



VIA FDMS

December 7, 2014

Mr. James H. Williams
Manager
UAS Integration Office, AFS-80
Federal Aviation Administration
800 Independence Avenue SW
Washington, DC 20591

Re: Supplement to Amazon Petition for Exemption – Docket No. FAA-2014-0474

Dear Mr. Williams:

Thank you for your letter, dated October 29, in which you seek additional information to supplement Amazon's petition for exemption submitted on July 9 under Section 333 of the FAA Modernization and Reform Act of 2012. I am writing in reply.

As described in our petition, the Amazon Prime Air delivery system will get packages to customers in 30 minutes or less using small aerial vehicles (a.k.a., unmanned aircraft systems, or "UAS"). We believe customers will love it, and we are committed to making Prime Air available worldwide as soon as we are permitted to do so.

To date, much of our Prime Air research and development efforts, including flight testing operations, have been conducted inside our laboratory and indoor testing facilities in Washington State. However, we must move beyond indoor testing if we are to realize the consumer benefits of Amazon Prime Air. In the absence of timely approval by the FAA to conduct outdoor testing, we have begun utilizing outdoor testing facilities outside the United States. These non-U.S. facilities enable us to quickly build and modify our Prime Air vehicles as we construct new designs and make improvements. It is our continued desire to also pursue fast-paced innovation in the United States, which would include the creation of high-quality jobs and significant investment in the local community. We believe this is what Congress intended when enacting Section 333, and it is why we continue to make every effort to seek this exemption.

To ensure that our outdoor flight testing operations are as safe as possible, we have proposed to test on private property in a rural area of Washington State, away from people or crowds. We also have proposed to do so under the supervision of trained pilots, at low altitudes, below 400 feet above ground level (“AGL”), within visual line of sight, employing “geofencing” technology that will keep the vehicle confined to the test area, and abiding by the detailed safety measures outlined in our petition. These detailed safety measures are much stronger than those currently required for hobbyists and manufacturers of model aircraft, who already do every day what Amazon is proposing.

Given the very conservative nature of Amazon’s request, especially in contrast to the nature of other petitions for commercial small UAS operations that already have been granted, as well as the way that thousands of hobbyists are permitted to operate small UAS today, we are very concerned that our needs for testing operations have not yet been accommodated.

At the FAA’s suggestion, and again in-line with our desire to pursue fast-paced innovation in the United States, we also have been exploring another regulatory path to accommodate our research and development needs, an Experimental Certification under 14 C.F.R. § 21.191. However, this alternative entails a lengthy process that was designed for manned aircraft and bears little practical application to small UAS. This process requires certification for each individual vehicle, which is burdensome considering how fast we are designing new Prime Air vehicles. Our first Experimental Certification application has been delayed multiple times as we try to work with the FAA to simplify the process. Disconcertingly, there is no guarantee that this alternative process will provide us the flexibility we need or at the pace we need it. Therefore, we are maintaining our Section 333 petition, and hope that we have not lost time pursuing this alternative.

I have provided responses to your letter’s question about the Experimental Certification alternative; however, I am concerned your question implies that alternatives must be pursued and demonstrated ineffective before our Section 333 petition will be fully considered: *“Given that the proposed operations can be conducted in accordance with existing regulations of § 21.191, please explain the particular circumstances regarding why an exemption would be an appropriate vehicle to permit those operations.”* It seems far from clear that our proposed operations can be conducted successfully under Section 21.191 at this time. There is nothing in our reading of Section 333 that requires exhaustion of other regulatory provisions before the FAA grants petitions for exemption. Moreover, the FAA has concluded that an airworthiness certificate, experimental or otherwise, is not required to operate a small UAS under Section 333, which Congress created to get small UAS safely flying as soon as possible in the United States. Requiring exhaustion of alternatives before granting our Section 333 petition would impede that goal.

Of equal concern is your letter's request for us to further explain "*why granting [Amazon's] request would be in the public interest.*" I have responded to this question in detail below, but I fear the FAA may be questioning the fundamental benefits of keeping UAS technology innovation in the United States. Simply put, Prime Air has great potential to enhance the services we already provide to millions of our customers by providing rapid parcel delivery that will also increase the overall safety and efficiency of the transportation system. We want approval to conduct outdoor testing operations with our small UAS in the United States to help realize this goal.

