

Chairman CHABOT. Okay. Thank you.

Dr. McLain, I will turn to you now. In your testimony you stated that "to enable and accelerate growth in UAS industry and facilitate the participation of small business, the regulatory barriers to entry must be kept low." And I tend to agree with you. Does the FAA's proposed rule for small UAS, in your belief, strike the right

balance between ensuring safe operations and permitting small businesses to participate in the development of industry?

Mr. MCLAIN. I believe that the proposed rule is a good step forward in the right direction, but there are some limitations to it that have been mentioned—the beyond line-of-sight restrictions, as well as the restrictions that Mr. Stroom mentioned that do not allow nighttime flight. Those are a couple of restrictions that I believe could be carried out safely with the implementation of proper technology and proper regulations. Like I said, I think the small UAS rule is a good step forward, but I think many of the most promising applications for small UAS, or even larger UAS, are not encompassed by that rule.

Chairman CHABOT. Okay. Thank you. My time is about expired.

I think this is a very interesting topic that we are on here today, and I have heard the same concerns, Mr. Gilkey, that you have heard, and have seen some of the programs, 60 Minutes and some of the others that you have people afraid you are going to have somebody flying one of these up to your window and looking in or they are going to be doing something they should not be doing, or even terrorists, or who knows. And it was not particularly helpful when this knucklehead in the copter came up here on Capitol Hill. Now, that was not an unmanned vehicle, obviously, because he was in it, but there is always potential abuse in anything but I think this is something that could be tremendous for our country and job creation if we do it right. And you are all here helping us to make sure that we do get it right. So thank you for being here.

And I will now yield to the gentlelady from New York.

Ms. VELAZQUEZ. Thank you, Mr. Chairman.

Mr. Wynne, one survey found that many companies are unclear of the current FAA regulations; yet, they continue to operate commercial drones anyway. This arbitrary rule-following is troublesome and could present a risk to the public safety. What can be done to avert a recurrence of this behavior and increase the level of public adherence to the regulations?

Mr. WYNNE. I am going to answer that with one word and that is education. There are a lot of people that are coming into this community, into the unmanned systems and robotics community that are not aviators, and they are operating in aviation space, in the national airspace system. And it is not a particularly complex system in some respects, but in other respects it really is. If we looked at the number of instances, I think what we would find is that many of them might be real estate agents who want to take a picture of a house from a different angle that have not bothered to get a Section 333. I am opposed to that. People need to obviously respect the law, and until we have the proposed rules finalized which would allow such operations, they need to get a Section 333.

Ms. VELAZQUEZ. So you do not feel that any enforcement mechanism should be put in place?

Mr. WYNNE. I think it would be very appropriate for the FAA to enforce the rules, and if you are flying for money illegally without a 333 exemption, enforcement should be carried out. It is very difficult to do that at this stage of the game, which is why we were encouraging the FAA to finalize those rules very quickly.

Ms. VELÁZQUEZ. Professor McLain, there are some countries that have already solved some of the airspace integration problems the FAA is addressing in these rules. Have the current regulations in this area prevented us from solving these issues at the same pace as other countries?

Mr. MCLAIN. So the regulations in other countries are in many respects similar to the small UAS rule. There are some countries where they have beyond-line-of-sight flight capabilities. But the FAA, I think the biggest problem with their approach thus far is just the pace at which they moved forward. The regulations that were in place prior to 2007 are essentially the same regulations that the FAA is proposing to enact this year. So the question would be, why has it taken nine years to bring about the current UAS rule proposal? In the course of these nine years, small businesses have come and gone because of the lack of a regulatory framework.

Ms. VELAZQUEZ. So you do not see any steps that other countries have taken that could be implemented here by the FAA to expedite the process?

Mr. MCLAIN. Well, I think the small UAS rule is a good step forward, and I think if they could get that in place, that would close the gap between the regulations in other parts of the world and what we have currently in the United States, which is very, very limiting.

Ms. VELAZQUEZ. Thank you.

Mr. Stroom, your business holds a certificate of authorization from the FAA that allows it to commercially fly drones for close-range aerial imaging. How difficult was it for your firm to obtain the certificate?

Mr. STREEM. It was incredibly difficult, in particular, because we were one of the first to file for it. There was no roadmap to really go by.

Ms. VELÁZQUEZ. But my question is, today, are you aware if it is complex and difficult?

Mr. STREEM. I am not because I am not going through the process. I would expect it is simpler.

Ms. VELAZQUEZ. Okay.

I have a question about insurance and liability. I understand that not too many carriers are providing insurance, and so what risk does it pose to the public and to those who have drones at this point?

Mr. STREEM. Yes. We have insurance. It is expensive.

Ms. VELAZQUEZ. One study found that two-thirds of businesses operate without commercial liability.

Mr. STREEM. Right. It is an expensive cost for small businesses that many avoid until they have to. We just got our insurance recently when we just began to fly, and we have collision and liability insurance for our operations.

Ms. VELAZQUEZ. And with two-thirds, what is happening when accidents occur and the operator does not have insurance?

Mr. STREEM. I do not know.

Ms. VELAZQUEZ. They will be taken to court?

Mr. STREEM. Yes.

Ms. VELAZQUEZ. Okay. Thank you.

Chairman CHABOT. The gentlelady's time is expired. Thank you.

The gentleman from California, Mr. Knight, is recognized for five minutes.

Mr. KNIGHT. Thank you, Mr. Chair.

Thank you for the Wright Brothers' history there. I always appreciate that, and I appreciate seeing all these new companies here since the Wright Brothers beat out government contract over 100 years ago, and I think that that is kind of the story.

My questions are, and I think either Mr. Gilkey, maybe Mr. Wynne, talked about privacy. We have had some recent problems in firefighting in California where folks have flown UAS into the firefighting scene trying to get some pictures or put something on the Internet. They have interfered with firefighting operations. In fact, at one point they had to stop drops into the area because of the UAS actions by civilians. How does your industry feel about that? Should there be some talk about that in Congress? Should there be some restrictions on that? How do you feel?

Mr. WYNNE. I am happy to field that one. My son is a firefighter, so I feel very strongly.

In all of these instances, a temporary flight restriction (TFR) was put up around the operation, and the airboss for that TFR, whoever was actually handling the operations was having to divert his traffic because there were things flying around in there that did not belong and they were not under positive control. That is a bad thing. That is a bad thing in any temporary flight restriction, whether it is over a sporting event or any other place.

I think education is, again, key. We have people flying right now who are not aviators. They do not understand exactly what a TFR is. They are violating FAA regulations and those regulations need to be enforced because there are lives and property at stake. So the community feels very strongly that this is our responsibility to educate our operators and make certain.

We have a difficult situation right now because in those instances, they might actually be people who are flying that are not commercial operators, and anyone can go and buy a UAS from a local electronics store. Again, we have a "Know before you fly" campaign that we have stood up with other organizations, such as the Small UAV Coalition, the Academy of Model Aeronautics, and the FAA is cooperating. We have tremendous support from across the general aviation community to get the word out that here is where the TFR is; stay out of the way. If there are firefighting operations going on, you cannot fly.

Mr. KNIGHT. Right. And I think we have seen that. You know, we have had this type of activity for 50-plus years. It is just somebody put a camera on one and turned it from a RC to a UAS. And that is kind of the systems we are working on today.

Recently, or in the last year and a half, they have released seven testing sites for UAS all over the country. My state did not get one, but they are in the works to get these new sites, these Excellence sites. Do you think that these testing sites are something that UAS need, or can we just test these things in all 50 states and we could probably flourish more? And the reason I say that is because Cali-

ifornia did not get a testing site, although we do most of the testing in California.

Mr. WYNNE. I would like to see better utilization of the test sites but I think it depends on what we are trying to get done. I think the challenge that we have got today is that we have only been talking about things essentially that are pretty low complexity types of operations. There are lots of things that can be done with this technology that are highly complex and we are sort of in a walk, jog, run situation. What we are encouraging the FAA, while they are finishing and finalizing the rules that are very low risk for under 500 feet, visual line of sight, daytime operations, et cetera, that they start looking at things beyond visual line of sight, extended line of sight. Operating under a bridge could actually be a beyond visual line-of-sight operation. That would require safety standards, if you will, that can only be set and can only be agreed to if they have been researched to the FAA's satisfaction. I think the test sites are an opportunity to do that.

Mr. KNIGHT. And Mr. Wynne, I am going to ask you my final question because it seems like you are a pilot.

On the larger UAS—and most of the UAS are under 40 or 50 pounds. I think that is probably 80 percent of the UAS in America are about that size—but the larger ones that are in the military, do you see that we need to change our kind of see-and-avoid process under 18,000 feet with chase planes, things like that? Do you think that we have gotten to a point that we can do those things and be in a safe arena for the rest of the air traffic?

Mr. WYNNE. That is being determined now, and that is a good example of what I am talking about. The military has figured out how to safely operate manned and unmanned systems in theater together without incident, and in some cases, very cooperatively. So we can learn from them. They have real clear standards that can be adopted for the national airspace system. There are organizations that are working on that, including NASA. The FAA is participating in that process, and those are good examples of how we need to test things to everyone's satisfaction, set those rules, and go forward from there.

Mr. KNIGHT. Thank you very much.

Chairman CHABOT. The gentleman's time is expired.

Mr. KNIGHT. I yield back.

Chairman CHABOT. Thank you.

If Ms. Clarke would not mind, before I call on her, the Wright Brothers were mentioned again, so I will just tell something I think is kind of interesting. Every state has two statues that are in the Capitol Building, most of them in the statutory hall. Ohio has President James Garfield and a fellow named Allen, who was a congressman, a senator, and a governor, and he was also a racist. It was during slavery times, and so he is being removed, and there was a contest. People in Ohio were asked who we wanted to replace him with, and the people who came in second were the Wright Brothers. And the one who won was Thomas Edison. So in the very near future you will see Thomas Edison's statue over there. Was that not interesting?

The gentlelady from New York, Ms. Clarke is recognized for five minutes.

Ms. CLARKE. A bit of trivia, Mr. Chairman.

Thank you, Mr. Chairman, and I thank our ranking member. I thank our panelists for taking the time to share your expertise with us today, and I would like to also welcome my fellow Brooklynite, Mr. Stroom. Thank you for attending today's hearing.

I am fascinated by the advancements in UAS technology. The fact that we have entered the age of technologically advanced use of unmanned aircraft is very encouraging. Unmanned systems hold the potential to truly revolutionize our economy and way of life in this country in such areas as agriculture, news coverage, inspections, surveillance, data collection, mapping, and surveying photo, video, film production, and many other services.

However, I also believe that we must address unanswered questions that this new technology brings to the forefront of safety in America's skies. We must address the issues of authority, privacy, accountability, and transparency. It was interesting to hear how this technology has developed over the years and its potential as a growth industry and what we can do to assure that we can facilitate drone use in American airspace while keeping all forms of air travel and ensure privacy for all people.

Having said that, Dr. McLain, when you speak of being able to go beyond line of sight for certain industries, my question is, how do we control and stabilize the aircraft beyond what our eyes can see, and what technology would need to be in place to ensure that we have control of the aircraft at all times given the challenges of cybersecurity and the liability inherent in commercial use?

Mr. MCLAIN. So that is a good question.

I think there are several technologies that can be brought to bear to enable beyond-line-of-sight flight. The control of the aircraft, or the stability of the aircraft, technology exists to do that. Current autopilot technology makes that possible, and of course, it is used in military applications all the time.

You bring up the security of communications links. I think it is fair to say that most of the communication links used in commercial UAS applications, and even in some military applications, are not as secure as they could be. So there might need to be technology applied to make those communication links as they extend, especially beyond line of sight, secure.

Other technology that could be brought to bear is sense-and-avoid or detect-and-avoid technology, which would allow the aircraft to detect other aircraft in the airspace and to take appropriate measures to avoid other aircraft as they were encroaching. There is a variety of ways to do that. The NextGen system that is being proposed by the FAA utilizes ADSB to communicate the locations of all the aircraft in the airspace and that could be used for unmanned aircraft. Certainly, most robust would be to have the capability of each aircraft to detect the other aircraft in the air what we call noncooperatively. So they can do it without the cooperation of any network system or something like that. And in that case they would be probably using radar or machine vision sorts of techniques to detect the other aircraft.

Ms. CLARKE. And the issue of liability, I raise that because baking in cybersecurity measures and liability now increases the cost

of actually operating for a small business owner. Do you see this as being sort of undercutting the industry or just a necessity?

Mr. WYNNE. I think for certain applications, the cybersecurity or the security of the communications link might be vital. There might be other applications where, whether it is due to the location of the flight and the lack of populated areas and so forth where it may not be necessary.

Ms. CLARKE. Very well.

Mr. Stroom, what measures are your company taking specifically to ensure safety of not only your UAS, but aircraft in the skies that might be flying in the spaces where you are filming?

Mr. STREEM. Sure. I mean, we have operating procedures that have been approved by the FAA. We cannot go above 400 feet. We have to file a COA. We have to file a NOTAM that pretty much notifies any other aircraft where we are, what we are doing. When it comes to a film shoot, the people on the ground are very well aware. There is typically a director and then there is a first AD, which is an assistant director. And that AD is in charge of saying, "Okay, there is going to be a car that is going to go over a ramp and it is going to explode. Everybody look out for the explosion." In this case it is, "There is going to be a drone flying in the sky. It is going to do this. Know about that."

Ms. VELAZQUEZ. I yield back. Thank you, Mr. Chairman.

Chairman CHABOT. Thank you very much. The gentlelady's time is expired.

The gentleman from New York, Mr. Hanna, who is the chairman of the Subcommittee on Contracting and Workforce, is recognized for five minutes.

Mr. HANNA. Thank you. I am also a pilot. I am on the FAA Subcommittee, and I have the privilege to represent Griffiss Air Park, which is one of the six sites, so I would invite you all to come and visit and look around. It is a great place. Thirteen thousand feet of runway and a solid four seasons.

Mr. Wynne, and everyone, one of the problems I have with all of this is UAVs are not new. They have been around the world for 20 years. Japan has been using in agriculture for at least that long. Other countries have. This is a known quantity, and yet the FAA, as you pointed out, nine years behind on their rulemaking. So my feeling is a lot of this is we are blaming the victim because in this case all of you are so far ahead of the FAA in your development, in your needs, your usage, your opportunities to grow your businesses which you have all explained so beautifully. So the kind of underlying statement I hear is that a common—maybe with the exception is Mr. Wynne—complaint about the FAA in the process. And things like line of sight, which frankly do not work are practical. Licensing. You know, they backed away from wanting to use people with not just VFR but IFR licenses, all those kinds of silly things.

And I guess I would like to ask your opinion about the process. I know there have been lawsuits the FAA lost. And the loss, was it against you, Mr. Stroom? You remember that. It went to the court. The FAA lost jurisdiction because they abrogated the opportunity to make rules, and so they said this is not for you.

I want, anybody, talk about the FAA and the urgency that, apparently their desire to keep things safe is overwhelming their ability to get their work done. What do you think of that?

Mr. STREEM. Yeah. I would like to say a few words on that.

We feel that the FAA, really it needs to take a risk-based approach to the regulations, and we are a big advocate of a concept that has been discussed, which is a micro UAS rule. So for small aircraft like ours under 4.4 pounds. We are in a different risk category entirely in terms of operations, and we are being held to the same standard now as these bigger, larger, more risky aircraft. And so it is a big challenge to us to get through the red tape and the extra cost and to live with some of the limitations that we do not feel are warranted for our class of operation.

Mr. HANNA. The 174th flies predator drones between Syracuse, New York and Griffiss. They are going to start, I think, this month, with a manned plane following. Do you want to talk about this, Mr. Wynne? I mean, you seem more supportive of the FAA than the others, but maybe I am just imagining that.

Mr. WYNNE. You are imagining it, Congressman.

Mr. HANNA. Good, good.

Mr. WYNNE. No, I do not mean to be disrespectful to you. We are the FAA. The bottom line is that I have promoted technologies that meet regulations my entire career and I have never seen a bureaucracy keep up with technology. It just does not happen.

Mr. HANNA. It does not happen here. Apparently, it happens other places.

Mr. WYNNE. Well, I think—

Mr. HANNA. We talk about next generation aviation. There are 20 other countries that have it.

Mr. WYNNE. You are right. And I think, you know, as long as we are focusing on the risk associated with the operation, we will be fine. I mean, the idea of an instrument-rated pilot having to keep up those kinds of requirements in order to fly under a bridge, even in a beyond visual line-of-sight circumstance, the risk there is actually very low, so we want to be focusing on the risk rather than the platform. If we are flying in Class A airspace above 18,000 feet, that is a different matter. That requires understanding commercial rules, et cetera, et cetera. So I think it really is a function of getting the FAA to understand this is not a system—you cannot apply a platform-based system.

Mr. HANNA. So you would agree with Mr. Gilkey then that they are just not using a risk approach that is practical in our world?

Mr. WYNNE. I think we are moving in that direction. I see elements of that in removing—in basically saying under 500 feet, visual line of sight, you are basically able to fly with a knowledge-based test. That was a step forward. Not necessarily a great step forward, but now we need to know what knowledge-based means. And it gets back to some of the challenges that we have had where we do have people flying that do not have any knowledge. And so I think somehow we need to find a way to meet them in the middle.

Mr. HANNA. My time is expired. Thank you very much.

Chairman CHABOT. Thank you. The gentleman's time has expired.

The gentleman from Nevada, Mr. Hardy, who is the chairman of the Subcommittee on Investigations, Oversight, and Regulations, is recognized for five minutes.

Mr. HARDY. Thank you, Mr. Chair.

I kind of want to continue down some of the same lines that my colleague, Mr. Hanna, was going. We talk about how long this has taken, this process. We talk about education here today. But it seems like in this place here on the Hill that we have a way of—we want somehow a “one size fits all” unless it comes to something new. Then we want to make sure that you get some new regulations, you get some new oversight.

In the industry that I am in, and I have been all my life, insurance aspects. You know what? In order to have something or do something in my business, sell it even, you have to have liability insurance before you can get it.

