



Hearing on

Unmanned Aircraft Systems: Key Considerations Regarding  
Safety, Innovation, Economic Impact, and Privacy

Before the

Subcommittee on Aviation Operations, Safety, and Security  
Committee on Commerce, Science, and Transportation  
United States Senate

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Testimony of

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Thank you, Chairwoman Ayotte and Ranking Member Cantwell. My name is Paul Misener, and I am Amazon's Vice President for Global Public Policy. Unmanned aircraft systems ("UAS") present tremendous opportunities for innovation and soon will provide consumer services unimagined only a decade ago. Thank you for your attention to this important topic; for calling this hearing; and for inviting me to testify.

I. AMAZON PRIME AIR

Amazon Prime Air is a future service that will deliver packages to customers in 30 minutes or less using small UAS. Flying below 500 feet, and generally above 200 feet except for takeoff and landing, and weighing less than 55 pounds total, Prime Air UAS will take advantage of sophisticated "sense and avoid" technology, as well as a high degree of automation, to ensure safe operations including at distances of 10 miles or more, well beyond visual line of sight.

Not only do we think our customers will love this service, we believe it will benefit society more broadly. Once operational, Prime Air will increase the overall safety and efficiency of the current ground transportation system, by allowing people to skip the quick trip to the store or by decreasing package delivery by truck or car. For the same reasons, Prime Air will reduce buyers' environmental footprint: if a consumer wants a small item quickly, instead of driving to go shopping or causing delivery automobiles to come to her home or office, a small, electrically-powered UAS will make the trip faster and more efficiently and cleanly. To realize these tremendous opportunities for innovation and other benefits in the United States, additional research and development – and, soon, rules of operation – are needed.

Amazon Prime Air has been conducting outdoor R&D flight testing in multiple locations abroad, *i.e.*, in other countries. Our testing abroad has required but minimal aviation regulatory approval, given the low risk presented by our small UAS designs; the R&D nature of our flight activity; and our relatively rural test sites. Nowhere outside of the United States have we been required to wait more than one or two months to begin testing, and permission has been granted for operating a *category* of UAS, giving us room to experiment and rapidly perfect designs without being required to continually obtain new approvals for specific UAS vehicles. Our outdoor flight testing is going well, and we are very pleased with the R&D progress this testing has enabled.

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

## II. INTERNATIONAL REGULATORY ACTIVITIES

No country in which we now have distribution facilities has yet adopted rules that would allow commercial UAS package deliveries. So, in addition to our Prime Air R&D; testing; and distribution

network preparations, we are working with government agencies to develop appropriate rules for small UAS operations. Such rules must allow UAS applications to take advantage of a core capability of the technology: to fly with minimal human involvement, beyond visual line of sight. Such rules of operation should be proportionate to risk, setting a level of safety but not mandating how that level must be met.

UAS present obvious safety risks of mid-air collisions and crashes to the ground. In its recently-released Notice of Proposed Rulemaking (“NPRM”), the US Federal Aviation Administration (“FAA”) tied these concerns to the lack of human “see and avoid” abilities and the hazard of ground-to-air communications “link loss.” Both of these factors would have been difficult to address even just a decade ago, but automated UAS *sense* and avoid technology and on-board intelligence address these factors and will mitigate the related risks.

Safety is Amazon’s top priority and, earlier this month, I discussed UAS safety with Europe’s most senior leaders of aviation regulation, including at the UK’s Department for Transport and Civil Aviation Authority; the European Commission (“EC”); and the European Aviation Safety Agency (“EASA”). I also conferred with leadership of the Joint Authorities for Rulemaking on Unmanned Systems (“JARUS”), in which Asian, European, and North American aviation officials are working on a set of UAS technical, safety, and operational requirements to be recommended to aviation authorities worldwide. Amazon also participated in the EC conference on UAS in Riga, Latvia, and this week we are attending the International Civil Aviation Organization (“ICAO”) UAS conference in Montreal, Canada.

I’m delighted to report that these aviation authorities with whom we met in the UK and at the multinational bodies are enthusiastically pursuing regulatory frameworks and operational rules for UAS. The approach they are taking is eminently reasonable: it is risk- and performance-based, and it is mindful of the tremendous opportunities for innovation and economic benefits that UAS present.

Two reports released this month, from the EC’s Riga conference and from EASA, demonstrate the important planning already underway for future commercial UAS operations. The official report of

the Riga conference included several important conclusions: UAS should be treated as new types of aircraft with proportionate rules based on the risk of the operation (“rules should be simple and performance based”); rules must be developed now (“the basic regulatory framework should be put in place without delay”); technologies and standards need to be developed for the full integration of UAS in the airspace; and EASA should lead the harmonization of UAS regulation across Europe. Following the EC’s Riga conference, EASA presented its new regulatory approach for UAS operations, concluding that:

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

By the end of 2015, EASA plans to present a “draft regulatory framework” to the European Commission.

