



THE FUTURE OF POSSIBLE

PREPARED STATEMENT

for the

UNITED STATES SENATE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

HEARING ON:

UNMANNED AIRCRAFT SYSTEMS:
INNOVATION, INTEGRATION, SUCCESSSES, AND CHALLENGES

March 15, 2017

Brendan Schulman

Vice President of Policy & Legal Affairs, DJI Technology, Inc.



Thank you, Chairman Thune, Ranking Member Nelson, and members of the Committee. I am Brendan Schulman, Vice President of Policy & Legal Affairs for DJI Technology, Inc. (“DJI”). I applaud the Committee for holding this hearing at this important time in the development of drone technology and for your interest in making sure the United States provides the right atmosphere to let our industry grow and thrive while at the same time protecting safety. We are in the somewhat unique position of being an early-stage technology industry that craves *more* regulation. But it has to be the right kind of regulation. Balanced regulatory policies that set clear, common-sense expectations for commercial, governmental, and recreational operators will help unlock the vast potential and nearly limitless benefits of unmanned aircraft systems. Countries that adopt these kinds of regulatory policies will have a distinct advantage as centers of innovation in this rapidly-evolving global industry, while those that adopt inflexible or reactionary policies will stifle progress and cause innovators to flee. I am pleased to have the opportunity to share my views, on behalf of DJI, on what “getting it right” looks like.

DJI: The Technology Behind the Current Drone Revolution

DJI is the leading manufacturer of small unmanned aircraft systems in use in the world today, and employs over 150 people across six offices in the United States. We have been proud to partner with American companies as diverse as Ford Motor Company, Microsoft, Velodyne, and Bentley Systems to develop the next generation of drone technology and applications. Although drones have become widely popular in the past two or three years, our company is actually ten years old, and has spent that decade developing and perfecting the underlying technologies. By some analyst estimates, our products are the choice of over 70 percent of commercial drone operators, and a similar fraction of personal drone operators. This gives us a privileged position to hear about the multitude of ways in which the user community is already putting drones to work, and to gauge their needs for the commercial, enterprise, and institutional drone operations of tomorrow. Our scale also places us in a unique position to be able to implement safety features and provide guidance to the vast majority of personal drone operators.

Safety is our highest priority. We are the market leader not just because our technology is smart and easy to use, but also because of our leadership in incorporating innovative safety features into our products and in our consumer and public safety efforts. We were the first manufacturer to incorporate GPS-based geofencing technology, which automatically prevents our drones from taking off within, or flying into, sensitive areas such as airports, nuclear power plants, and prisons. Our products include dozens of other safety features, such as automatic altitude limitation to prevent drones from flying too high, voice warnings, speed limitations, on-screen situational awareness information about flight altitude, distance, and speed, and a live map showing the drone’s location during flight. When the drone’s battery is running low, or if the radio control signal is lost, the drone automatically returns to the launch point and lands itself – it doesn’t just fall out of the sky. And we are continually developing new safety features. Our newest models, the Phantom 4, the Mavic Pro, and the Inspire 2, use computer-vision technology to automatically avoid collisions with obstacles during flight. Our latest enterprise drone, the Matrice 200, incorporates an ADS-B traffic information receiver to help the pilot maintain awareness of manned air traffic in the surrounding airspace.



Technology features are also enhanced by operator education. The overwhelming majority of drone operators want to follow the rules and operate safely. DJI and our fellow members in the Drone Manufacturers Alliance strongly believe that education offers an effective way to promote safety that can be responsive to emerging concerns – something that can't be said for rigid, prescriptive regulatory approaches. As part of our safety initiatives, DJI educates our users about operating drones safely, including through our on-screen safety information, our in-person New Pilot Experience courses, our video tutorials, our flight simulator built in to the drone, our beginner mode feature, and our in-box safety inserts from the FAA-endorsed “Know Before You Fly” campaign. We recently partnered with the venerable Academy of Model Aeronautics to launch [a joint program](#) to promote safe and responsible drone operations. We are also at work on a new feature to help ensure that our customers are aware of the rules of safe flight before they fly a drone, and hope to announce that initiative in the coming weeks.

Spontaneous Innovation, Fostered by Reasonable Regulation

You have almost certainly heard about the benefits that drones are beginning to bring to major industries like agriculture, construction, facility inspection, cinematography, and energy. And their contributions to public safety are unquestioned. For example, after Hurricane Matthew battered Florida last year and left 1.1 million people without power, Florida Power & Light [used DJI drones to inspect and repair power lines](#) safely and efficiently.

