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

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

July 27, 2015

Exemption No. 12167
Regulatory Docket No. FAA–2015–1689

Mr. Daniel Bliss
Bliss Laboratory of Information, Signals, and Systems
P.O. Box 875706
Tempe, AZ 85287-5706

Dear Mr. Bliss:

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.

By letter dated April 24, 2015, you petitioned the Federal Aviation Administration (FAA) on behalf of Bliss Laboratory of Information, Signals, and Systems (hereinafter petitioner or operator) for an exemption. The petitioner requested to operate an unmanned aircraft system (UAS) to conduct research.

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

The FAA has determined that good cause exists for not publishing a summary of the petition in the Federal Register because the requested exemption would not set a precedent, and any delay in acting on this petition would be detrimental to the petitioner.

**Airworthiness Certification**

The UAS proposed by the petitioner is a DJI Spreading Wings S1000.

The petitioner requested relief from 14 CFR part 21, *Certification procedures for products and parts, Subpart H—Airworthiness Certificates*. 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, *Certification 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[1]. 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, Bliss Laboratory of Information, Signals, and Systems 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.

[1] Aerial data collection includes any remote sensing and measuring by an instrument(s) aboard the UA. Examples include imagery (photography, video, infrared, etc.), electronic measurement (precision surveying, RF analysis, etc.), chemical measurement (particulate measurement, etc.), or any other gathering of data by instruments aboard the UA.

**Conditions and Limitations**

In this grant of exemption, Bliss Laboratory of Information, Signals, and Systems 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 DJI Spreading Wings S1000 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 Columbia, 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 operations for the purpose of 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 July 31, 2017, unless sooner superseded or rescinded.

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

Enclosures

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

**From:** Daniel W. Bliss

**Subject:** Exemption Request Pursuant to Section 333 of the FAA Reform Act and Part 11 of the Federal Aviation Regulations

**Date:** April 24, 2015

---

## Executive Summary

The Bliss Laboratory of Information, Signals, and Systems (BLISS) at Arizona State University (ASU) conducts research in a variety of areas including advance wireless multiple-input and multiple-output (MIMO) communications, advance remote sensing, in-band full-duplex communications, and anticipatory physiological monitoring. BLISS is seeking a petition for exemption for relief from airworthiness certification requirements under the Federal Aviation Administration (FAA) Modernization and Reform Act of 2012, Public Law 112-95 FEB. 14, 2012, Section 333 in order to use UASs to conduct research and investigate the multiple-input and multiple-output (MIMO) wireless channel phenomenology of UAS vehicles within the National Airspace ("NAS") system.

encl: Troy Built Models DJI S-1000 Plus Pilots Operating Handbook
DJI Spreading Wings S1000 User Manual
ASU's Fire Prevention & Safety Plan

# Contents

**I Petitioner's Proposed UAS Operations Meet the Requirements of Section 333 of the Reform Act** **3**

**II Regulations From Which Exemption is Requested** **3**
- A 14 C.F.R. Part 21, Subpart H - Airworthiness Certificates . . . 4
- B 14 C.F.R. §45.23(b): Aircraft Marking and Identification Requirements . . . 4
- C 14 C.F.R. §61.113 Private pilot privileges and limitations: Pilot in command (PIC) . . . 4
- D 14 C.F.R. §91.7(a) Civil Aircraft Airworthiness . . . 5
- E 14 C.F.R. §91.9 (b)(2) Civil Aircraft Flight Manual in the Aircraft . . . 5
- F 14 C.F.R. §91.103(b) Pre-flight Action . . . 5
- G 14 C.F.R. §91.105 Flight Crewmembers at Stations . . . 5
- H C.F.R. §91.119 Minimum Safe Altitudes . . . 5
- I 14 C.F.R. §91.121 Altimeter Settings . . . 5
- J 14 C.F.R. §91.151(a) Fuel Requirements for Flight in VFR Conditions . . . 6
- K 14 C.F.R. §91.203 Civil Aircraft: Certifications Required . . . 6
- L 14 C.F.R. §91.405 Maintenance required . . . 6
- M 14 C.F.R. §91.407 Operation after Maintenance, Preventive Maintenance, Rebuilding, Alteration . . . 6
- N 14 C.F.R. §91.409 Inspections . . . 6
- O 14 C.F.R. §91.417 Maintenance records . . . 7