Here are our specific answers to your letter's three questions:

1. *Section 333 of the 2012 FAA Modernization and Reform Act directs the Secretary of Transportation to determine if certain unmanned aircraft systems may operate safely in the national airspace system before completion of rulemaking required by section 332 of the Act, and furthermore, determine whether a certificate of waiver, certificate of authorization, or airworthiness certification under section 44704 of title 49, United States Code, is required for the operation of these unmanned aircraft systems. You are seeking an exemption for the purposes of experimentation, research and development, and conducting rapid prototyping of UAS. The aircraft to be operated for the purposes described in your petition may be issued special airworthiness certificates in the experimental category in accordance with the pertinent parts of 14 CFR § 21.191. Given that the proposed operations can be conducted in accordance with existing regulations of § 21.191, please explain the particular circumstances regarding why an exemption would be an appropriate vehicle to permit those operations.*

Section 333 is the appropriate mechanism to facilitate Amazon's innovation for Prime Air. The FAA has determined that the operation of small UAS for other than hobby or recreational purposes is commercial in nature. The agency has also concluded that small UAS do not require an airworthiness certificate pursuant to Section 333. Consistent with the FAA's own legal position, Amazon's development operations fall squarely within the scope of those that Congress intended to be covered by Section 333, and can be addressed by Section 333 to provide greater flexibility in R&D than the traditional Experimental Certification process.

While efforts have been made by the FAA to informally adapt the Experimental Certification process, which was designed for the development of manned aircraft – be it a Boeing 747 or a Piper Cub – it remains unnecessarily onerous and ill-suited for the small UAS operations that Amazon seeks to conduct under this exemption. Despite the dedicated and well-intentioned efforts of many FAA personnel, Amazon's experience to-date with the Experimental Certification process makes clear that the agency's requirements and guidance

must be updated or allow for deviations to be workable. Under this process, requiring the small UAS used in Amazon's development to obtain an airworthiness certificate undermines the intent of Section 333 as a mechanism to get safe operations flying quickly.

Our strict safety measures will apply to all operations under the requested exemption. This will provide for a level of safety exceeding that of the film production operations already permitted by Section 333 exemptions, given our vehicles will be operated in a secure, privately-owned location, away from populated areas. Additionally, there is nothing in our reading of Section 333 that requires exhaustion of other regulatory provisions before the FAA grants petitions for exemption. Requiring exhaustion of other options before granting our Section 333 petition would impede the goal we share with Congress of getting small UAS flying commercially safely and soon in the United States.

- 2. To assist with the assessment of how your petition for exemption is in the public interest, please explain more fully the reasons why granting your request would be in the public interest; that is, how it would benefit the public as a whole. What data or analysis supports Amazon's position that aerial delivery is in the interest of the American public? Other examples of benefit to the public may include reductions in injuries or fatalities related to current hand delivery practices or reductions in environmental footprints.*

The outdoor testing operations we seek in our petition for exemption is a necessary step towards realizing the consumer benefits of Prime Air, as well as a step in unlocking the enormous potential of small UAS technology. Aerial delivery is poised make goods available to consumers in a manner that is more environmentally-friendly than current surface delivery methods, while improving the overall safety of the transportation system.

It is also in the public interest for Amazon to keep its small UAS R&D operations in the United States, and help America establish itself as the leader in development of UAS technology. Our continuing innovation through outdoor testing in the United States and, more generally, the competitiveness of the American small UAS industry, can no longer afford to wait. Amazon is increasingly concerned that, unless substantial progress is quickly made in opening up the skies in the United States, the nation is at risk of losing its position as the center of innovation for the UAS technological revolution, along with the key jobs and economic benefits that come as a result.

We are poised to significantly expand our distinguished team of engineers, scientists, and aeronautical professionals at Amazon's next-generation R&D lab in Washington State. Amazon Prime Air currently has dozens of United States job openings for highly-skilled professionals including hardware engineers and research scientists.

Subject to demonstrating the appropriate safeguards that Congress outlined in Section 333, Amazon should be free to conduct research and development operations over our own private property in the United States without further delay.¹ Without approval of our testing in the United States, we will be forced to continue expanding our Prime Air R&D footprint abroad.

3. *The petition seeks specific exemption from 14 CFR § 21.191(a), 14 CFR § 45.23(b), 14 CFR § 91.9(b), and 14 CFR § 91.203(a) and (b). However, footnote 1 on page 3 of your petition requests, "relief from any associated or implementing requirements of several related provisions that my otherwise be applicable," and lists ten additional regulations for which Amazon believes it may require exemption. However, the petition may not provide sufficient information to assess the regulations noted; including, for example, 14 CFR § 91.151 or 14 CFR § 91.405. In accordance with 14 CFR § 11.81(b), the petition must specify the section or sections of 14 CFR from which you seek exemption. Therefore, if you seek relief from other regulations in addition to 14 CFR § 21.191(a), 14 CFR § 45.23(b), 14 CFR § 91.9(b), and 14 CFR § 91.203(a) and (b), the petition should be amended accordingly.*

Further details on the specific regulations implicated by Amazon's petition are as follows:

- *14 C.F.R. § 21.191(a)* – The FAA's interpretation of Section 333 obviates the need to seek relief from this airworthiness certification provision.²
- *14 C.F.R. § 45.23(b)* – Amazon will not be required to display the word "EXPERIMENTAL" on our vehicles because they will not be issued an Experimental Certificate under 14 C.F.R. § 21.191, but the vehicles will bear N-number markings that are as large as practicable in accordance with 14 C.F.R. Part 45, Subpart C.³
- *14 C.F.R. § 61.113(a) and (b)* – To the extent the FAA determines that the pilot in command ("PIC") for our specific operations must hold a private pilot certificate, and that a commercial pilot certificate would otherwise be necessary for our research and development operations, Amazon requests an exemption from these provisions. The FAA has already concluded that a private pilot certificate is sufficient to conduct small

¹ Amazon fully supports the FAA's test site program and looks forward to participating in it as a component of our overall research and development efforts. However as noted in our original filing, it would be impractical for Amazon to pursue the test sites as our sole method of testing at this time.

² See FAA, *Public Guidance for Petitions for Exemption Filed Under Section 333* (Sep. 25, 2014).

³ See, e.g., *In the Matter of the Petition of Astreaus Aerial*, Grant of Exemption No. 11062 (Sep. 25, 2014), Docket No. FAA-2014-0352, at 14.

UAS operations and nothing in our petition would give the agency cause to depart from its reasoned analysis.⁴

- *14 C.F.R. §§ 91.9(b) and 91.203(b)* – An exemption is no longer required because the FAA has deemed it acceptable for the documents required by these provisions to be kept at the ground control station (“GCS”) and available to the PIC any time the vehicle is operating.⁵
- *14 C.F.R. § 91.119(c)* – Because our vehicles will necessarily be operated closer than 500 feet to Amazon personnel participating in the operations, and consistent with the procedures set forth in our confidential Operations Manual, Amazon requests an exemption from this provision.
- *14 C.F.R. § 91.121* – Amazon requests relief from the requirement to have a typical barometric altimeter aboard the vehicle. We believe operating within visual line of sight and at or below 400 feet AGL, along with a telemetric data feed that provides altitude information to the pilot via downlink from the vehicle to the GCS, is sufficient to ensure that our operations do not adversely affect safety.
- *14 C.F.R. § 91.151(a)* – Amazon requests an exemption from the fuel minimum requirements to operate in visual flight rule conditions. We believe that operating within a secure, isolated operating area, with a vehicle under 55 pounds, within visual line of sight, and with procedures that require our flights to be safely terminated once our batteries fall below 20% capacity, provides an equivalent or greater level of safety.
- *14 C.F.R. §§ 91.405(a), 91.407(a)(1), 91.409(a)(1) and (2), and 91.417(a) and (b)* – Amazon requests relief from these regulatory maintenance and alteration requirements on the basis that the requirements for vehicle/component maintenance, overhaul, replacement, and inspection established and identified in our confidential Operations Manual will ensure that our operations will not adversely affect safety in the national airspace system or of the people and property on the ground.

In addition, we have included responses to the supplemental questions asked of all Section 333 petitioners as Appendix 1.

⁴ See *id.* at 16-18.

⁵ See *id.*; see also Memorandum from Mark Bury, FAA Assistant Chief Counsel for International Law, Legislation and Regulations, to John Duncan, FAA Flight Standards Service (Aug. 8, 2014).

Mr. James H. Williams
December 7, 2014
Page 7

Amazon urges the FAA to swiftly approve our Section 333 petition, submitted nearly five months ago. Without the ability to test outdoors in the United States soon, we will have no choice but to divert even more of our UAS research and development resources abroad.

Please do not hesitate to contact me via email at prime-air-exemption@amazon.com if you have any questions or concerns.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Paul E. Misener". The signature is stylized and written in a cursive-like font.

Paul Misener
Vice President, Global Public Policy
Amazon.com

Appendix 1

Additional Information Supporting this Petition

Regarding the Unmanned Aircraft System

Detailed proprietary information regarding the vehicles to be operated under this exemption, including the associated GCS, will be available in our confidential Operations Manual. In all planned configurations, our vehicles will weigh less than 55 pounds, including payload, and be powered by electric motors. The navigation system incorporates a geofence altitude altimeter that prevents the vehicles from flying outside the operating area or over 400 feet AGL. Given the current FAA restrictions on Amazon testing outdoors, we have not been flying our vehicles outdoors in the United States. We have however started testing outdoors in other countries with regulatory environments more supportive of small UAS innovation.

