U.S. Department
of Transportation
**Federal Aviation
Administration**

800 Independence Ave., S.W.
Washington, D.C. 20591

April 1, 2015

Exemption No. 11261
Regulatory Docket No. FAA−2014−0715

Mr. Jonathan B. Hill
Counsel for AeroVironment, Inc.
Cooley, LLP
1299 Pennsylvania Avenue NW
Suite 700
Washington, DC 20004

Dear Mr. Hill:

This letter is to inform you that we have granted your request for exemption. It transmits our decision, explains its basis, and gives you the conditions and limitations of the exemption, including the date it ends.

The Basis for Our Decision

By letter dated September 10, 2014, you petitioned the Federal Aviation Administration (FAA) on behalf of AeroVironment, Inc. (hereinafter petitioner or operator) for an exemption. The exemption would allow the petitioner to operate an unmanned aircraft system (UAS) to conduct agriculture, aerial survey, and patrol operations.

See Appendix A for the petition submitted to the FAA describing the proposed operations and the regulations that the petitioner seeks an exemption.

Discussion of Public Comments:

A summary of the petition was published in the Federal Register on September 30, 2014, (79 FR 58850). Three comments were received. The Small UAV Coalition (Coalition) commented in support of the petition, while the Air Line Pilots Association, International (ALPA) and the National Agricultural Aviation Association (NAAA) opposed it.

In support of the petition, the Coalition stated the petitioner has proposed to abide by stronger safety measures than hobby and modeler groups operating similar aircraft. The Coalition stated that it does not believe that heightened safety measures should be required for the petitioner simply because of the commercial nature of its operations. The Coalition urged the FAA to adopt an evaluation framework for UAS operations under Section 333 of Public Law 112–95 that weighs the relative safety issues and risks of UAS by class and operational circumstances, rather than adopting artificial distinctions among unmanned aerial vehicles based on commercial and noncommercial operations. The petitioner's UAS pose considerably less safety risk than larger UAS. The Coalition asserted that because UAS operations like the petitioner's pose minimal risk to safety, they should be subject to minimal and appropriate regulations.

The Coalition noted the FAA is to consider the seven factors[1] in Section 333 as a minimum. The Coalition stated the petition shows the FAA should consider factors other than those specified in Section 333, such as location, altitude of its UAS, and proven operating experience. The Coalition maintained that the petitioner's proposed operations satisfy the seven factors in Section 333 and include several additional mitigating factors to ensure the safety and security of the proposed UAS operations. The Coalition emphasized the FAA must evaluate each factor within the context of the petitioner's proposed UAS operations.

The Coalition also commented that the FAA should grant relief from the requirement to hold an airman certificate. The Coalition further stated that if an airman certificate is required then, at a minimum the, FAA should provide an exception from the training and testing requirements in part 61 in favor of requirements pertinent to the aircraft and operation proposed. The Coalition also asserted that in section 333 Congress intended for the FAA to consider national security with respect to the operation as opposed to addressing it through pilot certification.

The FAA notes that, as discussed in the grant of exemption to Trimble Navigation Ltd. (Exemption No. 11110), neither section 333, nor the FAA's exemption authority[2] allows the

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[1] Section 333(b) of P.L. 112 95 states, in part: "In making the determination under subsection (a), the Secretary shall determine, at a minimum-- (1) which types of unmanned aircraft systems, if any, as a result of their size, weight, speed, operational capability, proximity to airports and populated areas, and operation within visual line of sight do not create a hazard to users of the national airspace system or the public or pose a threat to national security; …"

[2] 49 USC § 44701(f)

FAA to exempt pilots from the statutory requirement to hold an airman certificate as prescribed in 49 USC § 44711.

The Coalition commented that a visual observer (VO) should not be required for all small UAS operations. The Coalition further asserted that the presence of one or more VOs may allow the UAS to be operated beyond visual line of sight (VLOS) of the pilot in command (PIC) and that the petitioner's proposal to operate the unmanned aircraft (UA) within VLOS of the PIC *and/or* VO should be permitted.

The FAA notes that one of the determinations for operations under Section 333 is operation within visual line of sight. The PIC must maintain VLOS while operating the UA. The FAA finds that a VO complements the PIC's capability to see and avoid other aircraft, including when the PIC may be momentarily attending to other flying tasks (e.g., maneuvering the aircraft close to actors and actresses and other objects on a film set). The VO provides an additional level of operational safety.

ALPA expressed concern regarding several aspects of the petition. ALPA noted the petitioner's reference to operations conducted within Class E and G airspace, and stated the petitioner does not detail procedures for controlling the airspace or area of operation. Specifically, ALPA stated "there must be means both to ensure that the sUAS remains within the defined airspace and to ensure that the hazard of other aircraft intruding on the operation is mitigated."

The FAA believes the limitations under which the petitioner will operate (i.e., VLOS and at or below 400 feet AGL) are sufficient mitigations to this risk so that the operations will not adversely affect safety.

ALPA stated the petitioner did not describe the method of communication to be used by the pilot and observer. ALPA noted that text messaging could have an unknown latency and extend to several minutes. ALPA also stated that voice communication with the pilot is a limited mitigation if both the pilot and observer are not able to maintain a visual observation of both the aircraft and the area. NAAA stated UAS observers must be present and able to communicate with the operator from the most minimal distance possible. The FAA conditions and limitations regarding PIC and VO communications address these concerns.

ALPA asserted the UAS's lithium polymer batteries have numerous associated fire and explosion hazards as outlined in DOT/FAA/AR−09/55, "Flammability Assessment of Lithium-Ion and Lithium-Ion Polymer Battery Cell Designed for Aircraft Power Usage (January 2010)," and that the safe carriage of the batteries and the mitigations in place for known risks should be addressed. The referenced study was primarily conducted to determine how certain battery cells react in a fire situation aboard manned airplanes. Given the size of the battery and the operating conditions of the UAS, the FAA concludes that the use of a lithium polymer battery will not pose an undue safety risk for the proposed operations.

