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## Section 333 Exemption Purpose

The exemption would allow operation of small Unmanned Aircraft Systems (sUAS) for the purpose of precision aerial surveys.

### **The petitioner requests relief from the following regulations:**

Part 21, Certification Procedures for Products and Parts, prescribes, in pertinent part, the procedural requirements for issuing and changing design approvals, production approvals, airworthiness certificates, and airworthiness approvals.

Section 45.23(b) prescribes, in pertinent part, that 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.

Section 61.113(a) and (b) prescribe that—

- (a) No person who holds a private pilot certificate may act as a pilot in command (PIC) of an aircraft that is carrying passengers or property for compensation or hire; nor may that person, for compensation or hire, act as PIC of an aircraft.
- (b) A private pilot may, for compensation or hire, act as PIC of an aircraft in connection with any business or employment if—
  - (1) The flight is only incidental to that business or employment; and
  - (2) The aircraft does not carry passengers or property for compensation or hire.

Section 91.7(a) prescribes that no person may operate a civil aircraft unless it is in an airworthy condition.

Section 91.9(b)(2) prescribes, in pertinent part, that no person may operate U.S.-registered civil aircraft unless there is available in the aircraft a current approved Airplane or Rotorcraft Flight Manual, approved manual material, markings, and placards, or any combination thereof.

Section 91.103 prescribes that each PIC shall, before beginning a flight, become familiar with all available information concerning that flight. This information must include—

- (b) For any flight, runway lengths at airports of intended use, and the following takeoff and landing distance information:
  - (1) For civil aircraft for which an approved Airplane or Rotorcraft Flight Manual containing takeoff and landing distance data is required, the takeoff and landing distance data contained therein; and
  - (2) For civil aircraft other than those specified in paragraph (b)(1) of this section, other reliable information appropriate to the aircraft, relating to aircraft performance under expected values of airport elevation and runway slope, aircraft gross weight, and wind and temperature.

Section 91.109 prescribes, in pertinent part, 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.

Section 91.119 prescribes that, except when necessary for takeoff or landing, no person may operate an aircraft below the following altitudes:

- (c) *Over other than congested areas.* 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.

Section 91.121 prescribes, in pertinent part, each person operating an aircraft to maintain cruising altitude by reference to an altimeter that is set “to the elevation of the departure airport or an appropriate altimeter setting available before departure.”

Section 91.151(a) prescribes that no person may begin a flight in an airplane under visual flight rules (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.

Section 91.203(a) prescribes, in pertinent part, that no person may operate a civil aircraft unless it has within it—

- (1) An appropriate and current airworthiness certificate; and
- (2) An effective U.S. registration certificate issued to its owner or, for operation within the United States, the second copy of the Aircraft Registration Application as provided for in § 47.31(c).

Section 91.203(b) prescribes, in pertinent part, that no person may operate a civil aircraft unless the airworthiness certificate or a special flight authorization issued under § 91.715 is displayed at the cabin or cockpit entrance so that it is legible to passengers or crew.

Section 91.405(a) prescribes, in pertinent part, that each owner of an aircraft operator or owner shall 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, Maintenance, Preventive Maintenance, Rebuilding, and Alteration.

Section 91.407(a)(1) prescribes that no person may operate any aircraft that has undergone maintenance, preventive maintenance, rebuilding, or alteration unless it has been approved for return to service by a person authorized under § 43.7 of this chapter.

Section 91.409(a)(2) prescribes, in pertinent part, that no person may operate an aircraft unless, within the preceding 12 calendar months, it has had an inspection for the issuance of an airworthiness certificate in accordance with part 21.

Section 91.417(a) and (b) prescribe, in pertinent part, that—

- (a) Each registered owner or operator shall keep the following records for the periods specified in paragraph (b) of this section:
  - (1) Records of the maintenance, preventive maintenance, and alteration and records of the 100-hour, annual, progressive, and other required or approved inspections, as appropriate, for each aircraft (including the airframe) and each engine, propeller, rotor, and appliance of an aircraft. The records must include—
    - (i) A description (or reference to data acceptable to the Administrator) of the work performed; and
    - (ii) The date of completion of the work performed; and
    - (iii) The signature and certificate number of the person approving the aircraft for return to service.
  - (2) Records containing the following information:
    - (i) The total time in service of the airframe, each engine, each propeller, and each rotor.
    - (ii) The current status of life-limited parts of each airframe, engine, propeller, rotor, and appliance.
    - (iii) The time since last overhaul of all items installed on the aircraft that are required to be overhauled on a specified time basis.

- (iv) The current inspection status of the aircraft, including the time since the last inspection required by the inspection program under which the aircraft and its appliances are maintained.
  - (v) The current status of applicable airworthiness directives (AD) and safety directives including, for each, the method of compliance, the AD or safety directive number and revision date. If the AD or safety directive involves recurring action, the time and date when the next action is required.
  - (vi) Copies of the forms prescribed by § 43.9(d) for each major alteration to the airframe and currently installed engines, rotors, propellers, and appliances.
- (b) The owner or operator shall retain the following records for the periods prescribed:
- (1) The records specified in paragraph (a)(1) of this section shall be retained until the work is repeated or superseded by other work or for 1 year after the work is performed.
  - (2) The records specified in paragraph (a)(2) of this section shall be retained and transferred with the aircraft at the time the aircraft is sold.
  - (3) A list of defects furnished to a registered owner or operator under § 43.11 shall be retained until the defects are repaired and the aircraft is approved for return to service.