Why are we reinventing the wheel? Does that seem like a logical thing that we just—if we are going to buy something, purchase something, you should have to be in the same aspects as all other business people utilizing it, not because you cannot afford it and the risk.

The other question I would ask is does it seem like things like the knowledge part of this, you know, in my industry, there is a lot out there nationally. “Call before you dig.” You know, in my business, ignorance is not a sign of innocence. You go to jail, you get paid, you pay your fines. Somebody out there flying around in restricted airspace or doing things without that—does anybody care to comment on that thought process and why it takes us so long to get things done in this place every time we turn around? I will take anybody’s—

Mr. MCLAIN. Initially, I think part of the problem is that the FAA pursued a “one size fits all” solution to aircraft in the airspace, and while that makes sense for manned aircraft, I think, it does not make sense for unmanned aircraft where the spectrum of sizes and relative risk from the micro UAVs that we are seeing here or to the Predators or Global Hawks, there is such a broad spectrum that it does not make sense to regulate them all with the same rule.

Mr. WYNNE. AUVSI is standing up an insurance program for UAS operators, so we are getting into that business. We are encouraging underwriters to come in and understand what is going on. Fundamentally, we are just at the cusp of this, and although Mr. Hanna pointed out that the technology has been around for some time, in some ways the insurance world is just understanding how. What is the risk associated with flying as a real estate agent versus flying as a construction person, et cetera, et cetera? There are a lot of different applications. I personally think that normal business rules are ultimately going to apply here. The insurance companies require certain things for flying an airplane that the FAA does not require. You know single engine land is single engine land. I could fly an airplane as a pilot but, you know, if the airplane has retractable gear, the insurance company is going to require you to do dual time with an instructor because they do not want you to land with the gear up kind of thing.

So the insurance companies will actually come along, I think, in this instance, and we are hearing that from the underwriters as we stand up this program. And they will basically come up with solutions and understand, what are the additional requirements that we need to put in place so that we can insure you at an appropriate premium?

Mr. HARDY. I would like to take a little bit different direction.

My district, I represent—Nellis Air Force Base is in my district and the Nellis test range. I have talked to the folks out at the base. Today, they are not worried too much about it, but as progression goes on and we are one of those sites selected, and they worry. There is top secret information out there, that as things are able to go higher, they get more ability, that maybe some of that secrecy may not be available. Is there anything we can do to stop—assure that will never happen as being one of our testing areas? Not really. We will just say not really. But it is a question that needs to be answered.

Is my time over?

Anyway, one of the other issues that is big for our area and I want to confirm it again that the science is there, as you may or may not know, the Creech Air Force Base is in the test range. Most of those drone strikes that we have that we read about are from Creech on sites over 11,000 miles away. So the technology is there to fly that unmanned vehicle without somebody being able to see it because I do not think anybody can see from 11,000 miles away. But does the private sector have the ability to have that same technology today?

Mr. MCLAIN. Absolutely. It is not military grade perhaps but the fundamental technology of flying beyond line of sight exists and it is not—it is well within reach of small business.

Mr. HARDY. Thank you. I believe my time is expired.

Chairman CHABOT. Thank you. The gentleman's time is expired.

The gentlelady from American Samoa, Ms. Radewagen, is recognized. She is the Subcommittee chairwoman on Health and Technology.

Ms. RADEWAGEN. Thank you, Mr. Chairman.

Mr. Gilkey, in your written testimony, you noted that state and local governments are establishing an inconsistent patchwork of operating restrictions that will be difficult for small businesses to navigate. Can you elaborate on why state and local operating restrictions are a challenge for small UAS operators?

Mr. GILKEY. Certainly. Again, we feel a number of these cases are motivated by reactionary public sentiment and not necessarily well founded on risk-based analysis, but to a small business, it is a real challenge financially and in terms of resources to get educated at every potential location that we might want to operate, what the local rules are. We are very much interested in uniform rules that we can apply nationwide. Now, that said, there are instances, like in the national capital region, where that is a no fly zone for drones, understandably. So there are site-specific exemptions that have to be implemented. We would like to see those vetted at a federal level to make sure that proper standards are applied and that the communication of those restrictions is easy to ac-

cess. So annotations on aeronautical charts, for example, or NOTAM filings, or things that are readily accessible that we could educate ourselves quickly on what those regulations are, those restrictions.

Ms. RADEWAGEN. Let me follow up.

What sort of issues do you foresee in developing a standard across all states, including the outlying territories, who often have their own rules and regulations in regards to flight operations?

Mr. Gilkey, follow-up question to you, sir.

Mr. GILKEY. Well, as a small business, we have to make decisions every day on how to deploy our capital and our equipment and resources. So we will gravitate to areas where it is easier and more accommodating for us to do business. And my fear with the state and local restrictions is that it is going to create a situation of haves and have-nots as far as folks who can reap the benefits of the technology that we have to offer and my colleagues and those who cannot.

Ms. RADEWAGEN. Thank you.

And for Dr. McLain, you mentioned that the FAA's Pathfinder Program, which is a collaborative effort between FAA and industry partners to research different types of operations including extended visual line-of-sight operations in rural areas, what is the benefit of this type of collaborative research-type program?

Mr. MCLAIN. Well, it is an opportunity to test and try out applications under, I guess, more restrictive test conditions in the sense that, for example, in surveying the railroad track in New Mexico, one of the applications I believe that is being considered here is it is done where the airspace is restricted and there is not any probability of having accidents or the probabilities are certainly lowered by restricting the airspace and access to that airspace. So these are experimental demonstrations of the technology proving out that they can be done safely.

Ms. RADEWAGEN. Dr. McLain, does this research program extend to the United States territories as well?

Mr. MCLAIN. I am not aware of any activities in the territories outside of the United States.

Ms. RADEWAGEN. Why not?

Mr. MCLAIN. Oh, I do not think there is any reason that it could not.

Ms. RADEWAGEN. Thank you, Mr. Chairman. I yield back.

Chairman CHABOT. Thank you very much. The gentlelady yields back.

The gentlelady from Michigan, Ms. Lawrence, is recognized for five minutes.

Ms. LAWRENCE. Thank you, Chairman.

First of all, being from Michigan, I wanted to recognize Aerius Flight LLC which was the first company in my state to get FAA approval of commercial application for drone photography and video graphics.

Mr. Wynne, according to an industry survey, videography and cinema is expected to comprise 41 percent of the market by the use of drones by small businesses. What other types of small businesses do you anticipate using the unmanned aircraft in the next five to 10 years?

Mr. WYNNE. That list would take us most of the afternoon.

Ms. LAWRENCE. Oh, okay.

Mr. WYNNE. Happily. I think what we are seeing, we are in the process of looking and analyzing the Section 333 applications to date, and a very, very large percentage are small business, beginning with real estate, insurance folks. Obviously, wedding photographers across the board to the kind of services that Mr. Stroom offers, because you can again use these platforms to put lots of different things on them, cameras being the most obvious for all of us.

So I think there is almost an unlimited number of small business that can take advantage of this. Agriculture is a big chunk of what we see going forward as well. And of course, agriculture, there is large agriculture, but the vast majority of farmers are small business people, and in many instances, that is a good example of a low-risk operation that might even be beyond visual line of sight where a farmer is surveying their crops over a hill, again, over their own property, and very safely with various procedures in place if say a helicopter came into the area, things like that.

Hopefully that answers your question, ma'am.

Ms. LAWRENCE. Yes. You went into my next question, which is regarding the farmers and restrictions. As we look at all the industries or small businesses that can spin off from this industry, there are some real concerns about—you talked about a challenge, which was line of sight, but there also has been a lot of issues, and I serve on Oversight, about regulation. What type of restrictions should I put as a government on this industry based on my privacy rights, based on my opting out of maybe a delivery? There is a big issue about package delivery. Maybe I do not want you to come drop a box on my porch. What are some of the restrictions that you are hearing as these small businesses are looking at implementing this that we should have on our radar as an oversight government that will be sensitive to businesses growing in this industry?

Mr. WYNNE. I guess my overall context would be let us not have solutions looking for problems. All of the laws that pertain to nuisance or privacy pertain to these platforms. So I think that is, you know, Fourth Amendment rights are Fourth Amendment rights no matter what the platform is, whether it is a manned helicopter or UAS. So I think that would be my first point.

The second point is that as an industry, we are permitted to safe and responsible use of the technology. We are not going to be able to optimize this opportunity for the country without a sustained growth in utilization of the systems. And you have some small businesses here. We have many, many industries that are coming to us saying our constituents would like to use this technology both for small business and large to optimize and to increase the profitability of our operations. I think we should see how that goes before we start trying to anticipate every single problem that comes along, recognizing that the industry will be committed to addressing these problems as they emerge, otherwise, we will not have a sustainable business going forward.

Ms. LAWRENCE. Thank you so much, and I yield back my time.

Chairman CHABOT. Thank you very much. The gentlelady yields back.

And we want to thank the panel for their very interesting and timely testimony here this morning and then now into this afternoon. I think the potential uses of commercial unmanned aircraft systems is virtually limitless and there obviously is a role for government to play in this, and that is going to slow things down. It always does. And so we will certainly encourage the FAA to get off the dime here to protect the rights of the public, but at the same time not be an obstruction to what could create potentially a huge number of jobs, and we certainly need to move in that direction in this country.

So again, thank you very much. We appreciate your testimony.

I would ask unanimous consent that members have five legislative days to submit statements and supporting materials for the record.

And if there is no further business to come before the Committee, we are adjourned. Thank you very much.

[Whereupon, at 12:14 p.m., the Committee was adjourned.]

**A P P E N D I X**



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

**U.S. House of Representatives  
Committee on Small Business  
"Taking Flight: Small Business Utilization of Unmanned Aircraft"  
July 15, 2015**

Chairman Chabot, Ranking Member Velazquez and members of the committee, thank you very much for the opportunity to participate in today's hearing on unmanned aircraft systems. I am speaking on behalf of the Association for Unmanned Vehicle Systems International (AUVSI), the world's largest non-profit organization devoted exclusively to advancing the unmanned systems and robotics community. AUVSI has been the voice of unmanned systems for more than 40 years, and currently we have more than 7,500 mem-

bers, including many small business members 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 and offer a superior way to see what needs to be seen, in less time and at less expense. It's no wonder businesses—small and large—are clamoring to use this technology.

For years, AUVSI has been a leading advocate for the safe integration of unmanned aircraft into the U.S. National Airspace System (NAS). We were delighted earlier this year when the Federal Aviation Administration published its long-awaited proposed rules for the commercial and civil operations of small UAS (systems that weigh 55 pounds or less).<sup>1</sup> These proposed rules are a critical milestone in the UAS integration process and bring us closer to realizing the tremendous societal and economic benefits this technology offers.

Indeed, as the FAA has worked on these rules, much has already changed in the industry. Since Congress tasked the FAA with creating UAS regulations in 2012, the technology has gone from a specialized tool to a must-have business asset. The flood of commercial exemption requests to the FAA, in particular, shows that a mature UAS commercial market is waiting to be unleashed.

In May 2014, the agency 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 more than 2,000 requests<sup>2</sup> and granted more than 700<sup>3</sup> exemptions to businesses looking to use UAS for precision agriculture; inspecting infrastructure; mapping and surveying; film, photo and video production; public safety or emergency response; and environmental inspection and regulation.

Many of these exemptions illustrate the sweeping impact the industry is having on small businesses. AUVSI has looked at the first several hundred exemptions that have been granted; and according to our analysis, the vast majority of businesses 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.

Let me provide just a few examples:

- North Carolina-based PrecisionHawk is a startup that manufactures UAS and cloud-based data collection software.

<sup>1</sup> <https://www.faa.gov/uas/nprm/>

<sup>2</sup> <http://www.regulations.gov/>

#lsearchResults;rpp=25;po=0;s=%2522section%2528333%2522%252BFAA;fp=true;ns=true

<sup>3</sup> [https://www.faa.gov/uas/legislative\\_programs/section\\_333/](https://www.faa.gov/uas/legislative_programs/section_333/)

Its UAS platform, the Lancaster, is helping farmers survey crops and assisting insurance companies with claims following natural disasters. The company received a Section 333 exemption to fly its platform commercially in the U.S., and a number of its clients have also received exemptions, including AIG and USAA. PrecisionHawk was also one of three companies selected to kickoff the FAA's Pathfinder Program.<sup>4</sup> The company will help the FAA and industry research extended visual line-of-sight operations in rural areas. Founded in 2010, PrecisionHawk started with six employees and has now grown to more than 70 employees, with multiple offices in the U.S. plus offices in Canada, India and the United Kingdom.<sup>5</sup>

- Another example is Southern California-based Aerial Mob. The company was one of the first to receive a commercial exemption from the FAA.<sup>6</sup> An innovator in UAS cinematography and technology, Aerial Mob is considered a pioneer in the development of UAS safety standards by the Motion Picture Association of America and the FAA. It performed the first ever FAA approved film production project with a major studio, Warner Brothers, on the set of the CBS TV show "The Mentalist."<sup>7</sup> The company has since filmed Super Bowl promos for NBC, a promo for a new show on Amazon Prime, and even helped Apple film a commercial.

- Then there is Douglas Trudeau. Based in Tucson, Arizona, Mr. Trudeau was the first Realtor to apply for, and receive, a Section 333 waiver from the FAA to use UAS in his real estate business.<sup>8</sup> A Realtor for 15 years, Mr. Trudeau saw an opportunity to capture unique aerial perspectives for his listings—images that he couldn't obtain from the ground. Mr. Trudeau now offers a how-to guide on his website for other real estate agents interested in applying for exemptions, and he is also a sought-after speaker.<sup>9</sup> Since Mr. Trudeau received his exemption in January this year, the FAA has issued waivers to more than 200 real estate-related companies, according to the National Association of Realtors.<sup>10</sup>

These are just a few examples of the real-world, small business applications of UAS. And there are many, many more.

The FAA continues to approve about 50 new commercial operations a week, a process that has been recently streamlined and expedited. However, this current system of case-by-case approvals—whether streamlined or not—isn't a long-term solution for the many small businesses wanting to fly. In addition, the requirements for UAS operators are generally more onerous under the section 333 exemption process than the operator requirements con-

<sup>4</sup> [http://www.faa.gov/news/press\\_releases/news\\_story.cfm?newsId=18756](http://www.faa.gov/news/press_releases/news_story.cfm?newsId=18756)

<sup>5</sup> <http://www.precisionhawk.com/>

<sup>6</sup> [http://www.faa.gov/news/press\\_releases/news\\_story.cfm?cid=TW251&newsId=17194](http://www.faa.gov/news/press_releases/news_story.cfm?cid=TW251&newsId=17194)

<sup>7</sup> <http://finance.yahoo.com/news/warner-bros-uses-drone-on-the-mentalist-set-a-hollywood-first-144435648.html>

<sup>8</sup> [http://www.nwitimes.com/lifestyles/hone-and-garden/drones-the-next-frontier-in-real-estate-marketing/article\\_829bd032-10cb-518f-ae6-ff092e519a82.html](http://www.nwitimes.com/lifestyles/hone-and-garden/drones-the-next-frontier-in-real-estate-marketing/article_829bd032-10cb-518f-ae6-ff092e519a82.html)

<sup>9</sup> Ibid.

<sup>10</sup> <http://www.realtor.org/articles/updated-list-of-faa-approved-drone-operators-available-on-realtororg>

templated in the draft UAS rules. It's our view that a Realtor or a wedding photographer who wants to fly a lightweight platform for aerial photography shouldn't have to master stalls in a manned aircraft or learn how to land a 2,000 pound Cessna.

As an industry, we want to see the integration of UAS proceed and without any further delays. 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. And importantly, the integration will establish rules for the commercial use of UAS so that small businesses from every industry sector can take advantage of this innovative technology.

Given the technology's potential, it is important that the FAA finalize the small UAS rules as quickly as possible. Moreover, Congress needs to pass—and the President needs to sign into law—an FAA reauthorization measure before the current authorization expires on September 30, 2015.

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.

Equally as important, government and industry need to work together to permit expanded uses of UAS technology that pose no additional risk to the airspace system. For example, whether within the context of the rule, through the FAA reauthorization measure or by other means, we need to allow for beyond-visual-line-of-sight, nighttime operations and operations over heavily populated areas. Otherwise we risk stunting a still-nascent industry, and restricting the many beneficial uses of this technology.

It's not just the many uses of this technology that are at stake, but also the 100,000 jobs and \$82 billion in economic impact that the UAS industry is expected to create in its first decade following integration.<sup>11</sup> With the right regulatory environment, there's no question these numbers could go higher. The benefits of this technology are broad, and we need to make sure we are doing all we can to support its growth and development. But the longer we take, the more our nation risks losing its innovation edge along with billions in economic impact.

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.

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<sup>11</sup> <http://www.auvsi.org/econreport>

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

Testimony of  
Michael J. Gilkey, CEO  
3D Aerial Solutions, LLC

Before the  
U.S. House of Representatives  
Committee on Small Business

Hearing on  
*Taking Flight: Small Business Utilization of Unmanned Aircraft.*

July 15, 2015

Good morning Chairman Chabot, Ranking Member Velazquez and Members of the Committee. It's a pleasure to be here today to discuss an entrepreneur's perspective on the emerging unmanned aircraft systems industry.

### **Opening Comments**

Unmanned systems hold the potential to truly revolutionize our economy and way of life in the United States. Unmanned Aircraft Systems, or UAS, provide innovative new tools to the common man, which are being employed in uncommon ways. A new industry is being born resulting in the creation of many new small businesses.

UAS enjoy wide coverage in the media. However, much of it is negative due to the irresponsible behavior of those who don't know or don't follow the rules. All of us in this industry are genuinely concerned about the proper use of UAS and want to see violators dealt with comprehensively and effectively. We understand and appreciate the need for rules.

However, the highly restricted nature of the current interim rules and the slow pace of permanent rulemaking continue to stifle the ability of small business to capitalize on this market's potential. Furthermore, the lack of permanent, uniform rules is spurring state and local governments to establish their own restrictions that are creating an inconsistent patchwork that will be difficult for small business to navigate.