ALPA commented that while the petitioner's aircraft may not have a barometric altimeter as required by 14 CFR § 91.121. ALPA stated that processes or mitigations must be in place to ensure the UA can accurately maintain altitude including engineering processes, software development and control, electronic hardware development and control, configuration management, and design assurance to ensure the aircraft and its control system(s) operate to the same level of safety as other aircraft operated commercially in the National Airspace System (NAS).

ALPA commented that command and control (C2) link failures are one of the most common failures on a UAS, and that lost link mitigations should require safe modes to prevent fly-aways or other scenarios. The FAA has inserted conditions and limitations in this exemption to mitigate the risk associated with such failures.

ALPA also noted that the petitioner's proposed operations are for "compensation or hire," and therefore contends the pilot must hold at least a current FAA commercial pilot certificate with an appropriate category and class rating for the type of aircraft being flown, as well as specific and adequate training on the UAS make and model intended to be used. Similarly, ALPA asserted a current second-class airman medical certificate should be required. NAAA also commented on pilot qualification, stating—

> Just as manned aircraft pilots are required to undergo a rigorous training curriculum and show that they are fit to operate a commercial aircraft, so too must UAS operators. Holding a commercial certificate holds UAS operators to similar high standards as commercial aircraft operators and ensures they are aware of their responsibilities as commercial operators within the NAS. Medical requirements ensure they have the necessary visual and mental acuity to operate a commercial aircraft repeatedly over a sustained period of time.

The FAA has reviewed the knowledge and training requirements of sport, recreational, private and commercial certificates and concluded that a UAS PIC holding a minimum of a sport pilot certificate, and operating under this exemption, would not adversely affect operations in the NAS or present a hazard to persons or property on the ground.

Although the petitioner did not request an exemption from § 91.113, ALPA noted the petitioner must specify a means to meet see and avoid requirements in § 91.113 given the absence of an onboard pilot. The FAA notes that all flights must be operated within VLOS of the PIC and VO.

Regarding the fuel requirements of § 91.151, ALPA argued that using batteries as the only source of an aircraft's power is a substantial shift from traditional methods of propulsion, and requires further research to determine best safety practices. The FAA has inserted a condition and limitation that addresses this concern.

ALPA also expressed concern that the petition makes no reference to compliance with, or a request for waiver from, 14 CFR 61.195, *Flight instructor limitations and qualifications*, which defines the requirements for flight instructors. A certificated flight instructor is authorized to provide the instruction required for the certificates or ratings or currency listed in 14 CFR § 61.193. A person instructing on how to operate the UAS under the petitioner's training program would not need to be a certificated flight instructor because the instruction is not being provided for a certificate or rating listed in § 61.193. We note that none of the UAS operations proposed by the petitioner require such flight instruction because § 61.31(*l*) allows for operation of the UAS by an airman who is current per 14 CFR § 61.56 without a category and class rating. Instruction provided toward obtaining the pilot certificate required by this exemption would need to be provided by a certificated flight instructor.

ALPA expressed concern about whether the petitioner's UAS can comply with the aircraft light requirements for night operations in § 91.209, given its limited electric power. The petitioner indicates that night operations will not be conducted and this exemption limits operations to daytime only.

Regarding §§ 91.405(a), 91.407(a)(1), 91.409(a)(2), and 91.417(a) and (b), ALPA opposed the petitioner's attempt to avoid compliance with established aircraft maintenance and recordkeeping requirements. ALPA states the UAS should comply with the same level of safety as other aircraft operated commercially in the NAS.

ALPA also expressed concern that the petitioner's request is not for a single specific operation or location, but for all operations of the same general type. ALPA stated that this results in a considerable increase in the FAA's oversight tasks. The FAA notes ALPAs concern and in order to minimize potential impact to the NAS, the FAA requires that each operator secure a Certificate of Authorization or COA which covers specific details of the petitioners operation. The FAA recognizes that UAS integration will generate new NAS access demand and will review and adjust accordingly.

NAAA noted that its members operate in low-level airspace, and therefore clear low-level airspace is vital to the safety of these operators. NAAA stated that seeing and avoiding other aircraft and hazardous obstructions is the backbone for agricultural safety, and that agricultural pilots depend on pilots of other aircraft to perform their see-and-avoid functions to prevent collisions. NAAA believes UAS operations at low altitudes will increase the potential for collision with agricultural aircraft.

The FAA recognizes these concerns and has incorporated associated conditions and limitations into this exemption, including: (a) a Notice to Airmen (NOTAM) issued for all operations; (b) operations conducted within VLOS of the pilot in command (PIC) and the VO; and (c) the UAS PIC must always yield right-of-way to manned aircraft.

NAAA stated that FAA airworthiness certification should be a requirement for all unmanned aircraft to operate within the NAS. NAAA recommended UAS be equipped with ADS-B or similar identification and positioning systems, strobe lights, high-visibility markings and registration numbers. NAAA also recommended UAS be operated strictly within the line-of-sight of the ground controller, with the assistance of a VO and clear of any low-flying manned aircraft.

Section 333 of the FAA Modernization and Reform Act of 2012 authorizes the Secretary of Transportation to determine, considering a number of factors laid out in the statute, that an airworthiness certificate is not necessary for certain operations. The Secretary has made that determination in this case and therefore the aircraft operated by the petitioner will not need to be certificated by the FAA.

Airworthiness Certification

The UAS proposed by the petitioner is a Puma AE DDL.

In accordance with the statutory criteria provided in Section 333 of Public Law 112−95 in reference to 49 U.S.C. § 44704, and in consideration of the size, weight, speed, and limited operating area associated with the aircraft and its operation, the Secretary of Transportation has determined that this aircraft meets the conditions of Section 333. Therefore, the FAA finds that the requested relief from 14 CFR part 21, C*ertification procedures for products and parts, Subpart H—Airworthiness Certificates,* and any associated noise certification and testing requirements of part 36, is not necessary.