What also excites us are the many unique applications that have been developed when creative thinkers and entrepreneurs invent spontaneous new ways to use our technology. For example, scientists at the Ocean Alliance are using DJI drones to collect whale mucus. By [flying one of our drones](#) a safe distance above a whale, scientists can collect a biological specimen from the whale spray. This sample tells the scientist about the whale's gender, its health, whether it is pregnant, whether pollutants are present, and assists in understanding animal migratory patterns. This wonderful way of helping save the whales isn't practical with any other technology. A boat cannot easily get close enough, and a helicopter would stress and endanger the animal. Similarly, Florida International University is using small drones [to estimate shark population density](#). Other unexpected applications we have seen in the past few months include using a drone to paint high exterior walls (preventing ladder falls), and using drones to distribute antibiotic-infused food pellets to endangered ferrets to help them survive against disease.

Just like smartphones, drones are a platform for software development. Using our software developer's kit (SDK), inventors can design their own software applications (“apps”) for drones, which then offer specialized functions tailored for specific needs. In this way, our technology lays a foundation for future innovation by hundreds of other companies. Apps that have already been developed for our drones include automated mapping, cinematography, agriculture crop analysis, and drone fleet management. In partnership with startup DroneSAR, we are collaborating on development of a search and rescue app to coordinate the use of drones to help find missing people and provide ground crews with terrain information for a safer, faster, and more effective rescue. In South Florida, Project Ryp tide is using our SDK technology, machine learning, and thermal vision to help beach lifeguards spot and rescue people in the ocean and drop a life preserver that will automatically inflate.

Innovative applications like these can be facilitated by comprehensive regulations that maintain the safety of the airspace while presenting reasonable operational requirements. The FAA's part 107, implemented last August, is an excellent leap forward in this regard. Thanks to part 107, the United



States now leads the world with a comprehensible and complete set of commercial operational rules, and the FAA is to be commended for its hard work in reaching this outcome. However, more work remains. Many of our commercial users have told us that FAA approvals for part 107 flights in controlled airspace, even at very low altitudes, take weeks and these delays often cost them the very job they are applying for. Streamlining and eventually automating these approvals is one area for improvement in the part 107 system that would result in immediate economic benefits to commercial drone pilots and to the nation. In the interim, releasing guidance in the form of maps showing where approvals would actually be granted would go a long way to reducing the volume of requests and setting expectations about what commercial jobs being offered to part 107 pilots will and will not be approved. Additionally, restoring the option for local air traffic controllers to grant these approvals would alleviate the workload at FAA headquarters as well.

There is also continued need to define a lowest-risk category of drones for commercial operations subject to a simplified set of rules and requirements. It does not make sense to regulate a two-pound drone the same way as a 54-pound drone, as we currently do. Other countries, such as Australia, Canada, India and Mexico, have recognized that a so-called “micro” category opens more pathways to innovation, fosters a culture of compliance, reduces burdens on the regulatory agency, and incentivizes the industry to put the best features into the smallest – and therefore inherently safest – drones. A [research paper we recently released](#) examines and refines the approach selected by the FAA’s Registration Task Force and concludes that a lowest-risk UAS category ought to be defined at a weight threshold of two kilograms (4.4 pounds). Last year, this Committee sensibly proposed such a “micro UAS” category in its FAA reauthorization bill.

We welcome the next rulemaking milestones, which will allow routine operation of small UAS over people, at night, in controlled airspace, and eventually beyond visual line of sight. Ours is an industry in which smartly-constructed new regulations are good news, because they expand the range of permissible operations that might otherwise be restricted or only available via a time-consuming individual approval process. Research and rulemaking priorities should focus on rules that enable the broadest range of beneficial applications that can be achieved within today’s technological capabilities. For example, a rule for routine part 107 night operations would enable search and rescue operations during critical hours when time is of the essence. That’s just one example of an immediate benefit that can be realized through nothing more than rulemaking. Delays in the rulemaking process will have a negative economic impact, and curtail public safety operations, including those that save lives. DJI looks forward to continuing our collaboration with the FAA on key regulatory endeavors, just as we did when we served on the FAA’s UAS Registration Task Force, on its Aviation Rulemaking Committee for Flight Over People, and through our present membership on the Drone Advisory Committee.