Small business people like me are slugging their way through the obstacles and bureaucracy to fulfill our dreams of creating this new industry. We are pioneers, determined to succeed and believe the country and world will be beneficiaries. I welcome the opportunity to be here today to inform the Committee of our story and explore how Congress can foster a more accommodating environ-

ment for small business, which also ensures safe operations and protects privacy.

### **Creating a Startup UAS Company**

My colleagues and I created 3D Aerial Solutions, LLC in 2013 to leverage our expertise working with military unmanned aircraft and transition advanced technology know-how to solve civilian problems. We focus on applications that utilize:

- Automated flight planning and aircraft control
- Automated sensor control and data processing
- Advanced man-machine interfaces

We self-funded 3D Aerial through an initial round of owner-investment and began buying aircraft and equipment. We purchased a senseFly eBee aircraft because it is highly automated, easy to use, and precise. We are now a sales agent for this product line. We began flying under Academy of Model Aeronautics (AMA) ‘hobbyist’ rules and became experts on this equipment.

3D Aerial became an affiliate member of The Entrepreneur’s Center, a technology business incubator in Dayton, OH, to gain access to business advice and meeting facilities. This is proving to be a positive relationship from which we are pursuing additional investment funding for capital investment and business expansion.

Well-intentioned state economic development funding is now being deployed to help foster the creation of new businesses in my area, and includes a special interest in the UAS industry. However, it appears to be directed primarily to public colleges and universities and has been of no benefit to the startup of private companies like 3D Aerial Solutions.

### **Getting our Wings**

Despite owning aircraft we were expert at flying, our small private business was not eligible to apply for a Certificate of Authorization (COA) in order to fly commercially. We were limited to demonstration flights and we began marketing future projects with no idea when we would be allowed to perform them.

3D Aerial believes we in the UAS industry have a responsibility to reach out and educate the public of the benefits and restrictions associated with responsible UAS operation. To this end, we started the Dayton Drone Users Group for community outreach and completed a volunteer community service project, producing a promotional video for a local YMCA camp.

We collaborated with the Ohio/Indiana UAS Center and Test Complex and were able to fly on a COA they established. For the most part, however, we spent a year and a half in a holding pattern awaiting authority to make money flying unmanned aircraft.

3D Aerial submitted our request for a FAA Modernization and Reform Act of 2012 (Pub. L. 112–95) Section 333 Exemption on October 14 2014. We received and responded to a FAA’s request for information in February and were granted an exemption on March

3, 2015. We were the 2nd company in Ohio to be granted a Section 333 exemption.

3D Aerial received the corresponding COA on March 23. It took over a month to get the registration for our eBee aircraft from the FAA, which came May 7th. With these steps complete, we are now authorized to legally perform commercial flying services, limited to only flights of the eBee aircraft and only for the agricultural applications that we requested. The blanket COA allows us to operate throughout the United States but is subject to a large number of significant restrictions.

### **Benefits of UAS to Agriculture**

Precision Agriculture is an information and technology-based agricultural management system used to identify, analyze and manage variability within fields for optimum profitability, sustainability and environmental protection (ref. USDA web site). These practices allow producers to determine precisely what their needs are for fertilizer, herbicide insecticide and water at every point throughout a field. Modern farm equipment allows them to apply exactly the prescribed amounts at the required location to maximize yield. This saves farmers money, maximizes yield reduces environmental risk from over application of unnecessary chemicals.

Aerial imaging using satellites and manned aircraft has been used for years in agriculture to augment on the ground techniques of soil sampling and crop scouting to support precision agriculture. Field techniques are highly accurate, but are labor intensive, time consuming and result in limited sampling. Aerial imaging offers greater coverage by sampling every point in the field at the camera's image resolution. Small UAS like our eBee can fly much lower than manned aircraft and can offer extremely high image resolution (to less than 1 inch per image pixel). They can also operate very inexpensively and virtually "on-demand".

### **What the Images Tell You**

The images record reflected sunlight at different wavelengths, or 'colors'. Different cameras are used to collect in different spectral bands (i.e. visible, near infrared and thermal infrared) to provide a variety of techniques for analysis. Multispectral cameras efficiently collect multiple colors simultaneously.

Early in the season, farmers may be imaging to perform plant counting, so areas that don't initiate can be replanted. Throughout the season, producers are looking for things like chlorophyll indication, plant stress, and moisture analysis. These conditions and more can be detected and localized in the field through the proper processing of aerial imagery using the various colors.

Collected images are ortho-rectified and geo-registered so each point in an image can be tied to its corresponding location on the ground. Image processing software stitches these images together into high-resolution, wide area 'maps' called orthomosaics. Also, 3 dimensional point clouds can be extracted through triangulation processing. Image analysis software applies algorithms to compute

vegetation indices and other health metrics. These can be used to create treatments to address various crop health problems. These prescriptions can be turned into a geographic ‘shapefile’ and loaded onto farm equipment for precision application of nutrients, etc.

3D Aerial is now providing UAS flight services to perform aerial imaging of crops using the eBee. We also process the imagery into the desired image products, which are provided to the farmer. We are in the process of hiring more pilots and buying more aircraft.

### **Permanent Rules**

The FAA has stepped up the issuance of the Section 333 exemptions and 714 exemptions approved as of the end of June 2015 (ref: Bloomberg News).

The FAA issued its Notice of Proposed Rule Making (NPRM) for Operation and Certification of Small UAS on February 23, 2015. Implementation of final rules is not expected until mid 2016 at the earliest. While there are still many restrictions, the current rules as proposed will represent a big step forward for the small UAS industry.

Positive aspects:

- *Pilot certification requirements are reduced.* A full private pilot’s license is not required.
- *No FAA airworthiness certification required.*
- *Aircraft performance limits accommodate operating range.* These will foster broad range of commercial UAS applications.
- Most of the remaining requirements are similar to what we operate under now.

3D Aerial’s concerns as a small business operator:

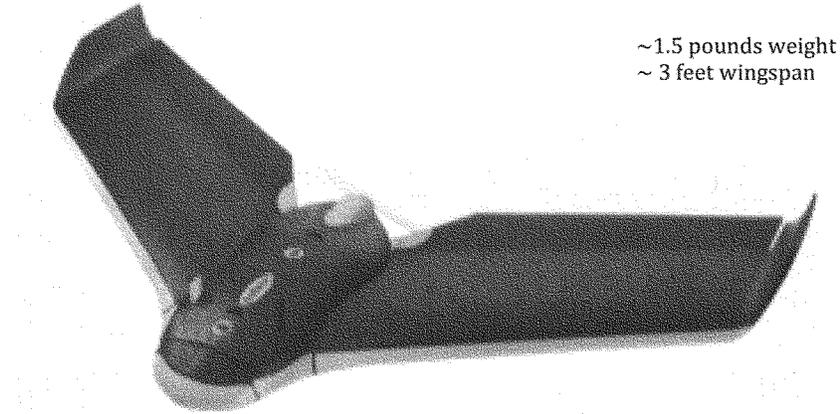
- *Cost to gain FAA operator certification.* The NRPM’s Regulatory Flexibility Determination estimates that out of pocket costs for small UAS operator to be FAA certified is less than \$300. This estimate appears quite low. Specific training and testing requirements are currently unknown.
- *Phase in period for compliance with the new rules.* Will currently approved operators (with private pilots with 2nd class medical certificates) be suddenly ineligible to perform their duties until new certification requirements are met?
- *Impact of state and local rules restricting UAS operations.* Will our small business be forced to learn and comply with a wide variety of rules that change state-by-state and city-by-city?
- *Enforcement of regulations.* Will FAA have the ability to prevent UAS businesses that don’t have the certifications and don’t follow the rules from operating and undercutting business from those of us who do?

### **In Summary**

It’s exciting to be on the ground floor of the emerging commercial small UAS industry. If fostered through a reasonable balance of regulations to protect the national airspace and accommodating

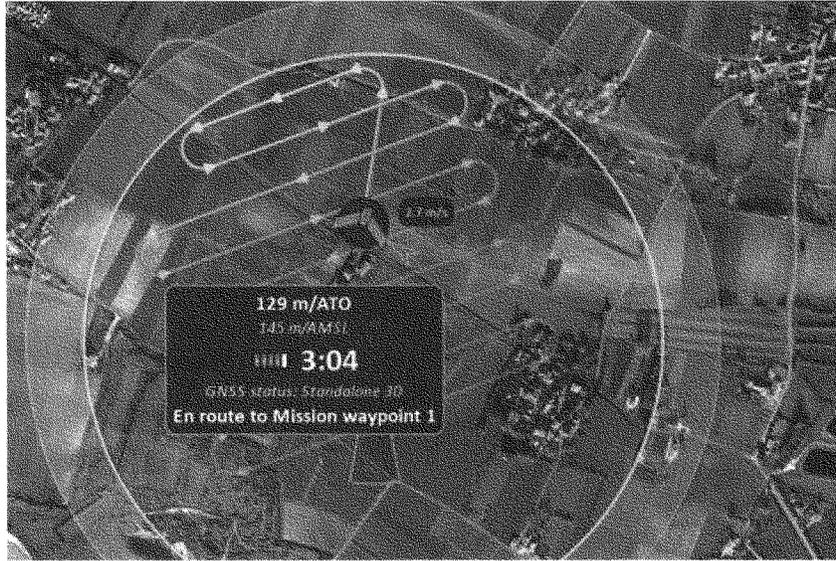
economic policy, small businesses will be a significant engine of growth, delivering on the promise of new jobs and an expanded tax base that will benefit our economy. Furthermore, the advanced technical capability we offer today will continue to improve and provide growing value to our society. On behalf of my colleagues at 3D Aerial Solutions, I thank you for allowing the opportunity to speak to you today.

SenseFly eBee Aircraft:

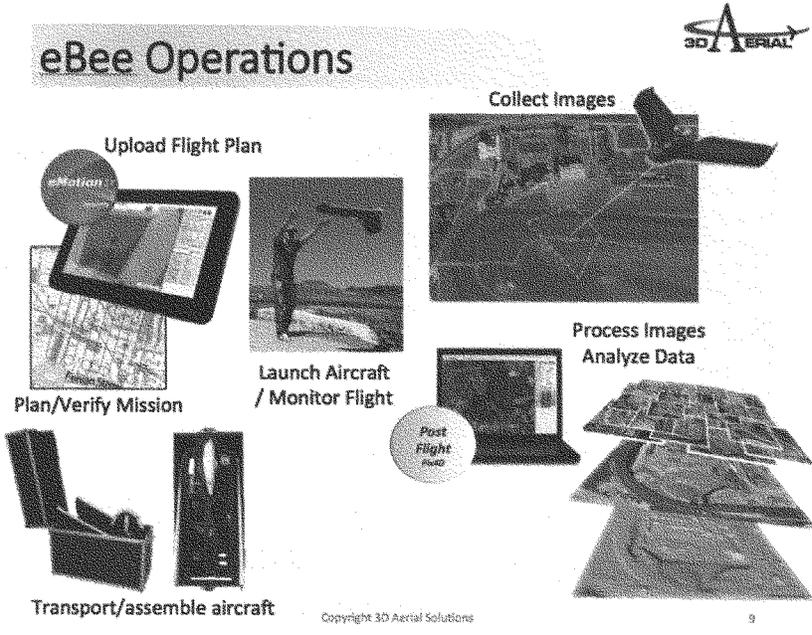


~1.5 pounds weight  
~ 3 feet wingspan

Automated flight planning, automated flight control, automated camera control.



How it works:



**Testimony of  
Brian Stroom  
CEO  
AeroCine**

**Before the United States House of Representatives  
Committee on Small Business  
“Taking Flight: Small Business Utilization of Unmanned Aircraft”  
July 15, 2015**

Chairman Chabot, ranking member Velazquez and members of the committee—thank you for having me here today and for holding this critical hearing—it is my honor to be here before you.

My name is Brian Stroom and I am the co-founder and CEO of AeroCine, a drone company that uses Unmanned Aerial Vehicles (UAVs) to fly Hollywood cameras for movies, television, advertising and real estate among other things.

I wish I could tell you that I am one of the world’s foremost roboticists or rocket scientists but for a hearing such as this, my experience as an artist and NYU Film School graduate is the real story. It just so happens, I might humbly add, I am building my own drones and consider this part of the new American Dream.

The Unmanned Aerial Systems (UAS) industry worldwide has created a new generation of entrepreneurs who are innovating with small businesses that will reshape the global economy. Safe and responsible use of UAS will be ubiquitous across every sector of the economy. Unfortunately, this worldwide phenomenon is in jeopardy here at home in the United States due to the current state of regulation that prohibits commercial operations absent an exception. I consider myself lucky as AeroCine was among the very first U.S. companies to receive an FAA exception to operate commercially but we continue to have to seek permission to adapt and change to what clients need. It is expensive, time-consuming and frustrating.

And yet, my passion for this industry has not waned.

Three years ago witnessing a quadcopter flying a miniature camera capturing breathtaking videography. I was astonished and realized that this new technology would introduce the world to a new creative frontier, in addition to hundreds, if not thousands, of additional efficient and paradigm shifting innovations. The implications for filmmaking were readily apparent. I thought, if someone could put a small camera on a small multicopter, why could I not put a thirty-pound, high-quality cinema camera on a twenty-five pound multicopter?

Film producers make extensive use of cranes, camera cars, and helicopters, all in an elaborate effort to get the best shot. This is sufficient and still viable in some cases, but drones are more cost effective and when operated responsibly can greatly reduce poten-

tial risks to human lives. A drone has the capability to replace all of these on film sets while reducing the risk to human life and enhancing the artistic pursuit. UAVs excel at showing us our world in new, fascinating and beautiful ways. What excited me about drones three years ago is the same thing the excites me today—at their very core, drones present a way to easily place a sensor anywhere in three dimensional space. What could once only be dreamed can now be produced.

What began as an idea for my business partner Jeff Brink and me to turn a quick profit in the world of ultra high-end production grew quickly and far exceeds what we had initially conceived. When we started the company we planned to simply purchase a drone to carry large cinema cameras. Finding no suitable system on the market, we drew from academic and aerospace circles to build a team of engineers and set out to create an aerial robotic system of our own. Today our work ranges from designing custom UAVs to operating UAVs for big budget films, television shows, live programs, and special events. We are proud to be bringing to consumers images and video that has never been imagined.

The FAA's efforts to integrate UAVs into the national airspace (NAS) are commendable in the face of extraordinary challenges. One notable step is the increased speed with which the FAA is awarding Section 333 Exemptions. The publication of a proposed rule for small drones is also promising, but we understand we may be a year or more away from a final rule, and even so, the proposed rule is in many respects too restrictive. We recognize the FAA prefers the incremental approach of crawl—walk—run. But right now regulation in the United States is sorely lagging behind the technology, which is sprinting. The industry in United States has been quick to create innovative hardware and software solutions ranging from auto-deploying parachutes to designing automated air traffic control (ATC) schemes. This technology exists to protect people and property in the NAS and on the ground and as a nation, we must be able to rapidly adopt these solutions.

UAV operators in America are subject to the onerous task of satisfying bureaucratic hurdles which do little to enhance safety, such as securing certificates of authorization (COAs) for flights under 400' above ground level (AGL). Securing a COA can take anywhere from hours to weeks for a routine series of flights.

A commercial UAV operator must also employ an FAA licensed ATP, Private Pilot or Recreational or Sport Pilot to fly their unmanned vehicles. The skills of piloting a passenger plane versus an unmanned vehicle are worlds apart—as the FAA acknowledges in its proposed rule—and this requirement does little to enhance public safety.

Evidenced by many companies move to test in Canada and elsewhere, if we do not scramble to bring our regulations up to speed quickly our innovators will be eclipsed by entrepreneurs in other countries that have an established legal framework.

We would like to see FAA expand its Section 333 Exemption authority to include flights over persons not involved with the particular UAS operation, flights closer than 500 feet from such per-

sons, and operations beyond the visual line of sight (VLOS). These various operations can be conducted safely because of the technological capabilities of the drone and because of operational limitations the FAA can impose.

Even after the FAA issues its final rule for small drones, we believe the FAA should use its discretion to authorize operations beyond what the rules allow, provided the safety case can be made. This can be done through the Section 333 Exemption process, or some other process that avoids both another rulemaking or protracted type and airworthiness certification.

AeroCine stands ready to assist this committee and the U.S. Congress in bringing this exciting technology to consumers and we thank you for your leadership in holding this hearing.

Mr. Chairman, ranking member Velazquez and members of the committee, this concludes my opening statement. I look forward to answering any questions from the Committee.



**Testimony on Unmanned Aircraft Systems  
Committee on Small Business  
U.S. House of Representatives**

Professor Tim McLain  
Director, Center for Unmanned Aircraft Systems  
Brigham Young University

July 15, 2015

Thank you Chairman Chabot, Ranking Member Velazquez, and members of the committee for inviting me to speak today. I will provide the perspective of a professor who has been involved in unmanned aircraft systems (UAS) research for over 15 years and who has interacted with small businesses in a variety of ways.

I am a professor of mechanical engineering at Brigham Young University and currently direct a research consortium called the Center for Unmanned Aircraft Systems (C-UAS). This center brings together researchers from industry and academia to collaborate on research challenges facing the UAS industry. The center is sponsored by the National Science Foundation and receives much of its financial support from industry members that include many of the leading UAS companies and government labs. Our research universities include Brigham Young University, the University of Colorado-Boulder, and Virginia Tech.

During the years that I have been involved with UAS research, I have collaborated with many small businesses on a variety of projects. Currently, several small companies are members of our research center (C-UAS) and provide guidance and funding for our UAS research. With my colleagues and students, I have been a co-founder of two UAS startup companies: Procerus Technologies and Flying Sensors. My colleagues and I have also partnered with numerous small companies in the UAS industry on 15 SBIR and STTR awards, most of which have gone on to receive Phase II funding. Most of my research experience has been with small, unmanned aircraft of both fixed-wing and rotorcraft varieties.

From my perspective, small businesses have played a vital role in the creation and growth of the UAS industry in the United States. Without doubt, a significant portion of the innovation in the UAS industry has come from entrepreneurial start-up companies.