The Basis for Our Decision

You have requested to use a UAS for aerial data collection. The FAA has issued grants of exemption in circumstances similar in all material respects to those presented in your petition. In Grants of Exemption Nos. 11062 to Astraeus Aerial (*see* Docket No. FAA−2014−0352), 11109 to Clayco, Inc. (*see* Docket No. FAA−2014−0507), 11112 to VDOS Global, LLC (*see* Docket No. FAA−2014−0382), and 11213 to Aeryon Labs, Inc. (*see* Docket No. FAA−2014−0642), the FAA found that the enhanced safety achieved using an unmanned aircraft (UA) with the specifications described by the petitioner and carrying no passengers or crew, rather than a manned aircraft of significantly greater proportions, carrying crew in addition to flammable fuel, gives the FAA good cause to find that the UAS operation enabled by this exemption is in the public interest.

Having reviewed your reasons for requesting an exemption, I find that—

- They are similar in all material respects to relief previously requested in Grant of Exemption Nos. 11062, 11109, 11112, and 11213;

- The reasons stated by the FAA for granting Exemption Nos. 11062, 11109, 11112, and 11213 also apply to the situation you present; and
- A grant of exemption is in the public interest.

Our Decision

In consideration of the foregoing, I find that a grant of exemption is in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. 106(f), 40113, and 44701, delegated to me by the Administrator, AeroVironment, Inc. is granted an exemption from 14 CFR §§ 61.23(a) and (c), 61.101(e)(4) and (5), 61.113(a), 61.315(a), 91.7(a), 91.119(c), 91.121, 91.151(a)(1), 91.405(a), 91.407(a)(1), 91.409(a)(1) and (2), and 91.417(a) and (b), to the extent necessary to allow the petitioner to operate a UAS to perform aerial data collection. This exemption is subject to the conditions and limitations listed below.

Conditions and Limitations

In this grant of exemption, AeroVironment, Inc. is hereafter referred to as the operator.

Failure to comply with any of the conditions and limitations of this grant of exemption will be grounds for the immediate suspension or rescission of this exemption.

1. Operations authorized by this grant of exemption are limited to the Puma AE DDL when weighing less than 55 pounds including payload. Proposed operations of any other aircraft will require a new petition or a petition to amend this exemption.

2. Operations for the purpose of closed-set motion picture and television filming are not permitted.

3. The UA may not be operated at a speed exceeding 87 knots (100 miles per hour). The exemption holder may use either groundspeed or calibrated airspeed to determine compliance with the 87 knot speed restriction. In no case will the UA be operated at airspeeds greater than the maximum UA operating airspeed recommended by the aircraft manufacturer.

4. The UA must be operated at an altitude of no more than 400 feet above ground level (AGL). Altitude must be reported in feet AGL.

5. The UA must be operated within visual line of sight (VLOS) of the PIC at all times. This requires the PIC to be able to use human vision unaided by any device other than corrective lenses, as specified on the PIC's FAA-issued airman medical certificate or U.S. driver's license.

6. All operations must utilize a visual observer (VO). The UA must be operated within the visual line of sight (VLOS) of the PIC and VO at all times. The VO may be used

to satisfy the VLOS requirement as long as the PIC always maintains VLOS capability. The VO and PIC must be able to communicate verbally at all times. Electronic messaging or texting is not permitted during flight operations. The PIC must be designated before the flight and cannot transfer his or her designation for the duration of the flight. The PIC must ensure that the VO can perform the duties required of the VO.

7. This exemption and all documents needed to operate the UAS and conduct its operations in accordance with the conditions and limitations stated in this grant of exemption, are hereinafter referred to as the operating documents. The operating documents must be accessible during UAS operations and made available to the Administrator upon request. If a discrepancy exists between the conditions and limitations in this exemption and the procedures outlined in the operating documents, the conditions and limitations herein take precedence and must be followed. Otherwise, the operator must follow the procedures as outlined in its operating documents. The operator may update or revise its operating documents. It is the operator's responsibility to track such revisions and present updated and revised documents to the Administrator or any law enforcement official upon request. The operator must also present updated and revised documents if it petitions for extension or amendment to this grant of exemption. If the operator determines that any update or revision would affect the basis upon which the FAA granted this exemption, then the operator must petition for an amendment to its grant of exemption. The FAA's UAS Integration Office (AFS-80) may be contacted if questions arise regarding updates or revisions to the operating documents.

8. Any UAS that has undergone maintenance or alterations that affect the UAS operation or flight characteristics, e.g. replacement of a flight critical component, must undergo a functional test flight prior to conducting further operations under this exemption. Functional test flights may only be conducted by a PIC with a VO and must remain at least 500 feet from other people. The functional test flight must be conducted in such a manner so as to not pose an undue hazard to persons and property.

9. The operator is responsible for maintaining and inspecting the UAS to ensure that it is in a condition for safe operation.

10. Prior to each flight, the PIC must conduct a pre-flight inspection and determine the UAS is in a condition for safe flight. The pre-flight inspection must account for all potential discrepancies, e.g. inoperable components, items, or equipment. If the inspection reveals a condition that affects the safe operation of the UAS, the aircraft is prohibited from operating until the necessary maintenance has been performed and the UAS is found to be in a condition for safe flight.

11. The operator must follow the UAS manufacturer's maintenance, overhaul, replacement, inspection, and life limit requirements for the aircraft and aircraft components.

12. Each UAS operated under this exemption must comply with all manufacturer safety bulletins.

13. Under this grant of exemption, a PIC must hold either an airline transport, commercial, private, recreational, or sport pilot certificate. The PIC must also hold a current FAA airman medical certificate or a valid U.S. driver's license issued by a state, the District of Colombia, Puerto Rico, a territory, a possession, or the Federal government. The PIC must also meet the flight review requirements specified in 14 CFR § 61.56 in an aircraft in which the PIC is rated on his or her pilot certificate.

14. The operator may not permit any PIC to operate unless the PIC demonstrates the ability to safely operate the UAS in a manner consistent with how the UAS will be operated under this exemption, including evasive and emergency maneuvers and maintaining appropriate distances from persons, vessels, vehicles and structures. PIC qualification flight hours and currency must be logged in a manner consistent with 14 CFR § 61.51(b). Flights for the purposes of training the operator's PICs and VOs (training, proficiency, and experience-building) and determining the PIC's ability to safely operate the UAS in a manner consistent with how the UAS will be operated under this exemption are permitted under the terms of this exemption. However, training operations may only be conducted during dedicated training sessions. During training, proficiency, and experience-building flights, all persons not essential for flight operations are considered nonparticipants, and the PIC must operate the UA with appropriate distance from nonparticipants in accordance with 14 CFR § 91.119.