**III Public Interest** **7**

**IV Privacy** **7**

**V Federal Register Summary** **7**

**VI Conclusion** **8**

# I Petitioner's Proposed UAS Operations Meet the Requirements of Section 333 of the Reform Act

The Bliss Laboratory of Information, Signals, and Systems (BLISS) seeks an exemption to use Unmanned Aircraft Systems (UASs) to conduct research and investigate the multiple-input and multiple-output (MIMO) wireless channel phenomenology of UAS vehicles within the National Airspace ("NAS") system. The Petitioner has access to experienced aviation professionals, to cover all of the skill sets necessary to offer safe and effective UAS services. In addition, Petitioner's research team intends to consult with these professionals often during the experiments. In addition, the Petitioner will proactively encourage UAS capability and safety demonstrations to the general public and local government agencies in an effort to collectively convince these organizations that the operation of UASs is safe, controlled and in the public interest.

The Petitioner seeks an exemption to use Unmanned Aircraft Systems (UASs) to conduct research and investigate the multiple-input and multiple-output (MIMO) wireless channel phenomenology of UAS vehicles within the National Airspace ("NAS") system. The Petitioner plans to accomplish this using the DJI S-1000 Octocopter UAS model with a Universal Software Radio Peripheral (USRP) Software Defined Radio (SDR) B-210 (operating within the S band frequency range 2 GHz - 4 GHz) transceiver and Intel Next Unit of Computing (NUC) computer as the payload. Exemption is further sought to enable Petitioner to share the collected data with other US and local government agencies, government contractors, and academic research institutions who share a common interest in MIMO wireless channel phenomenology.

The Petitioner will operate small UASs, in accordance with ASU's Fire Prevention & Safety Plan, the DJI Spreading Wings S1000 User Manual (S1000UM), and the Troy Built Models, Inc. Pilot Operation Handbook (TBMPOH) for DJI S-1000/Zenmuse. Furthermore, any conditions that may be established by the FAA as required by Section 333. In brief, the requested exemptions would permit the operation of UAS that are less than 55 lbs:

- by an FAA licensed pilot;
- at less than 400 feet of altitude above ground level (AGL);
- in an area that is limited and predetermined;
- where public access to such area is controlled;
- where operational intentions are communicated to the local FSDO;
- in accordance with any other rules set forth by the FAA.

# II Regulations From Which Exemption is Requested

The Federal Aviation Act expressly grants the FAA the authority to issue exemptions. This statutory authority, by its terms, includes exempting civil aircraft, as the term is defined under §40101 of the Act, including UASs, from its safety regulations and minimum standards when the Administrator decides that a requested exemption is in the public interest.

Petitioner seeks an exemption from several interrelated provisions of 14 C.F.R. Parts 21, 45, 61 and 91 for purposes of conducting the requested operations using a UAS. Listed below are (1) the

specific sections of 14 C.F.R. for which exemption is sought, and (2) the operating procedures and safeguards that Petitioner has established which will ensure a level of safety better than or equal to the rules from which exemption is sought.

## A 14 C.F.R. Part 21, Subpart H - Airworthiness Certificates

Petitioner requests exemption from the requirements for an airworthiness certificate, pursuant to 49 U.S. Code §44701(f) and Section 333 of the Reform Act. The UAS here (DJI S1000) is manufactured without an airworthiness certificate and there are no mechanics to certify these aircraft, an equivalent level of flight safety is attained by special pilot training, ground based security procedures, as well as safety features programmed into the UAS to guard against lost or degraded communications, lost satellite reception, geomagnetic interference. The UAS to be operated here is less than fifty-five (55) lbs. fully loaded, fly at a speed of no more than forty (40) knots, fly at altitudes of less than four-hundred (400) feet above ground level (AGL), have a total flight time of no more than forty (40) minutes, and is controlled by a pilot that will maintain visual line-of-sight (VLOS), in accordance with the statutory mandate under Section 333 (b)(1). Additionally, the UAS will carry neither pilot nor passengers, carry no flammable liquid or explosive materials, and operate in an area that is secured to prevent public entry. Furthermore, the UAS flight will not be operated within four (4) miles of any airport, and notice will be given to the local Flight Service District Office (FSDO) prior flight operations

## B 14 C.F.R. §45.23(b): Aircraft Marking and Identification Requirements

Petitioner requests an exemption, or in the alternative, a finding that §45.23(b) does not apply as the UASs hereunder will not be issued experimental certificates. Due to the small size and weight (less than 24 lbs fully loaded) of the UAS, there is no place on the UAS to which the N-Number identification number can be placed such that it will be readable to the pilot and/or ground crew.