UAS technology, particularly for small, lower-cost aircraft, truly represents a disruptive innovation [1]. Advancements in batteries, miniature GPS receivers, microprocessors, electronics, materials, and sensors have made the small, unmanned aircraft of today possible. These small UAS have created new markets for aircraft among an entirely different set of consumers. Professional and consumer-grade small unmanned aircraft are displacing piloted aircraft from many markets, such as aerial photography and mapping. Furthermore, they provide a low-cost alternative to

military-grade small UAS and could potentially disrupt the defense-related markets as their reliability increases.

Just ten years ago, the small UAS market was not profitable enough for most large defense contractors to pursue. During the last decade, as UAS have had a transformational impact on military operations and as the promise of regulatory change has increased their viability for commercial applications, larger companies have taken greater interest in small UAS. Illustrating the importance of small business to the UAS industry, a common approach for large companies to enter or become more competitive in the UAS marketplace has been for them to acquire small, agile, innovative UAS companies. (See Table 1).

*Table 1: Examples of small business acquisitions by large corporations.*

<b>Corporation</b>	<b>Acquisition</b>
Raytheon	Sensintel, Blackbird Technologies
Lockheed Martin	Procerus Technologies, Chandler/May, CDL Systems
Boeing	Insitu, 2D3 Sensing
Textron Systems	Aerosonde
UTC Aerospace	Cloud Cap Technology
Rockwell Collins	Athena Technologies
Facebook	Ascenta
Google	Titan Aerospace
Qualcomm	Kmel Robotics

In the early years of the development of the UAS industry, government funding, administered primarily through the Department of Defense, was critically important for the development of unmanned aircraft. Military applications defined the desired missions and capabilities for UAS technology. DoD funding, including that provided by SBIR and STTR programs, drove the innovation in UAS technology. Many of the major players in the UAS industry have grown up by providing products and services to meet military needs.

As regulations are put in place to allow commercial flights of UAS, there will be a shift away from defense applications and an acceleration of market opportunities. This is particularly true for small UAS, due to their accessibility and relatively low cost. Applications that have been envisioned for small UAS include: agricultural monitoring, law enforcement, infrastructure inspection, wildfire monitoring, package delivery, aerial mapping and surveying, communication networks, news videography, and many more. During the first ten years following integration of unmanned aircraft into the National Airspace System, their economic impact in the U.S. is projected to be \$82 billion with over 100,000 new high-tech jobs created [2].

Because many UAS application markets are undeveloped and high risk, it is likely that small, innovative businesses will be the first to enter these markets, to build them, and prove their viability and value. More than ever, small business is essential to the growth and maturation of the UAS industry. These businesses will include of innovators and developers of UAS technology and providers of UAS services, such as farm-crop health assessment and land surveying.

Current UAS market estimates are based on specific applications that have been identified. From my perspective, even more exciting than these known applications are the applications that have not yet been conceived. Much like the Internet of the 1990's, the potential of unmanned aircraft to

enhance our lives is in its infancy and we do not yet have a full sense of the impact of this technology.

To enable and accelerate growth in the UAS industry and facilitate the participation of small business, the regulatory barriers to entry must be kept low. This is true for research entities, such as universities, as well. If the costs of obtaining authorization to fly are too high, in terms of the time, effort, and cost to obtain licenses and certifications, then these UAS markets of opportunity will be closed to all but larger companies that are well capitalized. Smaller companies will not be able to participate and bring their creative products to market. Costs for UAS technologies and services will remain high. Innovation and progress will be hampered and the U.S. will lose its competitive leadership position in an industry that it pioneered.

The progress of UAS research and commercialization in the U.S. has been inhibited by the lack of a regulatory framework that allows unmanned aircraft flights to take place. The FAA's Small UAS Notice of Proposed Rulemaking, also known as the Small UAS Rule, is a good step forward that will help accelerate growth in many UAS application areas [3]. The basic provisions of the Small UAS Rule allow unmanned aircraft up to 55 pounds to fly at speeds up to 100 miles per hour, up to altitudes of 500 feet above ground level, during daylight hours, and within visual line of sight of the operator. As a small UAS researcher, this rule will accommodate most of my needs and I will be greatly relieved when it is finally implemented. I believe this rule will enable many commercial applications and allow viable UAS businesses to be established. For many applications with great potential for impact, beyond-line-of-site capabilities are essential. Many farms, for example, are much larger than could be efficiently surveyed by a UAS kept within visual site of the operator. Likewise, to inspect an oil pipeline or deliver a package, beyond-line-of-sight capabilities are essential for the UAS to be a useful tool. In consideration of these needs, the FAA has initiated the Pathfinder Program to perform experimental UAS flights beyond the line of sight of the operator [4]. Further research and development are needed to increase the reliability of beyond-line-of-site flight in demanding airspace conditions. Regulations permitting safe beyond-line-of-site flight are necessary to allow the benefits of UAS technology to be fully realized and to maintain U.S. competitiveness in this growing field.

In summary, small businesses have played a vital role in the development of the U.S. unmanned aircraft industry by way of their vision, innovation, and willingness to take risks in emerging technology markets. As we move into the future of commercial UAS applications, small businesses will continue to make critical contributions to the success of this industry. They will lead the way with technology innovations and in the creative application of UAS technology to problems facing the world.

Thank you again for this opportunity to address the committee. I would be happy to answer any questions that you may have.

#### References

- [1] Christensen, Clayton M. *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Boston, MA: Harvard Business School Press, 1997.
- [2] Jenkins, Darryl and Vasigh, Bijan. "The Economic Impact of Unmanned Aircraft Systems Integration in the United States," AUVSI, March 2013.
- [3] Federal Aviation Administration, "Small UAS Notice of Proposed Rulemaking (NPRM)," <http://www.faa.gov/uas/nprm>. February 2015.
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STEVE CHABOT, OHIO  
CHAIRMAN

NYDIA M. VELAZQUEZ, NEW YORK  
RANKING MEMBER

**Congress of the United States**  
**U.S. House of Representatives**  
**Committee on Small Business**  
2501 Rayburn House Office Building  
Washington, DC 20515-6515  
July 30, 2015

Mr. Brian Wynne  
President & CEO  
Association for Unmanned Vehicle Systems International  
2700 S. Quincy Street  
Suite 400  
Arlington, VA 22206

Dear Mr. Wynne:

In order to have a complete record for the hearing titled, *Taking Flight: Small Business Utilization of Unmanned Aircraft* held on July 15, 2015, the following questions are being submitted for your response.

**Chairman Chabot**

The FAA is considering subdividing its proposed rule on small unmanned aircraft systems, or UAS, to more lightly regulate micro UAS, which the FAA proposes to define as those that weigh less than 4.4 pounds. Do you think the FAA should further subdivide its regulation of small UAS and impose different operating restrictions based on size, weight, and the operating environment? For example, should a small unmanned aircraft being flown in a rural area be treated differently from one operating in an urban setting?

**Congressman Carlos Curbelo (FL-26)**

We hear often from local news providers on the difficulty in making a visual report on some events that would be enhanced with an aerial perspective, such as forest fires, conditions in the Everglades, or traffic patterns throughout densely populated South Florida. In light of First Amendment interests in giving the public improved news coverage, could you share your thoughts on the new regulations as they apply to "news-gathering"? Wouldn't it be much more cost-effective for news stations to use drones to gather traffic reports, as opposed to say, helicopters?

Please provide your responses to all questions by August 26, 2015 to the attention of the Committee's clerk, Susan Marshall, at [susan\\_marshall@mail.house.gov](mailto:susan_marshall@mail.house.gov) for inclusion in the hearing record. In addition, please send the response to Congressman Curbelo's question to his legislative assistant, Hector Arguello, at [hector\\_arguello@mail.house.gov](mailto:hector_arguello@mail.house.gov).

Thank you for your participation in the hearing and your timely reply.

Sincerely,

  
Steve Chabot  
Chairman

### House Committee on Small Business

#### July 15 2015 Hearing: “Taking Flight: Small Business Utilization of Unmanned Aircraft”

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

Question submitted by Congressman Carlos Curbelo (FL-26)

1. We hear often from local news providers on the difficulty in making a visual report on some events that would be enhanced with an aerial perspective, such as forest fires, conditions in the Everglades, or traffic patterns throughout densely populated South Florida. In light of First Amendment interests in giving the public improved news coverage, could you share your thoughts on the new regulations as they apply to “news-gathering”? Wouldn’t it be much more cost-effective for news stations to use drones to gather traffic reports, as opposed to say, helicopters?

*The question of whether using a UAS for “news-gathering” would be applicable to the proposed small UAS rule and best answered by the FAA. However, as outlined in AUVSI’s “Snapshot of the First 500 Commercial UAS Exemptions,” nine entities have already received FAA Section 333 exemptions for “news-gathering” operations.*

*The UAS platforms being used for these operations weigh on average 4.99 pounds, have an average flight endurance time of 18.13 minutes, and are mainly rotary wing. The most common platforms referenced in Section 333 exemption petitions were the DJI Inspire 1 and DJI Phantom 2.*

*ArrowData is an innovative aerospace and data services company headquartered in Las Vegas that specializes in persistent data collection, transmission, analytics and distribution services. It was the first company to receive a Section 333 exemption for newsgathering and the only company among the first 500 to focus solely on these operations.*

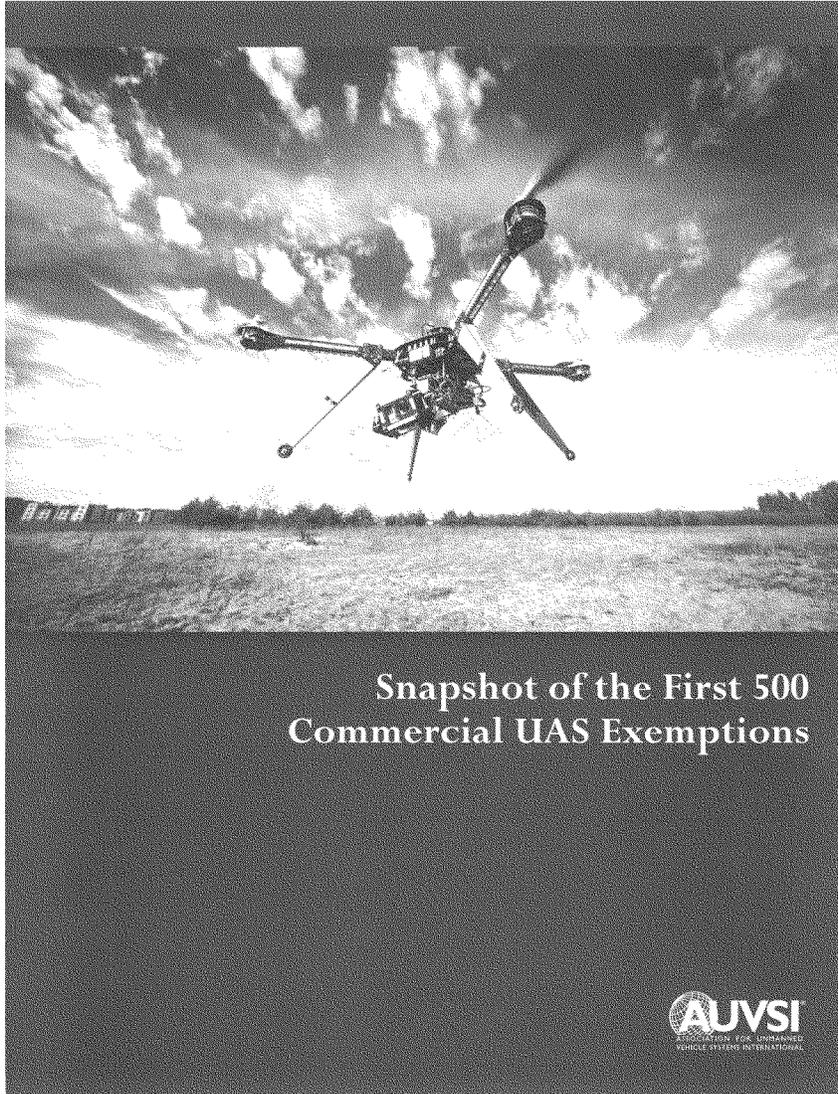
*ArrowData flew a CineStar 8 HL unmanned aircraft for ABC7 (KGO) in San Francisco on July 9, 2015, and both ArrowData and the TV station cannot be happier with the combined effort. The company integrated live unmanned aerial vehicle shots with numerous “hits” throughout the evening newscast.*

*According to ArrowData, which was featured in AUVSI’s “Snapshot of the First 500 Commercial UAS Exemptions,” there are many efficiencies, including cost, when using UAS platforms for “news-gathering” scenarios:*

*“It is clear to us that TV news organizations want to use UAVs to cover TV news. They are more economical than helicopters and in many cases can provide better video. We are hopeful that as we continue to prove safe operations to the FAA, regulations will be*

*relaxed involving flying over people and near airports. This will make using UAVs more effective when covering breaking news.”*

*Attached you will find a full copy of AUYSI's "Snapshot of the First 500 Commercial UAS Exemptions" for your reference.*



## EXECUTIVE SUMMARY

In late May 2014, the Federal Aviation Administration began accepting petitions for exemption to operate unmanned aircraft systems (UAS) commercially in the U.S. National Airspace System without an airworthiness certificate, which is allowed under Section 333 of the FAA Modernization and Reform Act of 2012. The agency approved the first set of commercial operators on Sept. 25, 2014 — six film and television production companies.

In the first year accepting exemption requests, the FAA approved almost 500 out of about 1,500 petitions. The agency continues to approve about 50 new operations a week, a process expedited by the FAA rolling out a summary grant process where similar petitions are batched and analyzed together rather than individually. However, the number of applicants continues to greatly outpace approvals.

The flood of commercial exemption requests to the FAA shows that a mature UAS commercial market is waiting to be unleashed. Given the technology's potential, it is important that the FAA finalize small UAS rules as quickly as possible. Moreover, Congress needs to pass — and the president needs to sign into law — an FAA reauthorization measure before the current authorization expires on Sept. 30, 2015.

Equally as important, government and industry need to work together to permit expanded uses of UAS technology that pose no additional risk to the airspace system. For example, whether within the context of the rule, through the FAA reauthorization measure or by other means, we need to allow for beyond-visual-line-of-sight, nighttime operations and operations over heavily populated areas. Otherwise we risk stunting a still-nascent industry and restricting the many beneficial uses of this technology.

Despite the commercial UAS industry being in its infancy, companies across the U.S. are involved with manufacturing and operations, and the positive effects of finalized rules for airspace integration will be felt across the country.

### KEY FINDINGS

The initial data show adoption of this enabling technology across many industries and in every corner of the U.S., foreshadowing great promise for the future of the UAS use.

#### Approved Operators

- There are approved operators from 48 states
- California has the most with 70, followed by Texas with 46 and Florida with 40.

#### Manufacturers of Approved Platforms

- California companies also manufactured the most platforms mentioned in approvals, totaling 50
- Florida follows with 18
- In all, 21 states house manufacturers of platforms.

#### Industry Use

- The exemptions also span more than 20 major industries, led by real estate, which was mentioned in 153 of the first 500 exemptions
- General aerial surveying had 128

- General aerial photography, 125
- Agriculture, 106
- Construction, 74
- Utility inspection, 69
- Film and television, 65
- Environmental uses, 42
- Emergency management, 24
- Search and rescue, 23.

#### Business Analysis

- More than 80 percent of all approved companies are small businesses.
- Still, the 196 companies with data listed with research firm Hoovers add nearly \$500 billion to the U.S. economy annually.

#### Platforms

- The estimated cost for all approved platforms was \$6.6 million.
- About 446 out of the 681 total platforms were manufactured by DJI and cost less than \$900,000 total.
- The U.S. led the way with platform sales at almost \$2 million for 114 platforms.
- Canada was just behind the U.S. at about \$1.9 million, with only 25 platforms.

Prior to this year, data on commercial UAS operations in the U.S. were nonexistent. Now, we have been able to take a look at early trends regarding safe commercial operations and can establish a basis for recommendations for future growth.

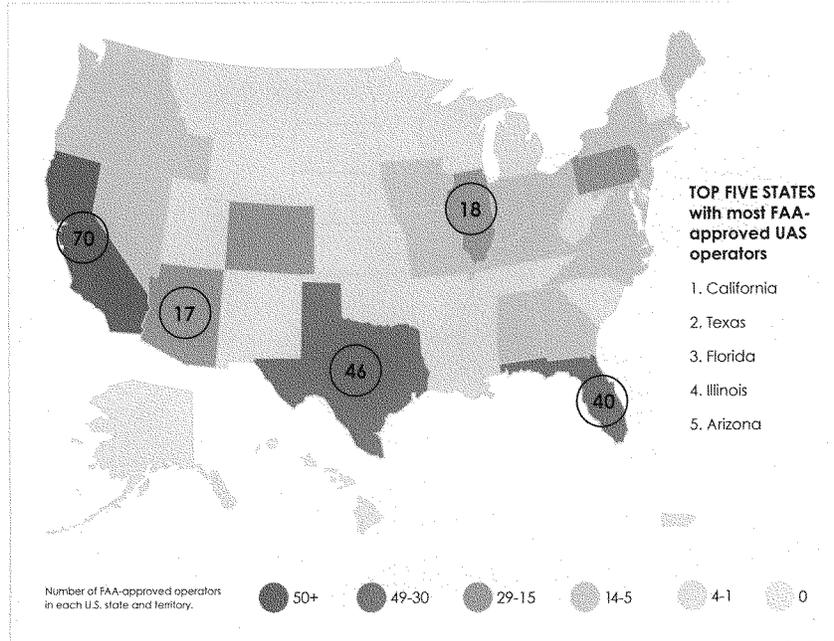
It is clear in the data that, even though many industries have started to benefit from UAS operations, beyond-line-of-sight operations, operations over congested areas and nighttime operations will be critical to achieving the full societal and economic benefits of UAS use. To achieve this, a risk-based, technology-neutral regulatory framework will be essential to getting this industry off the ground.