15. UAS operations may not be conducted during night, as defined in 14 CFR § 1.1. All operations must be conducted under visual meteorological conditions (VMC). Flights under special visual flight rules (SVFR) are not authorized.

16. The UA may not operate within 5 nautical miles of an airport reference point (ARP) as denoted in the current FAA Airport/Facility Directory (AFD) or for airports not denoted with an ARP, the center of the airport symbol as denoted on the current FAA-published aeronautical chart, unless a letter of agreement with that airport's management is obtained or otherwise permitted by a COA issued to the exemption holder. The letter of agreement with the airport management must be made available to the Administrator or any law enforcement official upon request.

17. The UA may not be operated less than 500 feet below or less than 2,000 feet horizontally from a cloud or when visibility is less than 3 statute miles from the PIC.

18. If the UAS loses communications or loses its GPS signal, the UA must return to a pre-determined location within the private or controlled-access property.

19. The PIC must abort the flight in the event of unpredicted obstacles or emergencies.

20. The PIC is prohibited from beginning a flight unless (considering wind and forecast weather conditions) there is enough available power for the UA to conduct the intended operation and to operate after that for at least five minutes or with the reserve power recommended by the manufacturer if greater.

21. Air Traffic Organization (ATO) Certificate of Waiver or Authorization (COA). All operations shall be conducted in accordance with an ATO-issued COA. The exemption holder may apply for a new or amended COA if it intends to conduct operations that cannot be conducted under the terms of the attached COA.

22. All aircraft operated in accordance with this exemption must be identified by serial number, registered in accordance with 14 CFR part 47, and have identification (N-Number) markings in accordance with 14 CFR part 45, Subpart C. Markings must be as large as practicable.

23. Documents used by the operator to ensure the safe operation and flight of the UAS and any documents required under 14 CFR §§ 91.9 and 91.203 must be available to the PIC at the Ground Control Station of the UAS any time the aircraft is operating. These documents must be made available to the Administrator or any law enforcement official upon request.

24. The UA must remain clear and give way to all manned aviation operations and activities at all times.

25. The UAS may not be operated by the PIC from any moving device or vehicle.

26. All Flight operations must be conducted at least 500 feet from all nonparticipating persons, vessels, vehicles, and structures unless:
    a. Barriers or structures are present that sufficiently protect nonparticipating persons from the UA and/or debris in the event of an accident. The operator must ensure that nonparticipating persons remain under such protection. If a situation arises where nonparticipating persons leave such protection and are within 500 feet of the UA, flight operations must cease immediately in a manner ensuring the safety of nonparticipating persons; and
    b. The owner/controller of any vessels, vehicles or structures has granted permission for operating closer to those objects and the PIC has made a safety assessment of the risk of operating closer to those objects and determined that it does not present an undue hazard.

The PIC, VO, operator trainees or essential persons are not considered nonparticipating persons under this exemption.

27. All operations shall be conducted over private or controlled-access property with permission from the property owner/controller or authorized representative. Permission from property owner/controller or authorized representative will be obtained for each flight to be conducted.

28. Any incident, accident, or flight operation that transgresses the lateral or vertical boundaries of the operational area as defined by the applicable COA must be reported to the FAA's UAS Integration Office (AFS-80) within 24 hours. Accidents must be reported to the National Transportation Safety Board (NTSB) per instructions contained on the NTSB Web site: www.ntsb.gov.

If this exemption permits closed-set motion picture and television filming and production, the following additional conditions and limitations apply.

29. The operator must have a motion picture and television operations manual (MPTOM) as documented in this grant of exemption.

30. At least 3 days before aerial filming, the operator of the UAS affected by this exemption must submit a written Plan of Activities to the local Flight Standards District Office (FSDO) with jurisdiction over the area of proposed filming. The 3-day notification may be waived with the concurrence of the FSDO. The plan of activities must include at least the following:
    a. Dates and times for all flights;
    b. Name and phone number of the operator for the UAS aerial filming conducted under this grant of exemption;
    c. Name and phone number of the person responsible for the on-scene operation of the UAS;
    d. Make, model, and serial or N-Number of UAS to be used;
    e. Name and certificate number of UAS PICs involved in the aerial filming;
    f. A statement that the operator has obtained permission from property owners and/or local officials to conduct the filming production event; the list of those who gave permission must be made available to the inspector upon request;
    g. Signature of exemption holder or representative; and
    h. A description of the flight activity, including maps or diagrams of any area, city, town, county, and/or state over which filming will be conducted and the altitudes essential to accomplish the operation.

31. Flight operations may be conducted closer than 500 feet from participating persons consenting to be involved and necessary for the filming production, as specified in the exemption holder's MPTOM.

Unless otherwise specified in this grant of exemption, the UAS, the UAS PIC, and the UAS operations must comply with all applicable parts of 14 CFR including, but not limited to, parts 45, 47, 61, and 91.

This exemption terminates on April 30, 2017, unless sooner superseded or rescinded.

Sincerely,

/s/
John S. Duncan
Director, Flight Standards Service

Cooley LLP

September 10, 2014

U.S. Department of Transportation
Docket Management System
1200 New Jersey Ave., SE
Washington, DC 20590

RE: Exemption Request Under Section 333 of the FAA Modernization and Reform Act of 2012 and 14 C.F.R. Part 11

Dear Sir or Madam:

Pursuant to Section 333 of the FAA Modernization and Reform Act of 2012 ("FAA Reform Act") and 14 C.F.R. Part 11, AeroVironment, Inc. ("AV") requests exemptions from several provisions of the Federal Aviation Regulations ("FAR"), specifically portions of 14 C.F.R. Parts 45, 61, and 91 to allow, among other things, commercial operations of its Puma AE DDL unmanned aerial system ("Puma") in the continental United States ("CONUS") by individuals who have successfully completed, at a minimum, FAA private pilot ground instruction and passed the FAA private pilot written examination, or FAA-recognized equivalents, and completed AV's US Military-approved training program for operation of the UAS.