## C 14 C.F.R. §61.113 Private pilot privileges and limitations: Pilot in command (PIC)

Petitioner requests an exemption from the limitations of §61.113 as an equivalent level of safety can achieved through specialized flight experience in piloting the UAS as well as through practice on a UAS software simulator. The training and knowledge required for pilots of conventional aircraft would not necessary make a pilot safe to operate a UAS. In addition, safety for the public, pilot, and crew is achieved through the design limits of the aircraft and petitioner's adherence to the conditions for flight as established by the FAA as required by Section 333. Furthermore, the Petitioner has access to experienced aviation professionals, who have experience flying similar UASs to cover all of the skill sets necessary to offer safe and effective UAS services. In addition, Petitioner?s research team intends to consult with these professionals often during the experiments.

Here, the risk to the public is mitigated because the small size of the UAS prevents carrying pilot or passengers or any cargo other than a USRP B-210 transceiver and Intel NUC control computer. As a Pilot In Command (PIC), Visual Observer (VO) and crew will always remain on the ground, the level of safety is thereby greater than what can be achieved in traditional aircraft. Additionally, the TBMPOH prescribes further safeguards through advanced flight planning and operations in a controlled environment.

## D 14 C.F.R. §91.7(a) Civil Aircraft Airworthiness

Petitioner seeks exemption to the extent this rule requires an airworthiness certificate. As no such certificates exist for UASs. An equivalent level of safety will be achieved as the PIC of the UAS will ensure the airworthiness of the UAS through use of the procedures prescribed in the TBMPOH for pre-flight inspection, review of logs, and test flights.

## E 14 C.F.R. §91.9 (b)(2) Civil Aircraft Flight Manual in the Aircraft

Petitioner seeks exemption because there is no approved Flight Manual for the proposed UAS. An equivalent level of safety can be achieved through adherence to the TBMPOH which includes aircraft specifications, aircraft operational limitations, and an operations check-list. The pilot in command will keep the TMBPOH on site during flight operations.

## F 14 C.F.R. §91.103(b) Pre-flight Action

Petitioner seeks exemption to the extent the rule requires the PIC to have a runway and the proposed UAS is a Vertical Take-off and Landing (VTOL) vessel. Thus, it will not be operated within four (4) miles of any public airport. An equivalent level of safety and public benefit is achieved by the comprehensive flight planning and communications as described in the TMBPOH.

## G 14 C.F.R. §91.105 Flight Crewmembers at Stations

Petitioner seeks exemption as the UAS have no ability to carry pilot or crew, and thereby have no seats, seat belts, or crew stations. An equivalent level of safety can be achieved by the pilot always having positive control of the remote control and maintaining VLOS with the UAS at all times.

## H C.F.R. §91.119 Minimum Safe Altitudes

Petitioner seeks exemption here because flight operations will always be below four-hundred (400) feet AGL. An equivalent level of safety will be achieved through pre-flight planning, communication with the local FSDO, securing the flight area to prevent the public from entering, briefing all crew on emergency procedures, and ensuring operation of aircraft safety systems. Protections equivalent to minimum safe altitudes are created because, in the event of low-battery power, loss of communication or interference with communication between the remote control and the aircraft, on-board safety programs will automatically land the UAS at a predetermined safe area. Similarly, the operational environment will be controlled to keep out the public.

## I 14 C.F.R. §91.121 Altimeter Settings

Petitioner seeks an exemption because the proposed UAS is manufactured without a barometric altimeter and two-way communications radio. An equivalent level of safety is achieved through an on-board flight control system that features a GPS sensor, which streams altitude data in real

time to the PIC. Further safety is achieved through the Section 333 requirement that the PIC maintain VLOS at all times.

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

Petitioner seeks an exemption given that the UAS flight duration will be less than 30 minutes. An equivalent level of safety is achieved by implementation of a minimum battery life requirement rather than minimum fuel requirement. The FAA has stated that an equivalent level of safety is provided if the UAS flight is terminated with at least 25% reserve battery power still available. *See* Grant of Exemption to Astraeus Aerial, Docket No. FAA-2014-0352.

### K 14 C.F.R. §91.203 Civil Aircraft: Certifications Required

Petitioner seeks exemption as the PIC of the UAS will have the TMBPOH and S1000UM on hand during flight operations and communicate pertinent information to crew.. The TMBPOH and S1000UM include all documentation, safety information, and warnings required for safe operation of the UAS. Given that the UAS proposed to be operated here is manufactured without the capacity to carry documents and are sold without Airworthiness Certificates an equivalent level of safety can be achieved by the PIC maintaining VLOS with the UAS.