### III. TESTING AND PLANNING IN THE UNITED STATES

#### A. Current Rules for R&D Testing

American commercial entities want to innovate and perfect UAS technology, and to do so we must conduct R&D testing. Amazon has a large *indoor* R&D facility in Seattle. In this facility, our Prime Air team of roboticists, scientists, aeronautical engineers, remote sensing experts, and a former NASA astronaut has conducted flight tests on rapidly improving designs. But of course we need to safely test these designs *outdoors*, exposed to the flight conditions our UAS eventually will experience in operations – namely, wind, turbulence, and the variety of temperature, humidity, and precipitation conditions of the real world.

So, beginning in early 2014, we began talking to the FAA about obtaining permission to conduct R&D testing outdoors. And, from the beginning, we made clear that the rapid pace of UAS innovation

means that we need permission to rapidly modify our test vehicles, without administrative delays associated with every change.

We are very grateful to the FAA for granting us permission to conduct UAS testing outdoors in the United States. This approval came last Thursday, and we're eager to get flying here as we have been abroad. However, the permission the FAA granted is more restrictive than are the rules and approvals by which we conduct outdoor testing in the UK and elsewhere. (It's even more limited than the rules applicable to non-commercial, amateur UAS fliers in the United States.) Moreover, obtaining permission took far too long, and certainly much longer – over half a year – than it took in other countries.

The good news is that, while the FAA was considering our applications for testing, we innovated so rapidly that the UAS approved last week by the FAA has become obsolete. We don't test it anymore. We've moved on to more advanced designs that we already are testing abroad. Last Friday, we asked the FAA for permission to fly one of these advanced UAS in the United States, as well, and we are hopeful that this permission will be granted quickly.

#### B. Planning for Future Operations

Although the United States is catching up in permitting current commercial UAS testing, the United States remains behind in planning for future commercial UAS operations.

We are grateful for the FAA's newly-released NPRM, so far as it goes. But it doesn't go far enough. Unlike the planning by the national and multinational groups with whom I met in Europe earlier this month, the FAA is not adequately addressing compelling UAS applications that involve highly automated operations beyond visual line of sight. The FAA has proposed rules in the NPRM – to be adopted probably in 18-24 months – that simply do not address these extremely important applications. The NPRM only briefly requests comments on *whether* the rules should permit operations beyond visual line of sight and, if so, how enabling technology should be evaluated.

Although the FAA has asked a subcommittee of one of its industry advisory committees to examine beyond visual line of sight operations (and I am a member of this subcommittee), the group has only met twice since its inception last year. This low level of government attention and slow pace are inadequate, especially compared to the regulatory efforts in other countries. This is not to suggest that regulators here or abroad can quickly adopt actual rules for UAS operations beyond visual line of sight. That may take some time. But surely regulators should start *proposing* regulatory frameworks and rules for future commercial UAS operations now.

#### IV. OPPORTUNITIES FOR FAA AND CONGRESSIONAL ACTION

Because the United States remains behind in planning for future commercial UAS operations, one might assume that Congress must step in to provide the FAA authority to act. But the fact is that, with few exceptions, the agency already has adequate statutory authority. What the FAA needs is *impetus*, lest the United States fall further behind.

Any impetus embraced by, or given to, the FAA should result in the agency commencing – now – to plan and develop rules for UAS operations that would encompass highly automated flights, beyond visual line of sight. A good starting point could be the ongoing work in the multinational body JARUS, in which an FAA staffer serves as the vice chair. Elevating the level and intensity of FAA participation in this group is one way the United States could confirm its commitment to UAS technology and services. And, here at home, the FAA could immediately begin – or be directed to begin – proposing regulatory frameworks and rules for operations of highly automated UAS beyond visual line of sight, perhaps through a further notice of proposed rulemaking.

Consumer privacy is an area in which the US approach to UAS regulation already is particularly strong. We recognize that UAS technology could cause privacy infringement if commercial operations are not undertaken in a sensible, privacy-conscious manner. Prime Air is a future delivery service, not a

surveillance operation, and we will respect the privacy of every person, with stringent privacy policies accessible to all. We strongly support the Commerce Department's effort to develop, through a multi-stakeholder process, best practices on privacy, transparency, and accountability.

Lastly, international harmonization of rules is strongly desirable, and domestic balkanization by states and localities is not. Harmonized rules, perhaps developed through JARUS or ICAO, should be a top FAA priority internationally. And within the United States, uniform federal rules should apply.

V. CONCLUSION

In conclusion, Madam Chair, I look forward to working with you, your Subcommittee, and the FAA to ensure that important commercial UAS services become available in the United States safely and soon. And I welcome your questions.

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