The Puma is an all-environment, electric-powered, hand-launched small unmanned aerial system ("UAS") that, depending on its payload, is capable of transmitting live airborne video images and location information to a Ground Control Station ("GCS") or conducting high resolution photogrammetry or LIDAR data collection. If used for high resolution photographs and LIDAR data, the Puma stores the photographs and data on board and makes them available for download after completion of the flight. The Puma has a maximum weight of 15.5 pounds, a wingspan of 9.2 feet, and a length of 4.7 feet. The Puma's minimum cruising speed and maximum speed are 36 feet/s and 69 feet/s, respectively. It is battery powered, has a flight endurance between two and three and one-half hours, can operate in temperatures ranging from -22°F to 122°F, and can be either hand-launched or launched from a rail launcher system to remove possible inconsistencies with hand-launching. The Puma's omni-directional antenna has a range of 6.2 miles, and its directional antenna has a range of 12.4 miles.[1]

The Puma is unique among the various UASs applying for exemptions under Section 333 because it has received a restricted category type certificate from the FAA based on its acceptance for use by the US Military.[2] The Puma has an unparalleled safety record based on this experience. When its experience is considered in tandem with the remote areas in which it

[1] For more detailed information on the Puma's specification, AV directs the FAA to its type certificate data sheet Q00018LA. AV also incorporates by reference all of the materials submitted in support of its application for a Restricted Category Type Certificate, Q00018LA, and Certificate of Waiver or Authorization, 2014-AHQ-100.

[2] FAA, Press Release, *FAA Approves First Commercial UAS Flights over Land* (June 10, 2014), http://www.faa.gov/news/press_releases/news_story.cfm?newsId=16354. A copy of the Restricted Category Type Certificate is attached as Exhibit 1.

will operate, it becomes clear that the Puma can operate safely in the National Airspace System ("NAS"), without posing a threat to national security, by operating in accordance with the requirements discussed herein.

The Puma's capabilities, along with AV's experience to date, make it ideally suited to conduct commercial operations such as agriculture, aerial surveying, and patrolling in remote areas (*i.e.* non-congested or non-populated areas, private or controlled-access property) under Class E or Class G airspace and within Visual Line of Sight ("VLOS"). Use of the Puma reduces the need to operate manned aircraft, decreasing the risk to the pilot, crew, and those on the ground as the Puma is carried to the site and not flown there with a load of flammable fuel.

As a result of the Puma's size, weight, maximum speed, operational capability, and safety record; the distance at which it will operate from airports and populated areas; and its operation using visual observers to provide deconfliction from other air traffic, the Puma does not create a hazard to users of the NAS or the public. Neither does it pose a threat to national security. Therefore, the FAA should grant AV the requested exemptions. Alternatively, if the FAA finds that modification of AV's application is required for safe operation of the Puma in the NAS, AV requests that the FAA delineate the required modifications and either process AV's application as if the modifications were already made or allow AV to amend its application to incorporate the FAA's findings.

The name and address of the applicant are:

AeroVironment, Inc.
Address: 900 Enchanted Way, Simi Valley, CA 93065
Attn: Andy Thurling
Ph: (805) 581-2198 ext. 1892
Fax: (805) 581-4512
Email: thurling@avinc.com

Attn: Doug Scott
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AV's exemption request encompasses the following regulations:[3]

[3] Based on a recent legal interpretation, AV does not believe that it needs an exemption from 14 C.F.R. §§ 91.9(b), 91.203(a), and 91.203(b) because the Puma's flight manual, airworthiness exemption, and registration certificate will be maintained at the pilot's control station. FAA Legal Interpretation from Mark W. Bury, Assistant Chief Counsel for International Law, Legislation and Regulations (August 8, 2014). Should the FAA determine that an exemption is required, AV respectfully requests one on the basis that similar exemptions have been granted on numerous occasions. *See* Exemptions 8607, 8737, 9299, 9565, 9665, 9789, 9797 10167, 10602, 10700, and 32827.

14 C.F.R. § 45.23(b)
14 C.F.R. § 61.113(a) and (b)
14 C.F.R. § 61.133(a)
14 C.F.R. § 91.7(a) and (b)
14 C.F.R. § 91.109(a)
14 C.F.R. § 91.119
14 C.F.R. § 91.151(a)
14 C.F.R. § 91.405(a)
14 C.F.R. § 91.407(a)(1)
14 C.F.R. § 91.409(a)(2)
14 C.F.R. § 91.417(a)

Section 333's Mandate and the Federal Aviation Act

Grant of this exemption application for use of the Puma in agriculture, precision aerial surveys, and patrols, pursuant to the exemption requested herein, will advance the Congressional mandate in Section 333 of the FAA Reform Act to accelerate the introduction of UASs into the NAS. Section 333 directs the Secretary of Transportation to consider whether certain UASs may operate safely in the NAS before completion of the rulemaking required under Section 332 of the FAA Reform Act. To make that determination, the Secretary must evaluate which types of UASs do not create a hazard to users of the NAS or the public or pose a threat to national security in light of several criteria:

- The UAS's size, weight, speed, and operational capability;
- Operation of the UAS in close proximity to airports and populated areas; and
- Operation of the UAS within visual line of sight of the operator.

FAA Reform Act § 333(b)(1). Once the Secretary determines that such vehicles "may operate safely in the national airspace system, the Secretary *shall* establish requirements for the safe operation of such aircraft in the national airspace system." *Id.* § 333(c) (emphasis added).[4]

The Federal Aviation Act expressly grants the FAA the authority to issue exemptions. 49 U.S.C. § 44701(f). This statutory authority, by its terms, includes exempting civil aircraft, as the term is defined under §40101 of the Act, from the requirements that all civil aircraft must have a current airworthiness certificate, 49 U.S.C. § 44711(a), and those used in commercial service must be piloted by private and/or commercial pilots. 14 C.F.R. §§ 61.113(a) and (b), 61.133.