Safety Features: Industry is Leading the Way

Safety features developed by industry are a key component for supporting safe operations by all drone pilots. But it is important to understand how those technologies are developed, how they are used, and their limitations before implementing any type of standard or legal mandate. Technology features involve making tradeoffs, and are often more complex than they might sound. There has been a lot of recent interest in geofencing, for example. DJI implemented geofencing in its drones in 2013, long



before there was a single news headline about drones spotted by airline pilots or flying near airports. We anticipated that technology could address concerns about drones flying where they don't belong.

The technology that enables this feature is straightforward. The drone has a GPS receiver just like a mobile telephone or a car navigation system. DJI pre-programs locations around the world that raise aviation safety or national security concerns, such as airports. When the drone senses that it is near those areas, the pilot gets a warning message. Closer in to a sensitive area, the flight of the drone is restricted and the drone will automatically override the pilot, stop, and hover without entering, or, if brought inside the zone on foot, the drone will not take off. Last year, with our airspace data provider partner AirMap, we upgraded our geofencing system to be live, so that FAA temporary flight restrictions (TFRs) and Department of the Interior wildfire notices are sent live to the drone pilot as a geofence, helping prevent unauthorized operations when airspace authorization conditions change.

We are certain that geofencing has already done a lot of good, and perhaps even prevented an accident, although that benefit will always be unknowable. Anecdotally, we have heard of situations where our software alerts people to airspace restrictions immediately prior to takeoff, thus preventing inadvertent operations in the wrong place. However, our long experience with this feature across hundreds of thousands of customers has also revealed something very important: geography alone is not a good indicator of authorization to fly. In places that might seem like good candidates for geofencing, drones are already being used in operations that enhance safety. For example, the Ventura County, California Department of Airports is using a small UAS to conduct facility inspection, assist with perimeter security, and monitor wildlife on the airport property at Camarillo and Oxnard airports, which are located in Class D controlled airspace. At first, our geofencing system prevented these airports from doing their work, and we had to work with the County to develop a workaround.

The notion that airports and drones never mix is an oversimplification. We have many customers doing important work at airports, enhancing the safety of the national airspace system. Similarly, our live geofencing system can help prevent drones from entering wildfire locations, but we also know that firefighters are using our drones to keep themselves safe and to help fight fires. Completely disabling a drone in such locations would result in a net detriment to public safety.

Here is the lesson we have learned that only comes with actual operational experience across hundreds of thousands of customers: while geofencing is a great feature that helps prevent inadvertent operations, it will always require a balanced approach involving exceptions. Requiring drones to simply turn off when they are near airports is not the right solution to safety concerns.

Additionally, locking in any specific technology mandate will discourage DJI and our colleagues in the industry from continuing to rapidly develop new safety technologies. A requirement to implement the best technology available today discourages manufacturers from developing the even better safety technologies of tomorrow. One reason that there are so many safety features available for today's drones is that manufacturers have the freedom to implement them, and to upgrade them as soon as a better version is ready. Many of our upgrades are actually software, which our customers can update for free even after their purchase.

We urge the Committee to preserve this flexibility and freedom to develop new safety innovations. The section of this Committee's 2016 FAA reauthorization bill concerning UAS "Safety Standards" proposed



to have the FAA and industry identify and consider UAS safety standards. Identifying and promoting safety standards is admirable, but the provision, Section 2124, went on to require FAA approval for each make and model of UAS prior to sale, a type of certification requirement that the FAA has already judged in its part 107 regulations to be unnecessary. Such a requirement would halt innovation in its tracks by preventing new products from being released without a lengthy and expensive FAA approval process that could take a year or more.

Last year's reauthorization bill also included a provision concerning remote identification standards. Developing a mechanism for remotely identifying the operator of certain UAS, as contemplated in Sections 2202 and 2124 of the bill, can provide accountability for violations of existing law, address societal anxieties, and provide a measure of security reassurance. However, it is important to recognize that drone pilots have privacy interests as well. Our commercial customers in the energy and agriculture sectors have competitive interests in not disclosing that they are using a drone to explore future wind farm locations, or to survey their latest seed crop. Other types of businesses are sensitive about what their patterns of drone usage might reveal about their business growth, profitability, or strategy. A teenager learning about drone technology in her backyard should not need to broadcast her identity to the public. An identification system akin to a car license plate, that provides identification information within the immediate area rather than tracking or recording all operations, strikes us as the best way to reconcile these concerns. As the largest manufacturer of small UAS, we look forward to playing a key role in the development of these and other technology-based solutions to policy challenges.