A risk-based, technology-neutral framework means that regulations should be based on the risk profile of a particular UAS operation instead of the platform being flown. For example, low-risk operations, such as aerial surveys above rural farmland and operations with micro UAS that weigh less than 4.4 pounds, would be 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.

The data have shown favor toward simple, low-risk operations. More than half of the approved platforms would fall into the FAA's proposed micro-UAS category, a weight class of UAS that is lightly regulated in countries with established UAS rules. Only one platform over 55 pounds, the Yamaha RMAX, which weighs over 200 pounds, has been approved so far.

Although research is still needed to understand full, high-level integration, more can and should be done to facilitate expanded operations that pose no threat to the National Airspace System, especially in rural areas under 500 feet.

The industry is primarily being held back by the continuous rulemaking delays that make it difficult to innovate without standards and other parameters. In the 2012 FAA reauthorization, Congress



mandated an August 2014 deadline for integration of small UAS into the National Airspace System and a September 2015 deadline for integration of all UAS — timeframes the FAA will miss considerably. We strongly advocate for swift rulemaking to take effect, not only to accelerate the safe commercial use of UAS and its benefits, but also to facilitate a larger data set to base future development on.

The six FAA-designated UAS test sites can help provide better access for industry testing, especially for these expanded use cases in places such as North Dakota, where the FAA has issued a blanket certificate of authorization for test site operations covering over two-thirds of the state.

To facilitate this, in the upcoming FAA reauthorization, Congress should consider making the test sites eligible for federal funding under current FAA offices and programs that are engaged with UAS activities in order to help them perform the valuable research needed for integration. 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.

Technological barriers to full-scale integration will be challenging to conquer as well with such a limited data set. Government and industry must develop a comprehensive research plan to gather data on expanded use cases and establish recommendations and deadlines

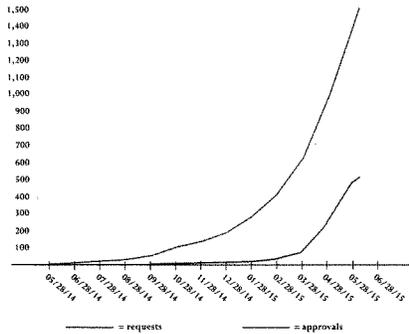
to achieve important research milestones. This includes an emphasis on developing a UAS traffic management system and coordinating UAS integration efforts with NextGen.

UAS integration should be a national priority, as delays and piecemeal solutions are greatly hindering the economic potential and societal benefits of the U.S. commercial UAS industry. Many other countries, including Canada, France, Australia and the United Kingdom, have had UAS rules in place for years, enabling industry there to progress, in some cases even with beyond-line-of-sight operations. The U.S. UAS industry is poised to be the leader in this field, as is shown by the rapidly increasing interest and innovation domestically. However, high-level leadership and coordination with industry and government partners is absolutely critical to ensure the United States regains trailblazer status in this global industry.

**INTRODUCTION**

In late May 2014, the Federal Aviation Administration began accepting petitions for exemption to operate unmanned aircraft systems (UAS) commercially in the U.S. National Airspace System without an airworthiness certificate, which is allowed under Section 333 of the FAA Modernization and Reform Act of 2012. The agency approved the first set of commercial operators on Sept. 25, 2014 — six film and television production companies. Prior to this, the only commercial unmanned aircraft operations were approved through special airworthiness certificates, which require a lengthy process originally created for manned aircraft. The first certificates allowed for minimal UAS operations supporting oil and gas activities off the Alaskan coast.

In the first year after accepting exemption requests, the FAA had approved almost 500 out of about 1,500 petitions. The agency continues to approve about 50 new operations a week, a process expedited by the FAA rolling out a summary grant process whereby similar petitions are batched and analyzed together rather than individually. However, the number of applicants continues to greatly outpace approvals.



In February 2015, the FAA released its “Notice of Proposed Rulemaking for Small UAS”, a set of rules that would, once finalized, govern the commercial drone industry for platforms up to 55 pounds. Until this set of rules is reviewed and completed, the Section 333 exemption process remains the most effective way for commercial entities to gain access to the airspace for UAS operations. Although limited, it has begun to give us data on this emerging market and provides a snapshot of what is to come.

This report analyzes the first 500 commercial UAS exemptions to gain an understanding of where this burgeoning industry is, where it is headed, and what we can do to ensure innovation and its success moving forward.

Although this is only the smallest sampling of a nascent commercial UAS industry, it offers a glimpse into the technology’s power to serve as a limitless economic driver and transform businesses in a way that will increase human potential, saving time and lives. A commercial UAS industry still remains largely grounded; however, we can begin to take a look at the current shape and scope of commercial use.

**REPORT**

In the 2012 FAA reauthorization, Congress mandated an August 2014 deadline for integration of small UAS into the National Airspace System and a September 2015 deadline for integration of all UAS, timeframes the FAA will miss considerably. As the next reauthorization approaches this September, we look to the current progress of industry and government collaboration and data collected from the first commercial uses to establish recommendations that will help accelerate the societal and economic benefits of commercial UAS use and ensure the safety of the national airspace.

As we progress through an analysis of the first commercial applications and accompanying systems, we gain a better understanding of the stages of airspace integration, the current successes and the limitations of the current process in enabling safe commercial uses of the technology.

In 2013, before the FAA developed a process to enable airspace access for commercial UAS users, AUVSI’s economic impact report projected integration would add \$82 billion in economic impact to the U.S. economy and create 100,000 new, high-paying jobs within the first 10 years of UAS integration.<sup>1</sup> According to the report, 80 percent of this impact would come from agriculture and related industries, which contributed \$789 billion to the U.S. economy in 2013, according to the U.S. Department of Agriculture.<sup>2</sup>

INDUSTRY/OPERATION	COUNT	% OF APPROVALS
Real Estate	153	30.6
Aerial Surveying	128	25.6
Aerial Photography	125	25
Agriculture	106	21.2
Aerial Inspection	86	17.2
Construction	74	14.8
Infrastructure Inspection	73	14.6
Utility Inspection	69	13.8
Film and TV	65	13
Environmental	42	8.4
Training	29	5.8
Research and Development	27	5.4
Emergency Management	24	4.8
Mining	24	4.8
Search and Rescue	23	4.6
Advertising	22	4.4
Insurance	18	3.6
Oil and Gas	17	3
Flare Stack Inspection	11	2.2
Newsgathering	9	1.8
Demos	8	1.6
Security	6	1.2
Sports	5	1
Railroad Inspection	4	0.8

INDUSTRY/OPERATION	COUNT	% OF APPROVALS
Mill Operations	1	0.2
Paving	1	0.2
Risk Management	1	0.2

The first 500 exemptions show that, although agricultural applications are referenced in greater than 20 percent of all approvals, there may still be inhibiting factors preventing greater adoption across this sector.

The benefits of UAS and other robotic technologies will be invaluable to the agriculture industry moving forward as agriculture professionals look for new ways to keep pace with the global market.

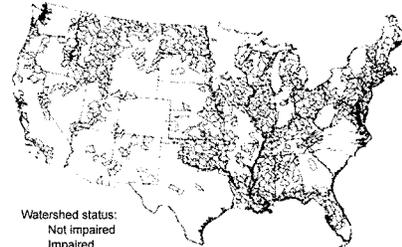
UAS enable analysis and improved planning for farmland that will result in increased efficiency, better yields and more accurate yield predictions. Better data can help farmers accurately prepare resources for harvest and prevent farmers from overstocking or having to leave mature crops in the field.

For example, if the projected yield in sugar beets exceeds the processing capacity, growers may have to leave beets in the ground.<sup>7</sup>

UAS are the most effective method for early detection of disease and nutrient deficiency in crops. In 2010, Georgia alone lost about \$4.24 billion (16.5 percent) of its crops due to disease.<sup>8</sup> UAS will also help reduce negative environmental impacts of pesticide and fertilization use, which are essential to maintaining healthy crops.

For example, nitrogen is one of the most critical fertilizers used in agriculture. Sixty-seven percent of nitrogen used every year is lost, costing farmers money and resulting in water contamination. Data obtained from UAS can help farmers optimize inputs, such as nitrogen and phosphorus, and more precisely apply these nutrients or fertilizers to crops, saving farmers money and mitigating the environmental impact.<sup>5,6</sup>

**Watersheds reported as impaired by nitrogen or phosphorus, 2007**



Source: U.S. Environmental Protection Agency

Farmers are also facing pressing challenges beyond these environmental and societal considerations. The USDA predicts that between the years of 2015 and 2020, net farm income in the U.S. will fall to around \$75 million from more than \$125 million in 2013.<sup>7</sup> UAS will be vital in enabling farmers to combat this decline.

**AGRICULTURE SPOTLIGHT**

AGRICULTURE PLATFORM STATS
Avg. weight: 9.14 pounds
without RMAX: 7.45 pounds
Avg. endurance: 37.59 min.
30 rotary wing
22 fixed wing
MOST COMMON PLATFORMS
1. DJI Phantom 2 Vision+ – 13 referenced
2. DJI Inspire, senseFly eBee, DJI Phantom 2 – 12 referenced

**John Nowatzki, agricultural machine systems specialist, North Dakota State University**

*Courtesy: Increasing Human Potential: Unmanned Unplugged Series*

Crop producers are increasingly providing digital data to manage crop production on a more precise field scale. UAS crop and livestock monitoring, and imagery collected with UAS, will provide an additional timely dataset to increase precision management practices for farmers and ranchers and simultaneously provide more effective safeguards for the natural environment.

UAS will provide timely, high-resolution imagery and a real-time eye in the sky for agricultural producers to use to more precisely apply crop inputs, to validate past management decisions and to adjust in-season practices.

UAS are safer, less expensive and timelier than manned aircraft remote sensing. UAS operated in crop fields and livestock rangeland in rural fields under existing safety guidelines provide essentially no safety threat to people on the ground or manned aircraft. Additionally, manned aircraft operated in close proximity to crop and livestock operations are potentially more dangerous to the aircraft operator.

**Yamaha RMAX for Crop Spraying in Napa Valley**

*Courtesy: Unmanned Systems magazine*

Napa Valley doesn't use manned aircraft for spraying, instead relying on ground tractors. Spraying crops with those can take much longer: tractors can travel only about 3 mph, while the RMAX can move along at 12 to 15 mph.

Even if manned aircraft were used in Napa, the RMAX would have some advantages. It can fly very low over the grapes, thereby minimizing fertilizer waste and runoff, and it's more nimble and able to steer away from the houses and other structures that share the space with the vineyards.

Although UAS are beginning to be a boon for farmers, regulatory limitations requiring line-of-sight and daytime operations may contribute to the inhibited adoption. The FAA's proposed rules for UAS would not allow for beyond-line-of-sight or nighttime operations, and no Section 333 petitions have yet been granted for these operations. Farmers have used autonomous tractors for over a decade, including overnight, to assist in operations — the same should be allowed for UAS in these rural areas.<sup>8</sup> UAS can be used to manage many acres of land in a fraction of the time compared to on-foot scouting, including surveying 1,500 acres of land in one hour at one-inch image resolution using a fixed-wing design.<sup>9</sup>

Although these essential growth areas will be required for widespread successful UAS adoption across agriculture and other industries, there is very clearly a need for more research involving beyond-line-of-sight operations, nighttime operations, operations over congested areas, and, even further down the line, operations involving larger platforms and full-scale airspace integration.

These operations will eventually facilitate services like UAS package delivery or unmanned cargo delivery. However, the exemption process currently does not allow for these expanded operations even though in many instances, especially in rural areas, there is no additional risk to the airspace.

Industry and government must continue to collaborate on UAS development and form a comprehensive research plan that will allow stakeholders to identify areas that require additional resources and where industry should develop solutions.

Twenty-nine of 49 platforms have a maximum altitude over 10,000 feet, according to the manufacturers. Nineteen of 57 platforms with the relevant data have a range greater than 10 miles. There has also been one platform approved that weighs more than 55 pounds — placing it outside the FAA’s definition of small UAS — the Yamaha RMAX, at over 200 pounds. The RMAX and its predecessor have been used in Japan for precision crop spraying since the 1980s, and the remotely piloted helicopter continues to spray 2.4 million acres of cropland there a year, according to Yamaha’s petition.

The technology to fly safely in expanded operational profiles exists in large numbers and continues to be developed. However, technology is outpacing regulation, and it will continue to as robotic technologies proliferate. This regulatory uncertainty discourages innovation. Companies will be reluctant to develop technologies too far ahead of rules in fear of spending precious time and resources developing platforms that may never fly. Additionally, as innovation is encouraged for UAS technologies, it will lead to advancements in industries such as health care, graphic imaging, remote sensing, data management and even manned aviation, which will help make the airspace safer for all users.

Another factor contributing to the agriculture industry’s UAS approval rate reflects the rapidly expanding use cases for the technology, now that commercial entities have a pathway to operate.

The real estate industry has lead the way in these initial operations, with over 150 references in the first 500 exemptions (30 percent). After only recently embracing the benefits of UAS, with the first approval coming in January 2015, real estate agents and photographers are finding an economic advantage under the exemption process. Real estate operations generally only require the simple operational profiles the FAA has, thus far, been able to approve. Low-level flights over private property do not pose a threat to the airspace and lead to improved safety over manned operations in legacy use cases.

Among the petitions that reference real estate, 24 of the platforms with data available are rotary wing, while only a single platform is fixed wing. This instance was from a petition approved for multiple industries and multiple UAS and may not actually be used for real estate operations.

The average weight for these aircraft is 5.37 pounds with an average endurance time of 23.1 minutes. DJI Innovations manufactured 173

out of the 195 platforms mentioned for real estate use. This includes 120 systems under three pounds. These data accurately portray the simple operational profiles required of real estate use.

### REAL ESTATE SPOTLIGHT

REAL ESTATE PLATFORM STATS	
Avg. weight: 5.37 pounds	
Avg. endurance: 23.1 min.	
24 rotary wing	
1 fixed wing	
MOST COMMON PLATFORMS	
1. DJI Phantom 2 Vision+ – 60 referenced	
2. DJI Phantom 2 – 52 referenced	
3. DJI Inspire 1 – 31 referenced	



Contract: National Association of Realtors

Technological advances have made it cost-effective to take pictures and videos from drones, aka Unmanned Aerial Vehicles (UAVs). Real estate professionals are interested in using this new technology to take videos and pictures to create dynamic marketing pieces for property listings, among other purposes.

Real estate professionals working with residential, commercial and land parcels can all benefit from the images and information obtained from using UAV technology. This imagery is an incredible tool for potential homeowners moving to a different city, buying a second home or trying to streamline the research process necessary to buy a new home. Many commercial properties or large parcels of land do not lend themselves well to traditional photography. Capturing the entirety of the plot will give a better representation of the property at hand.

Being able to easily view the information obtained through the use of UAV technology will help better inform the consumer. Just as digital photography made it easier to create high-quality, affordable images, real estate practitioners look forward to using UAV technology to take their listings into the next level in technical creativity and quality. Many real estate professionals want to hire a professional who offers UAV photography services, while some others are getting the FAA waivers and using the machines themselves.

Many industries that support real estate can also use UAV technology to enhance their businesses. Property appraisals, facility management, roof inspection, insurance evaluation and thermal imaging evaluations are all tasks that can be done expeditiously using UAV technology. Insurance companies can use UAV technology to quickly evaluate property damage in an area after a storm or other destructive event. That would expedite the information-gathering process for property owners and businesses to get back up and running.

Although real estate use significantly outpaced other uses overall, there are state and regional trends that favor other uses locally. California companies, unsurprisingly considering the state’s population, make up 70 of the first 500 exemptions. These 70 cases are led by film and television operations, at 23 exemptions, followed by real estate at 15.

## APPROVED EXEMPTIONS BY STATE

STATE	TOTAL EXEMPTIONS
California	70
Texas	46
Florida	40
Illinois	18
Arizona	17
Colorado	15
Pennsylvania	15
Ohio	14
Indiana	13
Iowa	12
North Carolina	12
Virginia	12
Washington	12
New Jersey	11
New York	11
Maryland	9
Oregon	9
Alabama	8
Georgia	8
Idaho	8
Kentucky	8
Massachusetts	8
Louisiana	7
Missouri	6
Nevada	6
Connecticut	5
Maine	5
Michigan	5
Kansas	4
Minnesota	4
Nebraska	4
New Mexico	4
Tennessee	4
Wisconsin	4
Alaska	3
Arkansas	3
Hawaii	3
North Dakota	2
Puerto Rico	2
Rhode Island	2
South Carolina	2
Utah	2
Mississippi	1
Montana	1
Oklahoma	1
South Dakota	1
Vermont	1
West Virginia	1
Wyoming	1

## EXEMPTIONS BY STATE BREAKDOWN \*

CALIFORNIA	70	TEXAS	46
Film and TV	23	Aerial Photography	16
Real Estate	15	Real Estate	15
Agriculture	14	Aerial Inspection	10
Aerial Survey	12	Utility Inspection	9
Infrastructure Inspection	10	Construction	9
Aerial Photography	10	Aerial Survey	9

FLORIDA	40	ILLINOIS	18
Real Estate	20	Real Estate	7
Aerial Photography	10	Aerial Photography	7
Agriculture	9	Insurance	3
Aerial Survey	8	Agriculture	3
Construction	8	Aerial Inspection	3
Film and TV	7		

ARIZONA	17	COLORADO	15
Real Estate	7	Aerial Survey	9
Agriculture	6	Construction	4
Aerial Photography	4	Infrastructure Inspection	4
Aerial Survey	4	Aerial Photography	4
Mining	3	Aerial Inspection	3
Aerial Inspection	3	Real Estate	3

PENNSYLVANIA	15	OHIO	14
Aerial Survey	8	Real Estate	5
Real Estate	7	Aerial Photography	4
Utility Inspection	6	Construction	4
Aerial Photography	6	Utility Inspection	3
Infrastructure Inspection	5	Infrastructure Inspection	3

INDIANA	13	IOWA	12
Real Estate	7	Agriculture	9
Aerial Photography	5	Utility Inspection	6
Environmental	3	Aerial Survey	5
Aerial Inspection	3	Infrastructure Inspection	4
Construction	3	Real Estate	4

NORTH CAROLINA	12	VIRGINIA	12
Utility Inspection	4	Aerial Survey	7
Agriculture	4	Real Estate	4
Aerial Photography	4	Aerial Photography	4
Real Estate	4	Agriculture	3
Environmental	3	Infrastructure Inspection	3
Construction	3		
Aerial Survey	3		

\* Single approvals may apply to more than one industry.