The grant of the requested exemption is in the public interest based on (i) the clear direction in Section 333 of the FAA Reform Act; (ii) additional authority in the Federal Aviation Act, as amended; (iii) the strong equivalent level of safety surrounding the proposed operations; and (iv) the significant public benefit, including enhanced safety and cost savings associated with utilizing UASs for agriculture, aerial survey photography, and patrolling. Accordingly, AV respectfully requests that the FAA grant the requested exemption without delay.

[4] AV submits that this provision places a duty on the Administrator not only to process applications for exemptions under Section 333, but for the Administrator to supply conditions for the safe operation of the Puma if he deems the conditions proposed herein require modification necessary to allow approval. AV would welcome the opportunity to consult with FAA staff in order to address any issues or concerns related to this proposal that they believe may require modification.

Airworthiness

The Puma is safe and fit for operation in the NAS under the conditions listed herein. The FAA has deemed the Puma safe because the US Military has accepted it for use. The US Military has flown the Puma since 2007, amassing over one million flight hours on AV's family of sUAS. Based on the US Military's acceptance of the Puma, the FAA issued the Restricted Category Type Certificate Q00018LA and also recently granted AV a Certificate of Waiver or Authorization to conduct commercial operations over land in Alaska.[5]

In support of this application, AV is submitting, under separate cover and with a request for confidentiality, the following documents: the FAA-approved Airplane Flight Manual ("AFM") for the Puma, accepted May 20, 2014 by the FAA (Exhibit 3); the Puma's Maintenance Manual dated July 18, 2013 (Exhibit 4); the North Slope Standard Operating Procedures Manual ("SOP") dated May 2014 (Exhibit 5)[6]; and the AV Pilot Training Conduct Support Document dated May 4, 2012 (Exhibit 6).

Mandatory Operating Conditions

AV proposes that the grant of the exemption be subject to the following mandatory conditions, which are based upon operating conditions set forth for operation of UAS by public entities pursuant to Certificates of Waiver or Authorization, with additional restrictions:

- All operations to occur in Class G or Class E airspace.
- Operations to avoid congested or populated areas, which are depicted in yellow on VFR charts.
- Operations to be conducted over private or controlled-access property.
- Permission from land owner/controller required before commencing any flight.
- Operations to occur during Visual Flight Rules Meteorological Conditions (VMC).
- Aircraft to remain within Visual Line of Sight (VLOS).
- Operations to occur during daylight hours.
- Above Ground Level (AGL) altitude to be restricted to 400 feet.
- All operations conducted in vicinity of airport to remain more than 2.5 NM from centerline azimuth of runway centerline measured from runway thresholds.
- Operator will file a NOTAM for each flight.
- All required authorizations and permits will be obtained from territorial, state, county, or city jurisdictions, including local law enforcement, fire, or other governmental agencies.

[5] A copy of the COA for Alaska operations is attached as Exhibit 2.
[6] The North Slope SOP identifies requirements and describes procedures for the AV Digital Imaging and Mapping team to coordinate, plan, and conduct imaging operations for services in support of BP Exploration Alaska North Slope, Alaska. AV submits the North Shore SOP to illustrate to the FAA that AV takes the safety of its Puma operations very seriously. AV intends to supplement its application with a Standard Operating Procedures manual for operations in remote areas of CONUS as soon as possible.

Operator Requirements

AV respectfully proposes that operator requirements should take into account the characteristics of the particular UAS. The Puma is an inherently stable, light-weight aircraft that weighs 15.5 pounds and will be operated in remote areas. The safety concerns addressed by requiring a pilot certificate are not present; moreover, although the Puma can be configured to give the pilot full control of the aircraft and payload during flight, the Puma has an advanced autopilot that flies the aircraft, managing altitude and flight path within the intended flight envelope at all times when that flight mode is engaged. The autopilot limits maneuvering to simple airspeed, altitude, and turn rate changes. These limits are hard coded into the autopilot and define the aircraft's normal flight operating envelope. The autopilot manages pitch, bank, and throttle to maintain target airspeed, target turn rate, and target altitude. For in flight modes that do not use GPS, the operator manually guides the flight path by controlling target airspeed, target altitude, and target turn rate directly. In flight modes that use GPS, the autopilot controls target turn rate to fly to waypoints. The system does not allow commands that are outside of the normal operating envelope, and the operator never affects control surface movements directly. See Puma AFM, Exhibit 3, at 55-56.

Equally significant, even if a problem were to ever arise, the Puma is a modular structure, comprised of composite materials, several of which disassemble on impact to decrease risk of injury to people, absorb energy, and reduce damage to the Puma during landing. To that end, the Puma's wing is composed of Styrofoam laminated with a thin layer of Kevlar that disassembles into its sub-components upon impact.

The Puma Autoland feature enables landings in confined areas. Once Autoland begins, power is cut to the motor, the gimbaled payload is stowed (if installed), and the stabilator deflects fully trailing-edge upward. As a result, the aircraft pitches nose-up, with wings level, and begins a descent to the ground with approximately a 1:1 glide ratio. The pilot can steer during the Autoland phase, if required. Impact with the ground usually causes the Puma's components to separate. As noted above, this helps alleviate the impact of the landing and protects the airframe. During water landings, lanyards prevent separated parts from floating away from the fuselage, which will float. Landing pads on the bottom of the fuselage also provide impact protection.

During Loss of Link ("LOL"),[7] the Puma has three options—finish the programmed flight, land immediately, or go to a rally point. If link is re-established during LOL, the aircraft operator can simply press the enter button on the hand controller to resume the indicated flight mode or change to a desired flight mode. Setting the LOL action prior to launch is a mandatory check on the pre-flight check list. During loss of GPS, the pilot should use the Puma's last known bearing or terrain association to fly toward a landing site or select a suitable landing site and command the Puma to autoland.

[7] Loss of Link is identified by unchanging video and unchanging data and time, as well as the appearance of a clock symbol on the Link Status Bar. Loss of Link does not necessarily mean that the Puma has lost GPS.