Personal Drone Use: A Key Pathway to Innovation

Of key importance to the future of innovation in our industry is maintaining a pathway for people to experiment with technology on a personal level. Today's hobbyist is tomorrow's inventor, and tomorrow's inventor is next year's technology industry pioneer. In 2012, Congress wisely recognized that recreational UAS operations should be subject to a simple and easy-to-understand set of rules that put safety first.

Remotely controlled aircraft operated for recreation have a long history of inspiring young people to become aviation pioneers. Burt Rutan, founder of innovative aerospace company Scaled Composites, was inspired by model aircraft as a youngster. John Kiker, an avid model aircraft hobbyist, was instrumental in conceiving and designing the iconic piggy-back space shuttle transport system that mated the NASA space shuttle to the back of a Boeing 747. Engineers doubted it could ever work but [model aircraft proved that it did](#). But personal drones today are not just about aeronautics. They are about robotics, programming, automation, problem-solving, and sensor technology – many of the skills that young people will need in their future careers. And they bring excitement among a new generation of pilots and dreamers. Internationally, the reigning champion in the exciting new world of drone racing is Luke Bannister, who is only 16 years old.

Drones are also a tool for creating visual art, in both photography and videography. There may be no better tool to encourage people of all backgrounds to become interested in robotic technology than by introducing them to a technology whose aspects are so broad, ranging from the thrill of remote flight to the satisfaction of computer programming, to the excitement of exploring new business opportunities, to the creativity of visual art that lasts far beyond the flight. We also should not overlook the long-term societal benefits of recreational activities. In an era with much free time spent behind glowing screens,



a technology that gets young people to spend time outdoors and to create their own art should be broadly welcomed. What does it tell us that 750,000 Americans have registered with the FAA as drone owners in a little over one year? It tells us that this is exciting technology that Americans want to use to create art, to experience the thrill of flight, to learn about robotics and technology, and to start and grow a business. This excitement and interest in technology is something to foster, not something to fear.

What we have also learned from our customers is that the same drone that is often used for hobby purposes on Saturday is used for work on Monday. As people become comfortable with the technology recreationally, they find ways to incorporate it into their business. Commercial and recreational drones are not two distinct products, segregated by use. Like computers, smartphones, and automobiles, they are tools used across a full spectrum.

Recreational use has also directly led to the innovations that all users today are enjoying. Many leading companies in this industry, including our own and that of our colleagues at Berkeley's 3DRobotics, were founded by people who started their exploration of remotely-controlled aircraft as enthusiasts, tinkering in garages, basements, and, in the case of our founder, school dormitories. Some of the most intriguing applications, improvements, modifications, and software have come from people who were "just having fun." Passion is one of the purest drivers of spontaneous innovation, and perhaps no other industry exemplifies that better than ours. What was long assumed to be an industry that would evolve from large military-type platforms has instead grown from technology many had only recently thought of as toys. In one wonderful recent example, in India, [a 14-year-old student has developed a mine-clearing drone](#) and was awarded a \$730,000 USD government contract to produce them.

The consumer drone industry is also driving down costs, and providing resources to engage in research and development that benefits commercial operators. A commercial photographer who spent the last few years awaiting the FAA's commercial drone rules that were only finalized in August 2016, upon obtaining her new FAA part 107 license, had immediate access to a sophisticated, portable, flying ultra high-definition camera for under one thousand dollars – because the consumer drone market had been rapidly innovating and pushing the technology forward for years already. Various studies of the Section 333 individual commercial permits issued by the FAA from late 2014 to mid 2016 showed that the most popular drones for professional use were the ones most often used for personal use, such as the DJI Phantom specified for use in over 60 percent of those applications. Virtually anyone operating a commercial drone today can be thankful to the consumer market for the benefits of widespread adoption and economies of scale. Burdens placed on the development or sale of these technologies will also impact the business users.