WASHINGTON		NEW JERSEY	
Construction	4	Aerial Inspection	4
Real Estate	4	Real Estate	4
Agriculture	4	Film and TV	3
Infrastructure Inspection	3	Agriculture	3
		Construction	3
		Aerial Survey	3
		Aerial Photography	3

NEW YORK	
Film and TV	5
Aerial Photography	5
Real Estate	4

As of the first 500 exemptions, the FAA has approved companies from 48 states, Puerto Rico, Ontario, Saskatchewan and the United Kingdom. The only states not represented are New Hampshire and Delaware.

Although the California film and television industry got off to a quick start with five of the first seven exemptions granted, the continued prevalence of closed-set filming exemptions shows clear strength in the Hollywood/Los Angeles film industry compared to other states. The next highest instances of film and television exemptions are Florida with seven and New York with five. The New York number stands out as well, because the film industry operators make up almost half of the state's exemptions, the highest percentage of any state for the industry.

UAS have already been used abroad on many major motion pictures, including the James Bond film "Skyfall" and both Avengers movies. The safety standards within the industry for closed-set filming are, at times, more stringent than the FAA's requirements for these operations. The on-set safety process requires everyone to sign a waiver and attend safety briefings, typically with or without UAS use. It is, therefore, logical that these operations were the first to apply for and receive exemptions, comprising the first seven and 10 out of the first 20 exemptions, because of its history and dedication to safety.

### FILM AND TV SPOTLIGHT

FILM AND TV PLATFORM STATS	
Avg. weight:	12.39 pounds
Avg. endurance:	19.05 mins.
	25 rotary wing
	0 fixed wing

MOST COMMON PLATFORMS	
1. Spreading Wings S1000	19 referenced
2. DJI Inspire 1	14 referenced
3. DJI Phantom 2	13 referenced

**Motion Picture**  
Courtesy: Mission Critical magazine

A pulse-quickening sequence in a 2012 James Bond movie, "Skyfall," which was shot in Istanbul, Turkey, is one often-cited example of effective aerial cinematography, using a small UAS. Daniel Craig as 007 is shown from above and many other angles as he rides a motorcycle in a wild chase on the roofs of buildings, battles with a bad guy atop a speeding train, plunges off a cliff and is swept over a roaring waterfall.

"While we have already seen movies filmed with SUAS from overseas productions — take for example the roof sequence of 'Skyfall' — the sky is literally the limit in imagining what new angles and views filmmakers will thrill us with next," says Lauren Reamy, director of government affairs for the Motion Picture Association of America. "Every day, moviemakers are increasingly leveraging the latest technologies to advance their craft. Using SUAS is an example of that, one in which audiences will continue to see scenes and shots we could only have imagined a few years ago."

"Small unmanned aircraft systems are a safer, more efficient and a more flexible alternative in many cases," says Reamy. "For example, SUAS run on electricity, while manned helicopters require thousands of gallons of gasoline."

Independent filmmakers and other producers whose budgets don't allow for manned helicopters could save money and broaden their creative possibilities by using drones, says Richard Crudo, president of the American Society of Cinematographers. "The independents will embrace the cheapness of it, and the studios will embrace the trendiness of it."

"I find, as a cinematographer, where the shots are most interesting and most dynamic is down low," says David Wagreich, CEO and pilot for Astraicus Aerial Cinema Systems. "Typically, with full-scale helicopters, you're always asking to go lower. To be high and wide and looking down on something isn't as exciting as being down in the action. Typically, our best shots are at 50, 30 feet or below."

Previously, he says, for movies like "Spiderman," crews had to spend days — and tens of thousands of dollars — rigging cable cameras and programming their movements.

"There are a lot of production economies," Wagreich notes. "In comparison with full-scale helicopters, which can cost upwards of \$30,000 a day to operate ... you can fly a UAS for [about] half the price."

The demand for unmanned aerial cinematography has been "very strong," says Treggon Owens, cofounder of Aerial Mob, but the time needed to gain clearance makes it a challenge to meet the demand. "The demand for the use of it is definitely outstripping our ability to get through the regulatory hurdles, but [FAA officials] are working on that very hard."

"What I really like about the drone is that it frees up your creativity," he says. "You are providing the filmmaker a whole new way to tell a story."

Advantages of UAS over manned helicopters for moviemaking include greater safety. Most fatalities of film crew members have involved manned helicopter accidents.

"The technology, from our perspective, is game changing," Astraicus Aerial's Wagreich says. "You can create shots that you could never achieve before."

With drones, he says, "you can show up and fly it in real time," saving time and money and allowing greater creativity. "I think what's going to happen now is directors of photography are going to start conceiving shots around UAS."

Dedication to safety, however, is not unique to the film and television industry. It is important for all commercial entities to operate safely in order to protect employees and their business interests. In some cases, UAS actually greatly improve safety in these commercial uses.

Film industry users no longer require low-flying manned aircraft to get certain aerial shots. Oil and gas operations and flare stack inspections, with the reduction in flammable fuel in the vicinity and the absence of manned aircraft maneuvering dangerously close to equipment and infrastructure, become much safer operations for inspectors using UAS.

OIL AND GAS SPOTLIGHT	
OIL AND GAS PLATFORM STATS	
Avg. weight:	9.83 pounds
Avg. endurance:	97.4 min.
Avg. endurance without UAV Factory Penguin:	39.37 min.
10 rotary wing	
4 fixed wing	
MOST COMMON PLATFORMS	
1. S1000, eBee, AscTec Falcon 8 – 2 of each referenced	
<b>Flying With Flare</b>	
<i>Context: Mission Critical, major</i>	
<p>Flare stacks play a key role in oil and natural gas production by burning off unusable gas at drilling rigs and refineries, but inspecting the flame-tipped towers for damage has traditionally been dangerous and difficult. Advocates of unmanned aircraft systems say the technology could make such inspections far safer and easier.</p> <p>Flare stacks can stand several hundred feet tall and emit 2,000-degree-Fahrenheit heat. Having inspectors climb flare stacks or nearby structures or elevating them with a sky lift is risky, and using manned helicopters can be cost-prohibitive.</p> <p>Small UAS offer a better option, according to operators and manufacturers. The unmanned vehicles keep people out of harm's way and are relatively inexpensive and simple to operate. Their agility and compact size allow them to easily fly above and around flare stacks, potentially providing better views than other means. And flare stacks do not have to be shut down for UAS inspections.</p> <p>"Drone technology improves safety, reduces liability, increases accuracy, and saves time and money for our customers while allowing them to continue work as usual during the inspection process," says Houston-based Total Safety U.S. Inc., one of several companies that plan to participate in the American UAS flare stack inspection market.</p> <p>"The risk to an onboard pilot and crew during an incident or accident is eliminated with the use of a UAS [unmanned aircraft] for the inspection operation," the FAA wrote in its approval document for Total Safety. "In addition, utilizing UAS to conduct flare stack inspections will reduce the need for inspection personnel to perform this hazardous activity."</p> <p>"There are potentially 3,500 potential inspection sites just in the Gulf of Mexico," says Brian Whiteside, founder and president of VDOS Global, the first company approved for flare stack inspections. "There are something like 60,000 cell phone towers throughout the U.S., one-third of which have to be inspected every year. All the refineries throughout the U.S. are inspection candidates, as are the pipelines and windmills."</p>	

Similarly, the construction and infrastructure inspection industries improve inspector safety by eliminating the need for dangerous inspections of towers or bridges that may require climbing by harness for

manual inspection. It is also a very efficient way to document progress at a construction site, either for the owner or for planning purposes.

Forty-two unique platforms were approved for infrastructure inspection, totaling 116 references in the first 500 exemptions, including 26 rotary wing and three fixed wing. Slightly more robust than those approved for general construction operations, the infrastructure inspection platforms have an average endurance of just over 30 minutes and 8.7 pounds. This includes more advanced platforms, such as five references of Altavian's Nova F6500, which can fly for 90 minutes at 15 pounds; the Microdrone md4-1000, which can fly for almost 90 minutes at 12 pounds; and Lockheed Martin's Indago quadrotor, which, at almost five pounds, flies for 50 minutes.

These systems, as is common with the higher end, industrial multirotor platforms, can cost anywhere from \$10,000 to \$50,000 and up depending on sensor payload. However, the three most common systems for construction and infrastructure remain DJI models — Phantom 2 Vision+, Phantom 2 and Inspire 1.

CONSTRUCTION INDUSTRY SPOTLIGHT	
CONSTRUCTION PLATFORM STATS	
Avg. weight:	7.22 pounds
Avg. endurance:	26.85 min.
21 rotary wing	
5 fixed wing	
MOST COMMON PLATFORMS	
1. DJI Phantom 2 Vision+, DJI Phantom 2 Vision – 20 of each referenced	
INFRASTRUCTURE INSPECTION PLATFORM STATS	
Avg. weight:	8.72 pounds
Avg. endurance:	30.1 min.
26 rotary wing	
3 fixed wing	
MOST COMMON PLATFORMS	
1. DJI Phantom 2 Vision+ – 16 referenced	
2. DJI Inspire 1 – 13 referenced	
3. DJI Phantom 2 – 12 referenced	
<p><b>AGC of America</b>  <i>Contractors • The Associated General Contractors of America</i></p> <p>The Associated General Contractors of America, a nationwide trade association of construction companies and related firms, has engaged its more than 26,000 members in a discussion of UAS and their potential benefits to the construction industry.</p> <p><b>Project Planning and Design</b> – UAS have the potential to reduce the cost and improve the quality of the currently available maps of specific project sites. Improvements in the design and planning processes will reduce the number and degree of expensive changes that a project team has to make in the field and will help a project stay on schedule and within budget.</p> <p><b>Safety</b> – Building contractors would like to use UAS to inspect the work being done on roofs or curtain walls, or other vertical surfaces.</p>	

rather than ask their employees to get onto a lift, to climb a scaffold or to descend from a higher elevation in a bosun's chair. Similarly, civil contractors would like to use UAS to inspect bridges, towers, wind turbines and similar structures without putting their workers at risk. UAS can also help contractors determine the safest way for work to flow throughout a project site and to identify potentially dangerous areas that they may need to barricade.

**Efficiency** – As noted, UAS have the potential to help contractors monitor their jobsites, how equipment and materials are laid out, and how the work actually flows. This would also help them plan and supervise their site logistics.

**Quality** – UAS have the potential to reduce the cost of inspecting the quality of work done at higher elevations, including the many joints in a building's envelope and the caulking, flashing or other work needed to prevent water from penetrating. UAS would also make it much easier for contractors to inspect welds and other structural connections at whatever elevation they may be. Contractors report that small UAS often provide a vantage point that manned aircraft simply cannot match.

**Environmental Compliance** – UAS would also make it much easier for contractors to document their compliance with a host of environmental and other requirements. Among these requirements are storm water controls that the U.S. Environmental Protection Agency and its counterparts at the state level require contractors to inspect every seven to 14 days (depending on the state) and after rain.

**Other Possibilities** – In the future, contractors might also find that they can use UAS to carry tools, equipment or construction materials from one location to another. If appropriate for such use, UAS would be far more versatile than the cranes being used today.

Despite the overwhelming majority of the approved systems coming from DJI, which manufactures abroad — 446 out of 681 (65 percent) — U.S. manufacturers still come out ahead in total platform sales. The 114 platforms manufactured in the U.S. cost an estimated \$1.95 million, followed closely by Canada at \$1.90 million with only 25 platforms. Total estimated platform cost for all 681 platforms was about \$6.6 million.

**PLATFORM SALES BY COUNTRY**

MANUFACTURER LOCATION	# OF PLATFORMS	TOTAL ESTIMATED COST
United States	114	\$1,950,048.83
Canada	25	\$1,908,785.00
China	460	\$895,954.60
Switzerland	33	\$726,000.00
Germany	22	\$472,303.00
Belgium	7	\$365,994.00
Latvia	2	\$110,000.00
Japan	1	\$86,000.00
France	1	\$33,507.00
Netherlands	3	\$30,000.00
New Zealand	4	\$17,283.58
South Korea	4	\$14,000.00
Austria	1	\$10,000.00

10 AUVSI'S SNAPSHOT OF THE FIRST 500 COMMERCIAL UAS EXEMPTIONS

MANUFACTURER LOCATION	# OF PLATFORMS	TOTAL ESTIMATED COST
Slovenia	1	\$10,000.00
South Africa	4	\$7,180.00

Canada's Aeryon Labs has benefited from its SkyRanger UAS with over \$1.5 million in sales over 10 references. The SkyRanger has also been selected by the Michigan State Police as its platform for law enforcement operations across the state. China and its 460 platform references falls to third with just under \$900,000 in sales, as many of the systems are lower end or consumer models.

**TOP PLATFORM SALES**

PLATFORM	# OF EXEMPTIONS	TOTAL PLATFORM COST
Aeryon SkyRanger	10	\$1,580,000.00
senseFly eBee (all models)	24	\$726,000.00
DJI Inspire 1	96	\$326,304.00
Trimble UX5	6	\$305,994.00
PrecisionHawk HawkEye Lancaster Mk III	11	\$275,000.00
DJI Spreading Wings S1000	58	\$245,340.00
Altavian Nova F6500	12	\$120,000.00
DJI Phantom 2 Vision+	110	\$98,890.00
DJI Spreading Wings S900	28	\$95,200.00

Many of the SkyRangers have been approved for utility inspection operations, which will improve the safety and speed of inspection services for power lines, transmission lines and pipelines.

According to Southern Company Services' petition, UAS "would vastly reduce risks to crews responsible for power line inspections and significantly hasten power restoration in the event of storms, hurricanes, tornadoes and other weather events."

Beyond-line-of-sight operations will be essential to the future use of UAS for utility inspection, as companies have thousands of miles of service lines to inspect.

The Mid-Atlantic Aviation Partnership at Virginia Tech, one of the six FAA-designated UAS test sites, recently tested an American Aerospace Technologies RS-16 UAS to inspect 11 miles of Colonial Pipeline Co. energy pipeline in 90 minutes with a chase plane for safety.<sup>10</sup>

A closer look at domestic manufacturers of approved platforms reveals broad representation from the states. With the small sample size it is encouraging to see that 21 states already have manufacturers with UAS approved for commercial operations.

California manufacturers have the most platforms mentioned in the exemptions with 50, including 23 platforms from 3D Robotics. Florida was next with 18 platforms, 16 manufactured by Altavian. Manufacturers from 21 states have platforms approved in the first 500 exemptions.

PLATFORMS MANUFACTURED BY STATE

STATE	# OF PLATFORMS
California	50
Florida	18
North Carolina	11
Kansas	4
Washington	4
Arizona	3
Texas	3
Colorado	2
Illinois	2
Maine	2
Maryland	2
Missouri	2
New Hampshire	2
Ohio	2
Idaho	2
Minnesota	1
Mississippi	1
Oklahoma	1
Oregon	1
South Carolina	1
Virginia	1

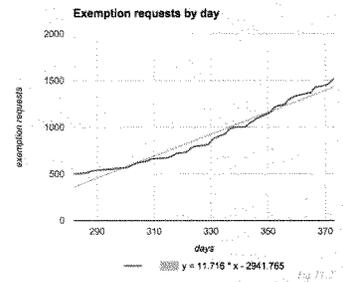
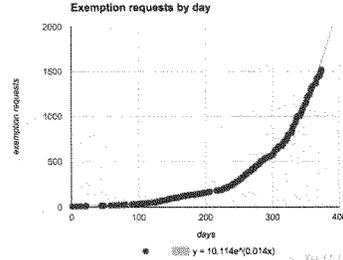
Despite the commercial UAS industry being in its infancy, companies across the U.S. are involved with manufacturing and operations, and the positive economic effects of finalized rules for airspace integration will be felt across the country.

Looking forward, the industry and its economic effects promise to expand rapidly. To date, exemption requests have increased exponentially since May 2014, reaching over 1,900 by July 2015. If this exponential growth continues, there will be 8,956 exemption requests by the time FAA reauthorization is set to expire on Sept. 30, 2015 (Fig. 11.1).

More realistically, using a standard linear regression starting at 500 exemptions, if the recent pace of exemption requests does not continue to increase, there will be nearly 3,000 requests by the end of September 2015 (Fig. 11.2). The case-by-case exemption process will continue to struggle to keep up with requests if rules and reauthorization are further delayed.

This number jumps to 25,910 potential commercial operators by Sept. 30, 2020. This figure is many times higher than commercial air traffic numbers, which the FAA claims is about 7,000 at any given time.<sup>41</sup> As many more operators take to the air, it will be crucial to develop a UAS traffic management system and integrate UAS activities with Next Generation Air Transportation System plans. NASA and industry collaborators are currently working on these issues that will require coordinated government support moving forward to support the proliferation of UAS use.

The numbers for potential operators do not take into account petitions that have been closed without approval, which add to 85 compared with 822 approvals as of July 21, 2015. These are largely due to petition documents with insufficient information and in some cases may include operators that have reapplied successfully. It also does not factor in an



upper limit based on fixed population and therefore finite demand for potential operators.

However, the more than 25,000 potential operators by 2020 may still be understated considering the growing pace of exemption requests and the wide-ranging UAS uses that grow every day. Assuming no further rate increase in operators and similar platform sales, platform sales alone will reach over \$48 million by September 2015 and over \$342 million by September 2020, even though the majority of the current platforms are low-end consumer models. As the industry develops with established rules, more high-end industrial platforms will be used, especially in expanded use cases such as beyond line of sight. Currently, government UAS, such as NASA's Ikhana research UAS, can cost millions of dollars per aircraft.