Given these safety features, AV proposes that operators of the Puma should not be required to possess a commercial or private pilot certification. Instead, operators should be required to meet the following criteria:

- Successful completion, at a minimum, of FAA private pilot ground instruction and a passing score on the FAA private pilot written examination or FAA-recognized equivalents;
- Completion of the manufacturer's US Military-approved training program for operation of the UAS. The manufacturer's training program, which is discussed in Exhibit 6.

AV notes that the FAA has found that safety factors have permitted operation of UASs by operators with these qualifications pursuant to COAs for public aircraft when the mandatory operating conditions specified above were present. *See* Federal Aviation Administration, Notice N-8900.227, Unmanned Aircraft Systems (UAS) Operational Approval, at 20-21 (July 30, 2013).

Specific Exemption Requests and Equivalent Level of Safety Showings

14 C.F.R. § 45.23(b) – Display of marks; general

Section 45.23(b) provides as follows:

> When marks include only the Roman capital letter "N" and the registration number is displayed on limited, restricted or light-sport category aircraft or experimental or provisionally certificated aircraft, the operator must also display on that aircraft near each entrance to the cabin, cockpit, or pilot station, in letters not less than 2 inches nor more than 6 inches high, the words "limited," "restricted," "light-sport," "experimental," or "provisional," as applicable.

The Puma has no entrance to the cabin, cockpit, or pilot station on which the word "Restricted" can be placed as required by this provision. Two-inch lettering also is not possible given the overall size of the Puma. AV, therefore, requests an exemption to display, with one-inch lettering, the word "Restricted" on the forward fuselage in compliance with § 45.29(f).

The equivalent level of safety will be achieved by having the Puma marked with one-inch lettering on its forward fuselage because the pilot, observer, and others working with the UAV will see the identification of the UAS as "Restricted." The FAA has issued similar exemptions to this regulation, including to Pioneer Hi-Bred International, Inc., Exemption No. 10810; Raytheon Missile Systems/Advanced Programs, Exemption Nos. 10167 and 8738; and Trimble Navigation Limited, Exemptions No. 10700 and 11042.

14 C.F.R. §§ 61.113(a) and (b), 61.133(a) – Private Pilot Privileges and Limitations: Pilot in Command; Commercial Pilot Privileges and Limitations

Subsections (a) and (b) of § 61.113 prohibit private pilots from operating aircraft in commercial operations, and Section 61.133(a) requires an individual operating an aircraft for compensation or hire to hold a commercial pilot certificate. As mentioned above, the FAA has the statutory authority to waive the pilot requirements for commercial operations. 49 U.S.C. § 44701(f).

AV requests an exemption from 14 C.F.R. §§ 61.113(a) and (b) and 14 C.F.R. § 61.133(a) so that the Puma may be operated by individuals who have (a) completed FAA private ground instruction and passed the FAA private pilot written examination or FAA-recognized equivalent, and (b) completed AV's US Military-approved training program for operation of the Puma.

Based upon the design features of the Puma, its autopilot system and safety factors the FAA should permit operation of UASs by operators without a pilot certificate when the following conditions have been satisfied:

- The PIC has successfully completed, at a minimum, FAA private pilot ground instruction and passed the FAA private pilot written examination or FAA-recognized equivalents. (Airman Test Reports are valid for the 24-month period preceding the month the exam was completed, at which time the instruction and written examination must be repeated.)
- Operations occur during daylight hours.
- The operation is conducted in a sparsely populated location.
- Operations are approved and conducted solely within visual line-of-sight in Class E or Class G airspace.
- Visual line-of-sight operations are at an altitude of no more than 400 feet AGL at all times.
- Operations are conducted no closer than 5 NM from any FAA-designated airport or heliport other than the airport from which the aircraft is operating.
- The operation is conducted from a privately owned airfield, military installation, or off-airport location.

Federal Aviation Administration, Order 8900.1, 16-4-1-3(B)(5) (June 23, 2014); *see also* Federal Aviation Administration, Notice N-8900.227, Unmanned Aircraft Systems (UAS) Operational Approval, at 20-21 (July 30, 2013).

AV proposes to conduct operations in accordance with these restrictions. Given these conditions and restrictions, an equivalent level of safety will be provided by allowing operation of the Puma without a private pilot's certificate or a commercial pilot's certificate. The risks associated with the operation of the Puma (given its size, speed, operational capabilities, and lack of combustible fuel) are so much less than the level of risk associated with fixed wing and rotorcraft operations, both private and commercial, as contemplated by Part 61, that allowing operations of the Puma, as set forth above, meets or exceeds the present level of safety provided under 14 C.F.R. §§ 61.113(a) & (b) and 61.133(a).

14 C.F.R. § 91.7(a) and (b): Civil aircraft airworthiness.

Sections 91.7(a) and (b) prohibit operation of a civil aircraft unless it is in airworthy condition. AV requests an exemption from this regulation because the Puma would not operate with an airworthiness certificate under the proposal set forth in this filing.[8] Given the size of the aircraft and the requirements that have already been met in approval of AV's Restricted Category Type Certificate and Certificate of Waiver or Authorization, an equivalent level of safety will be achieved by insuring compliance with AV manuals prior to each flight.

14 C.F.R. § 91.109(a): Flight Instruction

Sections 91.109(a) provides that no person may operate a civil aircraft (except a manned free balloon) that is being used for flight instruction unless that aircraft has fully functioning dual controls.

The Puma is a remotely piloted aircraft, and, by design, it does not have fully functional dual controls. Flight control is accomplished through the use of a control box that communicates with the aircraft via radio communications. Completing instruction through AV's training program will ensure an equivalent level of safety.

The FAA has approved exemptions for flight training without fully functional dual controls for a number of aircraft and for flight instruction in experimental aircraft. *See* Exemption Nos. 5778K and 9862A.

14 C.F.R. § 91.119: Minimum Safe Altitudes

Section 91.119 establishes safe altitudes for operation of civil aircraft. Specifically, Section 91.119(c) limits aircraft flying over areas other than congested areas to an altitude of 500 feet above the surface, except over open water or sparsely populated areas. In those cases, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure.