Also rarely mentioned is how drones in the hands of recreational pilots are contributing to public safety in life-saving ways. Our analysis of news reports reveals that drones have already helped save at least 59 lives in the past two years – in floods, fires, earthquakes, and when people go missing, and are now saving lives at the rate of one per week. One-third of those rescues involved a consumer bystander or volunteer being in the right place at the right time with the right tool: a drone. This technology not only has the power to do great good, but is already doing it around the world, even in places without much regulation, and in the hands of people without licenses or formal training. Sensationalized media



accounts of minor drone mishaps fail to provide crucial context, both in terms of the number of people who have used drones safely (millions), as well as the societal value of those activities.

As you move forward with potential UAS legislation, and the FAA continues with its steady pace of aviation rulemaking, we all owe it to future generations of aviation pioneers and visual artists to balance the safety goals we all share with the benefits of a transformative new technology, and leave unburdened these important pathways to innovation.

Preserving Uniformity While Addressing Local Issues

Successfully integrating UAS into the national airspace system requires addressing the legitimate concerns of state and local government. In 2016, DJI counted nearly 300 state bills concerning drones. There were also countless other proposals at the county and municipal levels. Some of those proposals were thoughtful and welcome. Many others, however, were based on uninformed assumptions about what drone technology is, how it is used, and how it is already regulated, resulting in proposals that would duplicate or even directly conflict with FAA regulations and federal statutes, or otherwise unreasonably burden pilots.

If the rules vary from state to state, county to county, and city to city, the result is an airspace system that is less safe, and DJI in particular loses the ability to communicate what the rules are to our customers. Conflicting rules also lead to confusion, disdain for the regulatory system, and ultimately non-compliance. UAS technology is increasingly portable, with one of our latest products, the Mavic Pro, weighing about a pound and a half and folding up into the size of a water bottle. As our industry moves forward with the full range of commercial, educational, artistic, scientific and governmental operations for drones, the potential disruption from inconsistent regulation presents a significant risk.

DJI is supportive of informed legislation at the state and local level that addresses problems not otherwise covered by existing law and regulation. For example, last year, DJI supported California Assembly Bill 1662 requiring accident reporting for drone operators, Assembly Bill 1680 prohibiting interference with emergency personnel, and Senate Bill 807 limiting the liability of first responders who damage drones interfering with emergency personnel. We also support the provision in last year's FAA extension legislation directing the agency to establish a centralized process for designation of critical infrastructure sites that warrant protection from unauthorized drones. That provision, Section 2209, is a good model for taking a legitimate local concern and ensuring that flight restrictions sought at the local level are considered and implemented consistently, by the experts at the FAA, and then made available in a central location for UAS pilots to consult.

Other concerns remain, and ought to be addressed in a thoughtful way that does not impair the great promise of this technology. The overwhelming majority of drone pilots are safe and responsible, and have no intent to disturb anyone when they are operating. Finding ways to address rare instances of misuse without thwarting legal and responsible operations is a goal we share. It is clear that the traditional federal preemption framework for aviation, so crucial to ensuring a set of uniform aviation safety standards, is not satisfying to local policymakers. And it is also clear that the traditional local authority over zoning and use of land does not provide a workable local governing solution for aircraft that require no ground facilities and that can take off and land anywhere. A new, creative approach to these issues may be warranted, and I am pleased that the FAA's Drone Advisory Committee, of which I



THE FUTURE OF POSSIBLE

am a member, has been tasked by the FAA, and is already hard at work in one of its task groups, to explore what a recommended alternative might be. The group is composed of stakeholders from city and county governments, manned aviation, the UAS industry, and academia who will try to reach consensus on the roles and responsibilities of different levels of government, and issue an interim report to the FAA by May 2017. An approach in which we collaboratively work together to understand and solve challenges like these is DJI's approach to policy issues not just in the United States but worldwide.

Conclusion

When Congress enacted the first significant legislation concerning drones five years ago, much of what I have described in this testimony was still at the workbench stage. The notion that almost anyone would soon have access to drone technology for work or play, supported by state-of-the-art safety features and careful operator education, probably exceeded anyone's expectations at that time. The rapid development of drone technology and the industry surrounding it, and the economic vitality it has contributed, are testaments to the transformative power of innovation. We firmly believe that the balanced approach that the United States has taken to the regulation of this emerging industry has been an essential ingredient in this process of innovation and growth. DJI looks forward to continuing to collaborate with you, the FAA, and other federal, state, and local authorities to ensure that the industry's *next* five years are as exciting and consequential as the last five. Thank you again for the opportunity to testify, and I would be happy to answer any questions you may have.