The exemptions thus far have been dominated by small businesses. Retired veterans and aviation professionals, hobbyists, and boutique photographers have latched on to this proliferating technology to create new revenue streams, even though the process currently requires at least a private, recreational or sport pilot's license to operate. These licenses mandate a minimum of 20-40 general aviation flight hours and cost thousands of dollars.

Among the first 500 exemptions, 196 had business data listed with Hoovers. Of those, 158 are small businesses or sole proprietors, which make up over 80 percent of the businesses listed. Companies with missing data are likely small or new businesses as well. Assuming this, small businesses make up over 92 percent of the approved operators so far.

Large corporations receiving early exemptions include Chevron USA, Dow Chemical Co., the U.S. Automobile Association and Amazon.com.

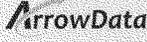
Other large companies have taken another route to the skies. A coalition of 15 news media companies have partnered with the Virginia UAS test site, including The New York Times, Gannet and NBCUniversal. CNN has also formed a partnership with the FAA to begin testing in congested areas under the FAA's Pathfinder Program.

Operations in public areas over people are essential to covering the news. UAS provide a quick and easy way to obtain valuable aerial footage to improve public awareness of emergency situations and current events. These can augment low-level news helicopter coverage and enable a safe, low-cost way to inform the public and first responders. As more and more commercial UAS operations take to the air, their consistency and track record of safe operations will provide a compelling case to begin wider testing in congested areas.

Because of the current regulatory limitations, newsgathering operations were mentioned only nine times in the first 500 exemptions, all of which accompanied other, more accessible applications. This valuable industry will remain grounded until regulations allow for operations over people, which will begin to open the door for coverage of news, emergencies, public events and sports.

### NEWSGATHERING SPOTLIGHT

<b>Newsgathering Platform Stats</b>
Avg. weight: 4.99 pounds
Avg. endurance: 18.13 min.
4 rotary wing
0 fixed wing
<b>Most Common Platforms</b>
1. DJI Inspire 1 – 5 referenced
2. DJI Phantom 2 – 2 referenced



ArrowData Courtesy: ArrowData

ArrowData is an innovative aerospace and data services company headquartered in Las Vegas, that specializes in persistent data collection, transmission, analytics and distribution services. It was the first company to receive a Section 333 exemption for newsgathering and the only company among the first 500 to focus solely on these operations.

ArrowData recently flew a CineStar 8 HL unmanned aircraft for ABC7 (KGO) in San Francisco on July 9, 2015, and both ArrowData and the TV station cannot be happier with the combined effort. The company integrated live unmanned aerial vehicle shots with numerous "lives" throughout the evening newscast.

"We provided live shots of the demolition of historic Candlestick Park that is being transformed into a housing and office space development called Candlestick Point," says ArrowData. "This was the first time a newscast in the Bay Area had used live UAV video to supplement its newscast. We also took numerous weather shots live from the UAV. KGO developed a specific website for this effort allowing viewers to see the video from our aircraft at all times during the broadcast."

"This debut of 'aerjournalism' was weeks in the making. After receiving a Section 333 exemption, we worked extensively with local authorities from the FAA in the Bay Area to ensure safe operations. We keep in regular contact with the FAA so they are familiar and comfortable with our operations."

It is clear to us that TV news organizations want to use UAVs to cover TV news. They are more economical than helicopters and in many cases can provide better video. We are hopeful that as we continue to prove safe operations to the FAA, regulations will be relaxed involving flying over people and near airports. This will make using UAVs more effective when covering breaking news.

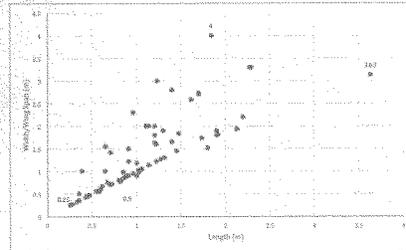
The 196 companies with available business data accrued 2014 sales of approximately \$480 billion. As potential applications for commercial UAS continue to grow, the technology stands to quickly impact companies that contribute a significant percentage of the U.S. gross domestic product.

However, operators are not the only ones being affected by the UAS industry. Manufacturers small and large are embracing the newest wave in aviation and creating platforms, software data analytics tools, and other technologies for unmanned aircraft systems.

### THE PLATFORMS

So how about the platforms themselves? We've already covered some industry specific analysis of the platforms referenced in the first 500 exemptions, but what are the broader characteristics of commercial UAS?

#### HOW BIG ARE THE PLATFORMS?

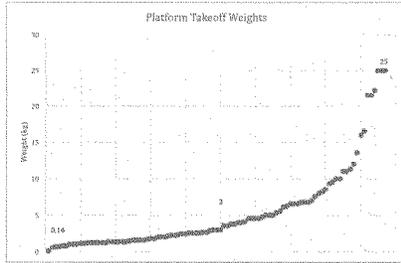


The smallest length and width noted for approved platforms was 0.82 feet with three feet as the median dimension. The Yamaha RMAX has the longest length at 11.9 feet, while the AeroLogix Consulting GeoStar has the largest wingspan at 13.1 feet.

The majority of the systems flying are small, sub-three-foot systems; however, some larger systems have taken to the air as well. The RMAX will be used for precision agriculture applications, and the GeoStar will support agriculture, construction, environmental and emergency management applications.

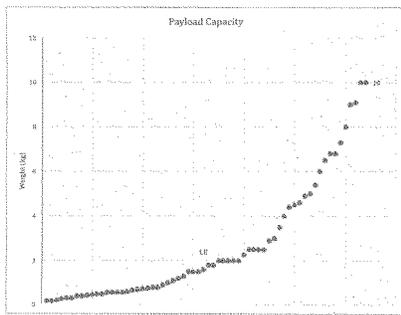
#### HOW MUCH DO THE PLATFORMS WEIGH, AND HOW LARGE OF A PAYLOAD CAN THEY CARRY?

The HyperLite Black Ops 275 from Thrust-UAV was the lightest UAS at 0.3 pounds, and the RMAX was by far the heaviest platform at 207 pounds. The median takeoff weight among all platforms was 6.6 pounds, somewhat skewed by the numerous cases of lightweight, consumer platforms. Greater than 50 percent of the platforms noted fall into the micro UAS category at less than 4.4 pounds. Weight figures largely reflect maximum gross takeoff weight, which includes the weight of the airframe plus the maximum payload capacity.



These numbers once again portray the infancy of the commercial UAS industry and reflect the simple operational profiles currently approved. In order to support domestic innovation from UAS manufacturers and a wealth of different business operations, expeditious rulemaking will be essential.

The median payload capacity for approved systems is four pounds. Data not displayed on the graph includes the Reigel RICOPTER with a payload capacity of 35 pounds and the Yamaha RMAX with a payload capacity of 62 pounds.

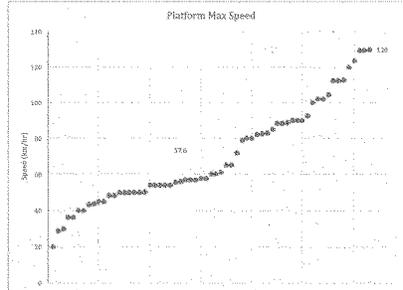


A four-pound payload capacity is sufficient for capturing aerial imagery from cameras such as the GoPro or other lightweight consumer and prosumer cameras. However, this number should increase as operators use more advanced imaging devices such as lidar or multispectral photography to support inspection and agriculture applications and for high-end videography where cameras for film, television and news media often greatly exceed this median figure.

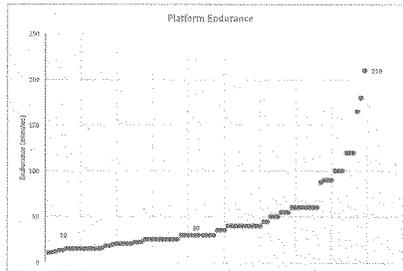
Spraying applications for precision agriculture or in cases where an unmanned cargo helicopter delivers water or fire suppressant to wildfires will require even higher payloads. The Lockheed Martin unmanned K-Max helicopter can lift over 6,000 pounds and has transported millions of pounds of cargo in support of military operations to date.

**HOW FAST CAN THEY FLY?**

The Aeromapper EV2 from Aeromao tops the charts with a maximum speed of 81 mph. The median maximum speed for all platforms was 35.8



mph. These fall well under the 100 mph speed limit outlined in the FAA's proposed rules. Although the proposed rules may not be as permissive as they could be in some cases, the guidelines do generally encompass the range of commercial operations thus far. A swiftly finalized rule will be an essential step in enabling this transformative industry.



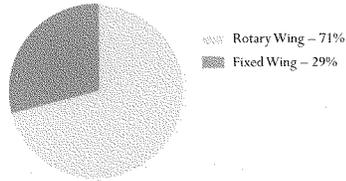
**HOW LONG CAN THEY FLY?**

The Bumblebee-S from Shenzhen Shengtian Model Co. has the lowest endurance of approved platforms at 10 minutes and has been approved to support real estate, search-and-rescue, agriculture, construction, and other aerial inspection applications. The median endurance for all platforms is 30 minutes. The MLB Co. Super Bat can fly for 10 hours and span a distance of 400 miles. The Penguin B and C models from UAV Factory have a 20-hour endurance with a top speed of about 80 mph and will support agriculture, oil and gas, and environmental applications.

The capability for long-endurance times has been firmly established in platform innovation. Aurora Flight Science's Orion UAS flew for 80 hours last December. However, many of the simple operational profiles currently approved do not require such robust specifications and contribute to the low average endurance.

Battery power is a key technological weakness, with most platforms capable of only around 30 minutes of flight. As the majority of approved platforms are electric multicopters, this explains the low endurance data across the board despite the few long-endurance systems approved.

WHAT TYPES OF PLATFORMS ARE BEING USED?



ROTARY-WING TYPE	% OF PLATFORMS
4-Rotor (Quadcopter)	50%
8-Rotor (Octocopter)	25%
6-Rotor (Hexacopter)	14%
Helicopter	9%
12-Rotor	3%

LAUNCH TYPE	% OF PLATFORMS
VTOL	71%
Hand Launch	18%
Launcher	13%

RECOVERY TYPE	% OF PLATFORMS
VTOL	71%
Skid/Belly	23%
Parachute	10%
Runway Required	2%

PROPULSION TYPE	% OF PLATFORMS
Electric Motor	96%
Combustion Engine	5%

(Values in charts may total >100% because some platforms have multiple launch/recovery methods.)

The majority of platforms referenced in the exemptions are rotary wing, at just over 70 percent. Among these, 50 percent are quadcopters followed by 25 percent octocopters. Less than 30 percent of the aircraft referenced had fixed-wing designs, nearly 70 percent of which come from agriculture use cases. Large plots of land require the endurance advantage carried by fixed-wing designs. Fixed-wing platforms may become more prevalent once beyond-line-of-sight operations unlock greater potential for agricultural applications, utility inspections and others. Now, with the line-of-sight requirement, there is little need for platforms that fly for farther and longer, exceeding this basic capability.

Over 95 percent of referenced platforms rely on electric propulsion, which improves safety, especially in cases where legacy tools require flammable fuel. For the simple operational profiles currently approved, the increased weight and endurance using a combustion engine can be limiting in other ways including decreasing efficiency, increasing operational complexity, and contributing to environmental and safety concerns. In the future, UAS innovation will drive forward novel solutions to the energy problem, including developments and integration with fuel cells, solar panels and even aerial recharging technologies.

TAKEAWAYS

The rate of UAS operators is finally growing after years of awaiting rules and a pathway to the airspace, and the initial data show great promise for the future of the industry. Prior to this year, data on commercial UAS operations in the U.S. were nonexistent. Now, we have been able to take a look at early trends regarding safe commercial operations and can establish a basis for recommendations for future growth.

It is clear in the data that, even though many industries have started to benefit from UAS operations, beyond-line-of-sight operations, operations over congested areas, and nighttime operations will be critical to achieving the full societal and economic benefits of UAS use. To achieve this, a risk-based, technology-neutral regulatory framework will be essential to getting this industry off the ground.

The data have shown favor toward simple, low-risk operations currently; however, more can and should be done to facilitate expanded operations that pose no threat to the National Airspace System, especially in rural areas under 500 feet.

The industry is primarily being held back by the continuous rulemaking delays that make it difficult to innovate without standards and other parameters. We strongly advocate for swift rulemaking to take effect, not only to accelerate the safe commercial use of UAS and its benefits, but also facilitate a larger data set to base future development on.

The six FAA-designated UAS test sites can help provide better access for industry testing, especially for these expanded use cases in places such as North Dakota where the FAA has issued a blanket certificate of authorization for test site operations covering over two-thirds of the state.

To facilitate this, in the upcoming FAA reauthorization, Congress should consider making the test sites eligible for federal funding under current FAA offices and programs that are engaged with UAS activities in order to help them perform the valuable research needed for integration. 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.

Technological barriers to full-scale integration will be challenging to conquer as well with such a limited data set. Government and industry must develop a comprehensive research plan to gather data on expanded use cases and establish recommendations and deadlines to achieve important research milestones. This includes an emphasis on developing a UAS traffic management system and coordinating UAS integration efforts with NextGen.

UAS integration should be a national priority, as delays and piecemeal solutions are greatly hindering the economic potential and societal benefits of the U.S. commercial UAS industry. Many other countries, including Canada, France, Australia and the U.K., have had UAS rules in place for years, enabling industry there to progress, in some cases even with beyond-line-of-sight operations. The U.S. UAS industry is poised to be the leader in this field, as is shown by the rapidly increasing interest and innovation domestically. However, high-level leadership and coordination with industry and government partners is absolutely critical to ensure the United States regains trailblazer status in this global industry.

## RESEARCH METHODOLOGY

The UAS industry is in its infancy and has barely begun to take to the air. These Section 333 exemptions are only a small sample size and may not perfectly reflect the industry once finalized rules are put into place, but this report will provide the most accurate snapshot of the budding U.S. commercial UAS industry currently possible.

This report features spotlights from six key industries with a clear stake in the future of the UAS industry and which, to varying degrees, are already taking advantage of the so-far limited opportunities available through the exemption process.

These industries — real estate, agriculture, construction, film and television, oil and gas, and newsgathering — will all benefit greatly from developing established UAS operations and have unique concerns and requirements moving forward.

For example, operations over congested areas will be essential to newsgathering operations, whereas for precision agriculture surveys over a large farm, there is very little need to fly over anyone not involved in the operation, but a great need to fly beyond line of sight.

There is also much more data that can be drawn from the exemptions than can be summed up in this report. We will continue to track the exemptions for a more thorough report after we reach 1,000 commercial operators.

### INDUSTRY/TYPE OF OPERATION

The nature of the language in each exemption is vague and leaves open to interpretation the industry or operation each entity will support. For instance, a petition may request "aerial acquisitions and research" or "aerial acquisitions within the National Airspace System." This phrasing can cover most operations currently conceived with UAS and does not give a precise account of the type of operation that will be supported.

Some petitions take up to half a page to list all of the potential uses, with the phrasing, "including but not limited to," similarly obscuring the actual operations that will take place. Reasons stated for doing so by the petitioners are to take advantage of servicing multiple markets that require similar operational profiles and to cover commercial work for any new market opportunities that may arise.

This analysis only takes into account key operations that are either 1) explicitly cited in the petition or 2) a main service provided by a company with vague petition language. We have also grouped general photography services, such as event photography or more ambiguous photography/videography applications, into the category "Aerial Photography." The areas of "Aerial Surveying" and "Aerial Inspection" follow suit for general survey and inspection operations that are not explicitly described. A distinction between survey and inspection applications is defined by the scope of the operation. Whereas survey involves large scope aerial data collection, inspection relies on more nuanced aerial data.

The "Environmental" category includes activities supporting forestry, geological mapping and studies, land management and planning, and even mosquito control, among others. "Emergency Management" covers all first responder or disaster relief activities that are not specifically "Search and Rescue."

Three outlier industries supported by commercial UAS approvals — including risk management specified by a risk management firm, paving specified by a paving company and mill operations specified by a mill — could not fit into a broader category. This does not mean, for instance, that many of the

approved operators will not use UAS for risk management practices; however, it would be for the support of a specific industry.

### PLATFORMS

The platform data used in this report were taken from AUVSI's Unmanned Systems and Robotics Database, which is the world's largest database of air, ground and maritime unmanned platforms.

The data collected on platforms referenced in the first 500 Section 333 approvals include 112 platforms with publicly available specifications. These 112 platforms total 681 approved uses in the first 500 approvals. Twenty-three proprietary designs, which are largely referenced only once in the approvals, have not been included in this analysis. These include platforms such as Amazon's proprietary multirotor sUAS, where public specifications are not available. The platform data only include those platforms referenced in the exemptions, not necessarily those that are currently registered and operational.

A note should be made that many of the data, especially regarding system endurance, are manufacturers' figures for ideal conditions and do not accurately reflect practical operations where factors such as payload and wind conditions could greatly diminish actual endurance times.

For industry-specific analysis, remember that as many petitions may include more than one industry and more than one platform, there is no precise way to measure which of these platforms might be used for which industry application.

There are also a few cases where certain data are not available for a system. For example, a manufacturer might leave out endurance or weight information from its specifications in cases where the data downplay the features of the system, where lightweight platforms are made for larger payloads or where the information could not be easily assessed, such as for maximum altitude.

### DEFINITIONS

**Small Unmanned Aircraft System (sUAS)** — An aircraft with no pilot on board that weighs up to 55 pounds.

**Operational Profile** — The parameters involved with support of a specific operation, including altitude, range, duration and location.

**Risk based, technology neutral** — A risk-based, technology-neutral framework means that regulations would be based on the risk profile of a particular UAS operation instead the platform being flown. This flexible framework will accommodate innovations rather than require new rules each time a new technology emerges.

**Fixed wing** — A vehicle capable of flight using wings that generate lift caused by the vehicle's forward airspeed, like commercial airliners.

**Rotary wing** — A flying machine that uses lift generated by blades that revolve around a mast, like a helicopter.

**Line of sight** — A requirement for unmanned aircraft to be flown within view of the operator.

**Beyond line of sight** — An operational parameter where an unmanned aircraft can fly beyond the operator's view.

**National Airspace System (NAS)** — The airspace, navigation facilities and airports of the U.S. including associated information, rules, services, policies, procedures, personnel and equipment.