### L 14 C.F.R. §91.405 Maintenance required

Petitioner seeks exemption from these sections because they only apply to an aircraft with an airworthiness certificate, which the UAS vehicles do not have. An equivalent level of safety can be achieved by following the maintenance and repair recommendations set forth in the TMBPOH and S1000UM. The PIC will be responsible for inspecting the UAS prior to each flight and determining fitness for flight after maintenance and logging this information for future reference.

### M 14 C.F.R. §91.407 Operation after Maintenance, Preventive Maintenance, Rebuilding, Alteration

Petitioner seeks exemption from §91.407 as there are currently no persons authorized under 47.7 to service the UAS. The Petitioner is the person most familiar with the aircraft and best suited to maintain the aircraft and perform post-maintenance, pre-flight inspections and ground tests to confirm that the flight characteristics of the UAS have not been substantially effected after maintenance.

### N 14 C.F.R. §91.409 Inspections

Petitioner is seeking exemption from §91.409 for reasons similar to those articulated in the requests for exemption from §91.407 and §91.405 above. There are currently no persons authorized under §47.7 to service or inspect UAS, but an an equivalent level of safety will be achieved by petitioner making thorough pre-flight inspections and keeping detailed records of all maintenance or repairs.

As above, post-maintenance pre-flight inspections and ground tests will be conducted to confirm that the flight characteristics of the UAS have not been substantially effected.

### O 14 C.F.R. §91.417 Maintenance records

Petitioner is seeking exemption from 91.417 to the extent the rule requires a certificated person to perform work under 91.417(a)(1)(iii), compliance with Airworthiness Directives under sub- section (a)(1)(v), and / or copies of alteration forms under (a)(1)(vi). An equivalent level of safety will be achieved by petitioner keeping maintenance logs and documentation in the Aircraft Operational Handbook.

## III Public Interest

Granting Petitioner's exemption request furthers the public interest. National policy set by Congress favors early integration of UAS into the NAS in controlled, safe working environments such as those proposed in this petition. Furthermore, the data collected through the UAS experiments will be used to further study methods in improving wireless communications systems. The data will help to give researchers insight into airborne wireless channel phenomenology to help with development of better channel prediction and channel estimation algorithms. The UAS proposed for the exemptions is very light, with a twenty-four pound (24lb) maximum gross weight. It will not not carry any flammable liquid fuel, further reducing the risk from any potential accident. Petitioner has access to experienced aviation professionals, to cover all of the skill sets necessary to offer safe and effective UAS services. In addition, Petitioner?s research team intends to consult with these professionals throughout the experiments. Here all aspects of flight including pilot training and check-out, site evaluation, mission planning, contact with the appropriate FSDO, preflight inspections, crew briefings and site security during flight operations will ensure a level of safety to the public equivalent, or higher than that provided in current rules.

## IV Privacy

All flights will be conducted in accordance with any federal, state or local laws regarding privacy.

## V Federal Register Summary

Pursuant to 14 C.F.R. Part 11, the following summary is provided for publication in the Federal Register, should it be determined that publication is needed. Petitioner seeks an exemption from the following rules: 14 C.F.R. §§21 Subpart H, 45.23(b), 61.113 (a) & (b), 91.7(a), 91.9(b), 91.103(b)(2), 91.105, 91.109, 91.119, 91.121, 91.151(a), 91.203(a) & (b), 91.405, 91.407, 91.409, 91.417 (a) & (b). The exemption will enhance safety by reducing risk to the general public and property owners from the substantial hazards associated with performing equivalent work with conventional aircraft and rotorcraft.

# VI Conclusion

Satisfaction of the criteria provided in Section 333 of the Reform Act of2012-size, weight, speed, operating capabilities, proximity to airports and populated areas, operation within visual line of sight, and national security - provides more than adequate justification for the grant of the requested exemptions to permit Petitioner to operate the selected UAS and investigate the multiple-input and multiple-output (MIMO) wireless channel phenomenology of UAS vehicles within the National Airspace ("NAS") system. Granting the requested exemption will benefit the public interest as a whole in many ways, including (1) significantly improving safety and reducing risk by alleviating human exposure to danger, and (2) improving wireless channel estimation and prediction algorithms for improving wireless communication systems.