As set forth herein, the Puma will never operate at higher than 400 feet AGL. It will, however, be operated in a manner that avoids congested or populated areas that are depicted in yellow on VFR sectional charts. Because agriculture, aerial survey work, and patrolling must be accomplished at relatively low altitudes, *i.e.*, less than 500 feet AGL, an exemption from Section 91.119(c) is needed.

The equivalent level of safety will be achieved given the size, weight, speed, and material with which the Puma is built. Also, no flight will be taken without the permission of the land owner or the party controlling the land. With advance notice to the landowner, all affected individuals will be aware of the agriculture, survey, and patrolling flights. Compared to similar operations conducted with conventional aircraft or rotorcraft, which weigh thousands of pounds and carry flammable fuel, any risk associated with these operations will be far less than those currently allowed with such conventional aircraft operating at or below 500 feet AGL. AV has received a

[8] The restricted category type certificate that AV has received for the Puma is limited to Alaska.

waiver for such operations in Alaska. *See* Exhibit 7. AV believes such operations can be conducted within the CONUS in Class E and Class G airspace for the same reasons justifying the waiver in Alaska.

14 C.F.R. § 91.151(a): Fuel Requirements for Flight in VFR Conditions

Section 91.151(a) prohibits an individual from beginning "a flight in an airplane under VFR conditions unless (considering wind and forecast weather conditions) there is enough fuel to fly to the first point of intended landing and, assuming normal cruising speed – (1) During the day, to fly after that for at least 30 minutes; or (2) At night, to fly after that for at least 45 minutes." 14 C.F.R. § 91.151(a).

The Puma's batteries provide between 2 and 3.5 hours of powered flight. Without an exemption from 14 C.F.R. § 91.151, the Puma's flights would be limited to approximately 1.5 hours in length. Given the limitations on its proposed operations and the location of those proposed operations, a longer time frame for flight in daylight VFR conditions is reasonable.

AV believes that an exemption from 14 C.F.R. § 91.151(a) is safe and consistent with the scope of a prior exemption. *See* Exemption 10673 (allowing Lockheed Martin Corporation to operate without compliance with 91.151(a)). Operating the Puma, a small UAS, without 30 minutes of reserve fuel does not engender the type of risks that Section 91.151(a) was meant to prevent. The fact that the Puma carries neither pilot, passenger, nor cargo also enhances its safety. Additionally, limiting Puma flights to 1.5 hours would greatly reduce its utility. In the unlikely event that the Puma should run out of fuel, it would simply land. Given its weight and construction material, the risks are less than contemplated by the current regulation.

AV believes that an equivalent level of safety can be achieved by maintaining 10 minutes of reserve fuel, which, allowing one hour and 50 minutes of flight time, would be more than adequate to return the UAS to its planned landing zone from anywhere in its operating area.

Similar exemptions have been granted to others, including Exemptions 2689F, 5745, 10673, and 10808.

14 C.F.R. § 91.405(a); 91.407(a)(1); 91.409(a)(2); 91.417(a): Maintenance Inspections

Section 91.405(a) requires that an aircraft operator or owner "[s]hall have that aircraft inspected as prescribed in subpart E of this part and shall between required inspections, except as provided in paragraph (c) of this section, have discrepancies repaired as prescribed in part 43 of this chapter." Section 91.407 similarly makes reference to requirements in Part 43; Section 91.409(a)(2) requires an annual inspection for the issuance of an air worthiness certificate. Section 91.417(a) requires that an owner or operator keep records showing certain maintenance work that has been accomplished by certificated mechanics, under Part 43, or licensed pilots and records of approval of the aircraft for return to service.

Maintenance of the Puma will be accomplished by the owner/operator pursuant to the manuals, provided by AV. See Exhibit 4. An equivalent level of safety will be achieved because the Puma is small in size, will carry no external payload, will operate only in restricted predetermined areas, and is not a complex mechanical device. As provided in the attached Maintenance Manual (Exhibit 4) and the SOP (Exhibit 5),[9] the operator of the Puma will ensure that it is in working order prior to initiating flight, perform required maintenance, and keep a log of any maintenance that is performed. Moreover, the operator is the person most familiar with the aircraft and is best suited to maintain the aircraft in an airworthy condition and to ensure an equivalent level of safety.

The Puma comes with one Field Repair Kit ("FRK"). The FRK includes the items necessary to complete field repairs or routine maintenance.

Federal Register Summary

Pursuant to 14 C.F.R. § 11.81(f), the following summary is provided for publication in the Federal Register, should the FAA determine that publication is needed:

> Docket No.: No. FAA-2014-____
> Petitioner: AeroVironment, Inc.
> Section of 14 CFR: 14 C.F.R. § 45.23(b), 14 C.F.R. § 61.113(a) and (b), 14 C.F.R. § 61.133(a), 14 C.F.R. § 91.7(a) and (b), 14 C.F.R. § 91.109(a), 14 C.F.R. § 91.119, 14 C.F.R. § 91.151(a), 14 C.F.R. § 91.405(a), 14 C.F.R. § 91.407(a)(1), 14 C.F.R. § 91.409(a)(2), 14 C.F.R. § 91.417(a).
> Description of Relief Sought: AeroVironment is seeking an exemption to conduct commercial agriculture, aerial survey, and patrol operations using a small unmanned vehicle (55lbs or less) in remote areas of the continental United States.

[9] Although the remote area SOP will differ in some respects from the North Slope SOP, it will include the identical requirements that the Puma operator ensure the Puma is in working order prior to flight, perform required maintenance, and keep a log of any maintenance performed.

Based upon the foregoing, AV requests that the FAA grant it the necessary exemptions under Section 333 of the FAA Reform Act and 49 U.S.C. § 44701(f) of the Federal Aviation Act as requested herein to allow commercial operations of the Puma within the continental United States and its territories.

Sincerely,

Jonathan B. Hill
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Benjamin M. Berlin
Counsel for AeroVironment, Inc.

cc: James Williams
Robert Pappas
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