**Hoovers** — A research firm with a database of more than 85 million companies.

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**CONTRIBUTORS**

**Writer and Researcher:** Scott Kesselman

**Lead Researcher:** David Klein

**Editors:** Danielle Lucey and Brett Davis

**Graphics:** Kellie Sigler and Victoria Bottlick

**Other contributions:** Chloe Svolos and Joseph Amato

**Special thanks to:**

ArrowData

The Associated General Contractors of America

Increasing Human Potential

*Mission Critical* magazine

The National Association of Realtors

*Unmanned Systems* magazine

**Cover Photo:** ©iStock.com/Corr

FOR MORE INFORMATION ON APPLYING FOR A SECTION 333 EXEMPTION,  
OR A CERTIFICATE OF AUTHORIZATION TO FLY, VISIT [WWW.AUVTI.ORG](http://WWW.AUVTI.ORG).

STEVE CHABOT, OHIO  
CHAIRMAN

NYDIA M. VELAZQUEZ, NEW YORK  
RANKING MEMBER

Congress of the United States  
U.S. House of Representatives  
Committee on Small Business  
2501 Rayburn House Office Building  
Washington, DC 20515-0515

July 30, 2015

Mr. Mike Gilkey  
CEO and Director of Flight Operations  
3D Aerial Solutions LLC  
4725 Constitutional Court  
Dayton, OH 45440

Dear Mr. Gilkey:

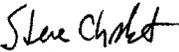
In order to have a complete record for the hearing titled, *Taking Flight: Small Business Utilization of Unmanned Aircraft* held on July 15, 2015, the following question is being submitted for your response.

The FAA is considering subdividing its proposed rule on small unmanned aircraft systems, or UAS, to more lightly regulate micro UAS, which the FAA proposes to define as those that weigh less than 4.4 pounds. Do you think the FAA should further subdivide its regulation of small UAS and impose different operating restrictions based on size, weight, and the operating environment? For example, should a small unmanned aircraft being flown in a rural area be treated differently from one operating in an urban setting?

Please provide your response to the question by August 26, 2015 to the attention of the Committee's clerk, Susan Marshall, at [susan.marshall@mail.house.gov](mailto:susan.marshall@mail.house.gov) for inclusion in the hearing record.

Thank you for your participation in the hearing and your timely reply.

Sincerely,

  
Steve Chabot  
Chairman

## **3D AERIAL**

3D Aerial Solutions, LLC  
4725 Constitutional Court  
Dayton, OH 45440

August 26, 2015

Congress of the United States  
U.S. House of Representatives  
Committee on Small Business  
2361 Rayburn House Office Building  
Washington, D.C. 20515-6315

Subject: Response to question from *Taking Flight: Small Business Utilization of Unmanned Aircraft*, held July 15, 2015

Dear Chairman Chabot, Ranking Member Velazquez and Members of the House Small Business Committee:

In an email message dated July 30, 2015, I was posed this follow up question.

The FAA is considering subdividing its proposed rule on small unmanned aircraft systems, or UAS, to more lightly regulate micro UAS, which the FAA proposes as those that weigh less than 4.4 pounds. Do you think the FAA should further subdivide its regulation of small UAS and impose different operating restrictions based on size, weight and the operating environment? For example, should a small unmanned aircraft being flown in a rural area be treated differently from one operating in an urban setting?

The following is my response.

The Department of Transportation, Federal Aviation Administration issued a Proposed Rule on Operation and Certification of Small Unmanned Aircraft Systems on February 15, 2015 (Federal Register, Vol. 80, No. 35). Section III D. 1 states that consideration is being given to defining a Micro UAS sub-classification, based in part upon similar rules successfully implemented in other countries.

The FAA has a long tradition of applying risk based analysis to aviation rules and consideration of a Micro UAS sub-classification with less restrictions is consistent with this approach. The fact that the FAA raises this issue in the first place demonstrates recognition that there is reduced risk to general aviation and the general public for this class of aircraft, which makes good sense.

### 3D AERIAL

3D Aerial Solutions currently has a Section 333 Exemption and Blanket Certificate Of Authorization to operate the senseFly eBee fixed wing aircraft weighs approximately 1.5 pounds and would qualify as a Micro UAS based on the 4.4 pounds definition. We are safely providing commercial flight operations today for customers under these interim rules and feel our ability to take advantage of the Micro UAS rule would provide significant economic advantages to our business.

Many of the proposed Micro UAS provisions represent a helpful relaxation of the Small UAS rules commensurate with the reduced flight risk of these smaller aircraft. Others are less helpful, but acceptable. Advantages would be realized in reduced time and costs for training and operations. However five provisions, as proposed, will significantly limit or possibly eliminate entirely the utility of this sub-classification. My comments are based specifically on our work with the eBee in remote sensing for agriculture, but I am confident my comments apply negatively to many other Micro UAS applications as well. Figure 1 below is a reproduction of a comparison of the Micro UAS Sub-Classification rule taken from the Small UAS NPRM.

COMPARISON OF CANADIAN RULES GOVERNING MICRO UAS CLASS WITH PROVISIONS OF PROPOSED PART 107 AND MICRO UAS SUB-CLASSIFICATION			
Provision	Canada	Small UAS NPRM	Micro UAS Sub-classification
Definition of Small UAS	Up to 4.4 lbs (2 kg)	Up to 55 lbs (24 kg)	Up to 4.4 lbs (2 kg)
Maximum Altitude Above Ground	300 feet	500 feet	400 feet
Airspace Limitations	Only within Class G airspace	Allowed within Class E in areas not designated for an airport. Otherwise, need ATC permission. Allowed within Class B, C and D with ATC permission. Allowed in Class G with no ATC permission.	Only within Class G airspace
Distance from people and structures	100 feet laterally from any building, structure, vehicle, vessel or animal not associated with the operation and 100 feet from any person	Simply prohibits UAS operations over any person not involved in the operations (unless under a covered structure)	Flying over any persons permitted
Ability to extend operational area	No	Yes, from a waterborne vehicle	No
Autonomous operations	No	Yes	No
Aeronautical knowledge required	Yes, ground school	Yes, applicant would take knowledge test	Yes, applicant would self-certify
First person view permitted	No	Yes, provided operator is visually capable of seeing the small UAS	No
Operator training required	Yes, ground school	No	No
Visual observer training required	Yes	No	No
Operator certificate required	No	Yes (must pass basic UAS aeronautical test)	Yes (no knowledge test required)
Preflight safety assessment	Yes	Yes	Yes
Operate within 5 miles of an airport	No	Yes	No
Operate in a congested area	No	Yes	Yes
Liability insurance	Yes, \$100,000 CAN	No	No
Daylight operations only	Yes	Yes	Yes
Aircraft must be made out of frangible materials	No	No	Yes

Figure 1: Rules Comparison from the Small UAS NPRM

Specific provisions that would negatively impact the ability of 3D Aerial (and similar small businesses) to utilize the Micro UAS sub-classification:

- **Airspace limitations: Class G only.** There are many small (0.5-1.0 nautical mile working radius) areas within controlled airspace (Class B, C D or E) in which small UAS could be operated safely under mutual agreements

### 3D AERIAL

arranged between the airport manager and the UAS operator. Airport managers are well aware their airport environment and well informed of the concerns of the pilots who use it. These concerns could be directly and effectively addressed in such an agreement. The Micro UAS provision should be the same as the Small UAS NPRM for airspace limitations.

- **Autonomous operation: No.** Autonomous flight of Micro UAS can deliver safer, more reliable and more repeatable flight operation by 1) reducing pilot workload and 2) reducing pilot induced errors. Furthermore, there is no downside to using autonomous operation, as it can be turned off at any time.
  - Autonomous UAS operation takes care of the continuous, manual flight control activity, which consumes a significant portion of an operator's attention during a flight. This attention is shared between a) aircraft flight control activity and b) monitoring aircraft status, flight hazards and anticipating contingency actions. Autonomous operation eliminates or reduces the continuous command and control tasking and frees up time to devote to monitoring flight hazards. The more time devoted to monitoring flight hazards and contingency planning, the safer the flight will be.
  - A long history of military and civilian aviation research shows clearly that under heavy workload conditions, pilots make more mistakes, which can result in mishaps. Reduction in workload helps mitigate this risk.
  - Autonomous control technology for UAS is highly advanced and very reliable. Autonomous control is 3D Aerial's primary operating mode for all UAS flights. Even so, autonomous flight can be easily and quickly interrupted at any time. Our senseFly eBee Micro UAS features many built-in control mechanisms to pause or stop the mission in progress, take evasive action, and perform emergency landings. Should the flight hazard pass, the mission can be resumed from where it was in process. Should it become necessary, the operator can even switch to manual control at any time.
- It makes no sense to deny this capability simply because the UAS is below 4.4 pounds. The Micro UAS provision should be the same as the Small UAS NPRM for autonomous operation.
- **Operate within 5 miles of an airport: No.** Airports are located in all classes of airspace. This provision is a further restriction of the Class G airspace only limitation discussed above. For the same reason as stated above, Micro UAS operators should be afforded the opportunity to gain permission to operate within 5 miles of an airport, regardless of the designated airspace class. Should a Micro UAS operator not be able to agreement with the airport operator, then no permission to fly the UAS should be granted. However, decisions against such agreements must be consistently applied and based on sound logic, and not unfounded public sentiment or local politics. The Micro

## 3D AERIAL

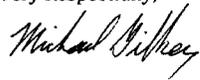
UAS provision should be the same as the Small UAS NPRM for airport proximity.

Additional Micro UAS provisions provided in the text that are of concern are as follows:

- **Maximum airspeed: 30 knots.** 3D Aerial's eBee aircraft is a fixed wing aircraft with a nominal cruise speed of 21-49 knots that is safe to fly in winds up to 23 knots. Fixed wing aircraft rely on adequate airspeed to create lift to sustain flight. There is no way 3D Aerial can reliably control the eBee to within a 30 knots limit. This is an unrealistic limit and will be a problem for many fixed wing Micro UAS aircraft. The Micro UAS provision should employ a 50 knots or higher airspeed limit to adequately satisfy the operating characteristics of fixed wing Micro UAS, keeping in mind that the aircraft are no more than 4.4 pounds and frangible.
- **Maximum operating distance from operator: 1500 feet.** For this provision to be practical, aircraft control must be located in the center of the flight envelope in order to minimize the distance to the aircraft. 3D Aerial provides aerial imaging services of farm crops at various times throughout the growing season. These flights must be launched and operated from one side of what can be a very large crop field. We operate at times at distances of 2500-3000 feet, and still maintain visual line of sight to the aircraft. The Micro UAS provision should allow the slant range from operator to aircraft to be at least 3000 feet.

This concludes my response to the above question. My comments addressed the specific Micro UAS provisions published in the Small UAS NPRM. It is my genuine hope that that additional flexibility is built into the final Micro UAS provisions in order for 3D Aerial to capitalize on its economic benefits due to relaxed training and operating requirements. Thank you for the unique opportunity to participate in the subject hearing and express my thoughts on this important question. I sincerely hope my response is helpful and I would be happy to clarify any of the points I have made here.

Very Respectfully,



Michael Gilkey  
CEO and Director of Flight Operations  
3D Aerial Solutions, LLC

STEVE CHABOT, OHIO  
CHAIRMAN

NYDIA M. VELAZQUEZ, NEW YORK  
RANKING MEMBER

**Congress of the United States**  
**U.S. House of Representatives**  
**Committee on Small Business**  
2501 Rayburn House Office Building  
Washington, DC 20515-0515  
July 30, 2015

Mr. Brian Stroom  
CEO/Cofounder  
AeroCine  
220 36th Street  
Suite 506A  
Brooklyn, NY 11232

Dear Mr. Stroom:

In order to have a complete record for the hearing titled, *Taking Flight: Small Business Utilization of Unmanned Aircraft* held on July 15, 2015, the following questions are being submitted for your response.

**Chairman Chabot**

The FAA is considering subdividing its proposed rule on small unmanned aircraft systems, or UAS, to more lightly regulate micro UAS, which the FAA proposes to define as those that weigh less than 4.4 pounds. Do you think the FAA should further subdivide its regulation of small UAS and impose different operating restrictions based on size, weight, and the operating environment? For example, should a small unmanned aircraft being flown in a rural area be treated differently from one operating in an urban setting?

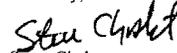
**Congressman Carlos Curbelo (FL-26)**

We hear often from local news providers on the difficulty in making a visual report on some events that would be enhanced with an aerial perspective, such as forest fires, conditions in the Everglades, or traffic patterns throughout densely populated South Florida. In light of First Amendment interests in giving the public improved news coverage, could you share your thoughts on the new regulations as they apply to "news-gathering"? Wouldn't it be much more cost-effective for news stations to use drones to gather traffic reports, as opposed to say, helicopters?

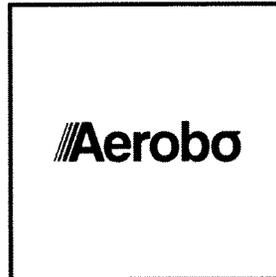
Please provide your responses to all questions by August 26, 2015 to the attention of the Committee's clerk, Susan Marshall, at [susan\\_marshall@mail.house.gov](mailto:susan_marshall@mail.house.gov) for inclusion in the hearing record. In addition, please send the response to Congressman Curbelo's question to his legislative assistant, Hector Arguello, at [hector.arguello@mail.house.gov](mailto:hector.arguello@mail.house.gov).

Thank you for your participation in the hearing and your timely reply.

Sincerely,

  
Steve Chabot  
Chairman

9/14/15



Dear Chairman Chabot,

Subdividing UAS into a more lightly regulated micro UAS category makes both scientific and common sense. The FAA's goal with their UAS rule is to preserve and protect life and property in the air and on the ground; in the event of a mishap, a micro UAS carries less kinetic energy and less potential energy than a larger system. In other words, a 4.4 pound system should not be regulated the same way a 55 pound system is.

Dear Congressman Curbelo,

There are innumerable uses for UAS in newsgathering on a local, national and international scale. The American public is absolutely entitled to the best news coverage that can be offered and drones offer an improvement over current technology. Drones represent one of the greatest advances in journalism since the advent of the printing press. Not only are drones more cost effective than news helicopters but they also increase the margin of safety by removing the need for a pilot and camera operator to be airborne.

Sincerely,

A handwritten signature in black ink, appearing to read "Brian N Stroom".

Brian N Stroom  
CEO, Aerobo (f/k/a AeroCine)

Aerobo  
220 36<sup>th</sup> St.  
Suite 506A  
Brooklyn NY 11232

**Motion Picture Association of America**  
**Statement for the Record in the House Committee on Small**  
**Business Hearing**  
**“Taking Flight: Small Business Utilization of Unmanned Aircraft”**

July 16, 2015

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 among the first approved commercial applications 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 last fall, 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 earlier this 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 Chabot and Ranking Member Velazquez and the other members of the Committee for their attention to this matter. 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.



Chris Polychron, CIPS, CRS, GRI  
2015 President

Dale A. Stinton  
Chief Executive Officer

**GOVERNMENT AFFAIRS  
DIVISION**

Jerry Giovaniello, Senior Vice President  
Gary Weaver, Vice President  
Joe Ventzone, Vice President  
Scott Reiter, Vice President  
Jamie Gregory, Deputy Chief Lobbyist

500 New Jersey Ave., NW  
Washington, DC 20001-2020  
Ph. 202-383-1194 Fax 202-383-7580  
www.REALTORS.org

July 14, 2015

The Honorable Steve Chabot  
Chairman  
U.S. House of Representatives  
Small Business Committee  
2371 Rayburn House Office Building  
Washington, D.C. 20515

The Honorable Nydia M. Velázquez  
Ranking Member  
U.S. House of Representatives  
Small Business Committee  
2302 Rayburn House Office Building  
Washington, D.C. 20515

Dear Chairman Chabot and Ranking Member Velázquez:

On behalf of the over 1 million members of the National Association of REALTORS® (NAR), thank you for holding this hearing, "Taking Flight: Small Business Utilization of Unmanned Aircraft." NAR has always had a close relationship with the small business community since REALTORS® are small business owners, or have them as their clients. Additionally, REALTORS® have demonstrated a strong interest in using unmanned aerial systems (UAS) for marketing properties, which for many will mean contracting with a small business that specializes in UAS photography and videography. NAR supports the FAA's proposed regulations for the commercial use of UAS, as they will allow for safe use of the technology by the real estate industry.

REALTORS® are excited about the potential to use UAS technology to take photographs and video footage of property listings for residential, commercial, and land sales or leases. In fact, a REALTOR® from Arizona was one of the first people to successfully apply for and receive a "Section 333" waiver, currently the only avenue available to fly a UAS for commercial purposes. NAR was thus pleased when the FAA released its proposed rulemaking on integrating small UAS for commercial use into the National Air Space (NAS) in February 2015. This is the first step toward a regulatory environment where commercial drone use is legal and has prescribed federal guidelines.

Commercial use of UAS has the potential to boost the U.S. economy, bringing research and manufacturing jobs to our country along with a new crop of small businesses specializing in their uses. NAR is excited about these possibilities, but also understands the need to balance them with protecting the privacy and safety of citizens and other users of the NAS. As end-users of this technology, REALTORS® want clear regulation that permits the commercial application of UAS in a way that is affordable to users and safe for their communities, both on the ground and in the NAS. The FAA's most recent proposed rules are a start, and are an improvement over the current regulatory scheme, but they are not expected to be finalized until 2017.

Again, thank you for holding this hearing. NAR looks forward to working with Congress and the FAA to create a safe and reasonable regulatory environment for the commercial use of UAS.

Sincerely,

Chris Polychron  
2015 President, National Association of REALTORS®

cc: U.S. House of Representatives Small Business Committee



REALTOR® is a registered collective membership mark which may be used only by real estate professionals who are members of the NATIONAL ASSOCIATION OF REALTORS® and subscribe to its strict Code of Ethics.