Prior to each flight, the PIC will conduct a pre-flight inspection of the vehicle and GCS. Maintenance will be performed and verified to address any condition potentially affecting safe operations. Repair of damaged parts will most likely mean replacement, and Amazon will have a sufficient stock of replacement parts. A functional flight test will be conducted following the replacement of any flight-critical component. All maintenance and alterations will be documented in the aircraft records. Vehicle technician qualification criteria, as well as requirements for vehicle/component maintenance, overhaul, replacement, and inspection will be established and identified in our confidential Operations Manual. Such requirements will encompass: (i) actuators/servos; (ii) transmission; (iii) powerplant; (iv) propellers; (v) electronic speed controller; (vi) batteries; (vii) mechanical dynamic components; (viii) remote command and control; and (ix) GCS.

The wireless spectrum utilized by our vehicles' primary and secondary communications link systems is approved by the Federal Communications Commission for unlicensed use.

Regarding the Unmanned Aircraft PIC

While Amazon can have a PIC available who holds at least a private pilot certificate with a third-class medical certificate for our testing operations, if absolutely necessary, we disagree strongly with the FAA's conclusion that "Section 333 does not provide flexibility for requirement to hold an airman certificate described in 49 U.S.C. §44711."⁶ There is no language that restricts its application to airworthiness certificate determinations only. Section 333 should be read broadly so as to enable small UAS operations before completion of the

⁶ See FAA, *Public Guidance for Petitions for Exemption Filed Under Section 333* (Sep. 25, 2014) at 4.

FAA's required rulemakings. The salient consideration of a Section 333 petition should be whether the vehicles can be operated safely.⁷ Given the scope of Amazon's desired operations, which will be conducted entirely over our own isolated private property, and associated safeguards, requiring our PICs to hold a private pilot certificate is simply unnecessary. The combination of small UAS flight experience and successful completion of FAA Ground School, a requirement for all our Operators, is more than sufficient under the circumstances.

We will use GCS Operators, and optionally other Operators, who will assist the PIC. In addition, we will have a Safety Officer who is responsible for ensuring that the overall operation is safe, and potentially other Safety Observers who will be used to observe the vehicle and its performance, to ensure that the operating area remains clear of other air or ground traffic. The Safety Officer and Safety Observers will be familiar with the applicable aviation regulations and also have completed a FAA Ground School course.

The PICs, Operators, Safety Officer, and Safety Observers will all have completed Amazon internal training on the normal, abnormal, and emergency procedures for our vehicles and operations. Detailed information regarding the knowledge and airmanship test qualifications, training, and flight experience, as applicable, for all employees involved in our operation will be set forth in our confidential Operations Manual.

Regarding the Operation of the Unmanned Aircraft

Procedures for conducting a pre-flight safety risk assessment in accordance with 14 C.F.R. § 91.7(b) to determine that the vehicle is in a condition for safe flight and that the planned operation can be completed safely, as well as proposed operating conditions and the potential hazards and corresponding safety mitigations associated with those conditions, will be detailed in Amazon's confidential Operations Manual. In addition to those set forth in Amazon's original petition, our proposed operating conditions include: (i) the vehicle remaining clear and yielding the right of way to all other manned operations and activities at all times; (ii) all operations being conducted under visual meteorological conditions ("VMC"); and (iii) the vehicle not being operated less than 500 feet below or less than 2,000 feet horizontally from a cloud or when visibility is less than three statute miles from the PIC.

There are also multiple redundant systems to ensure that the vehicles remain inside the operating area:

⁷ Amazon believes that using a PIC who has completed FAA private pilot ground instruction and passed the FAA private pilot written examination or FAA-recognized equivalent is more than sufficient to ensure safety of our testing operations and the National Airspace System. Flight experience gained through obtaining a private pilot certificate will not materially aid the PIC in our operational environment.

- Geofence functionality is programmed into the navigation software. If the vehicle has crossed a defined three-dimensional geographical area (i.e., the “geofence”), the flight control system will immediately command the vehicle to halt and hover in place. The PIC and Safety Officer can then clear the area under the vehicle and command an autoland, or the PIC can take manual command of the vehicle and return it to the operating area.
- The vehicle will be observed at all times by the PIC, Safety Observers, and the GCS Operator, who has a real-time position readout of the vehicle. If the vehicle leaves the operating area or behaves erratically, the PIC will execute emergency procedures and end the operation.
- If the geofence system were to fail, and the vehicle does not respond to manual commands, the PIC will initiate emergency procedures that automatically return the vehicle to the launch point for that mission. This functionality has been tested successfully and will be verified prior to all operations.
- If the vehicle still does not respond to the lost link procedures, the PIC or Safety Officer will immediately activate the vehicle’s emergency shutdown system, which will interrupt all power to the vehicle via a separate, redundant communications path.
- Remote observers in the operating area and security guards stationed at the entrance will be equipped with encrypted portable radios that will allow for immediate communication with the PIC. All personnel will also be able to contact the PIC directly by cellular phone as a backup means of communication in the case of a radio failure.