### Unmanned Aircraft System (UAS)

The UAS Unmanned Experts proposes to use is constructed by Aeryon Labs, Inc. and referred to as the *Aeryon SkyRanger* (hereafter referred to as SkyRanger). The SkyRanger is commonly referred to as a quad copter (4 rotors and 4 motors) which weighs a total of 5.3 pounds (lbs.) without payload and is powered by lithium polymer batteries. It can carry payloads up to 600 grams (1 lb., 5 ounces) resulting in a total weight of no more than 6½ lbs. and has an operational range of up to 1.6 nautical miles. The SkyRanger can be operated with a maximum wind threshold of 40 miles per hour (MPH) for sustained winds and wind gusts up to 55 MPH.

The SkyRanger can be operated entirely by a touch-screen, map-based interface. This means the operator only needs to command the system where to go, and the system does all the flying for the operator. The SkyRanger can be operated in both semi and fully autonomous flight modes, with the operator simply clicking on a map to create a pre-planned flight path for a flight. In addition, the operator can create no fly zones or maximum flight ranges and altitudes so the system cannot enter areas deemed unsafe or unnecessary to fly over.

The petitioner states further that the UAS has built-in intelligent fault handling which allows the SkyRanger to detect a system fault while in the air and automatically fly back to its take-off location and land. Faults that can be detected include: loss of communication; exceeding pre-set wind thresholds; and low battery levels.

All flight operations are global positioning system (GPS) controlled, making the system easy to navigate. At any point if the operator is not explicitly commanding the system to move, the system automatically holds its GPS position. The flight control system employs not only GPS positioning but a variety of sensors including sonar, barometric pressure, temperature, wind speed and others to ensure stability so long as wind thresholds are not exceeded. Also a flight termination link – to prevent a “fly away” or other potentially dangerous situation – is available to the operator.

Regarding the display of appropriate aircraft markings (14 CFR 45.23), the petitioner states that the SkyRanger has no entrance to the cabin, cockpit, or pilot station on which the word “experimental” can be placed. Further, the petitioner requests an exemption because no official marking systems for UAS have been established yet for operations inside the National Airspace System (NAS). The petitioner has instead offered to mark the system with the name of the organization and location or origin.

The petitioner states that the maintenance requirements in §§ 91.405(a), 91.407(a)(1), 91.409(a)(2), 91.417(a) and (b) apply only to aircraft with an airworthiness certificate and are therefore inapplicable to its sUAS operations. The petitioner states that the SkyRanger is nearly maintenance free since it performs automatic pre-flight checks prior to flight and the failure of any check will prevent take-off. The petitioner notes that checks which cannot be done by the system will be performed by a qualified person prior to each flight. The petitioner further states that Original Equipment Manufacturer (OEM) requirements will be followed in the performance of maintenance, inspection and record keeping for the SkyRanger as provided in the Operations Guide. Also, the petitioner will implement a maintenance and quality assurance program for the SkyRanger.

The petitioner states that the OEM defines the maintenance requirements for the unmanned aircraft and per those requirements Unmanned Experts will ensure that OEM qualified maintainers are performing all inspections to precise OEM standards. No operations will take place without required inspections and maintenance items being completed. Further, all inspections and maintenance action items will be documented in aircraft logs and communicated to the OEM as required. Aircraft maintenance logbooks will be made available upon official request.

#### UAS Pilot In Command (PIC)

The petitioner asserts all operations of the SkyRanger will be conducted by a designated PIC who shall hold a current private pilot certificate with a valid third class airman medical certificate. Further, the petitioner indicates that the PICs will be certified to operate by the unmanned system manufacturer.

The petitioner notes that for all flight operations a PIC will be designated and this person will be directly responsible for the operation of the UAS and the safety of the operation. It will be the responsibility of the PIC to ensure the operation complies with all applicable regulations and/or ensures professional “best practice” to all applicable regulations.

In addition, for each operation an observer will be responsible to visually maintain contact with the SkyRanger and scan the area for undetected aircraft or obstacles. The observer will also handle the communications between the PIC, external crew, air safety officer and the platform safety officer.

## UAS Operating Parameters

The petitioner states that the SkyRanger will remain within Visual Line of Sight (VLOS) of the pilot and all flight operations will be conducted at least 5 miles from an airport and at least 3 miles from any city or densely populated area, which are depicted in yellow on VFR sectional charts. The petitioner will provide notification to the local Flight Standards District Office (FSDO) and airport controller of all operations within five miles of an airport. The petitioner notes that the SkyRanger will be restricted to an altitude of 400 feet above ground level (AGL). The petitioner states that all operations will occur during daylight hours and the FAA will have advance notice of all operations through the filing of notices-to-airmen (NOTAMs). All operations will occur under Visual Meteorological Conditions (VMC) only.

The petitioner asserts all operations will be conducted over private or controlled access property. Flight operations will be conducted at least 500 feet from all non-participating persons (persons other than the PIC or VO), vessels, vehicles, and structures unless:

1. Barriers or structures are present that sufficiently protect non-participating persons from debris in the event of an accident. The PIC will ensure that non-participating persons remain under such protection. If a situation arises where non-participating persons leave such protection and are within 500 feet of the UA, flight operations will cease immediately and/or;
2. The aircraft is operated near vessels, vehicles or structures where the land owner/controller has granted permission and the PIC has made a safety assessment of the risk of operating closer to those objects and;
3. Operations near the PIC or VO do not present an undue hazard to the PIC or VO, per § 91.119(a).

The petitioner further asserts that the size of the aircraft, the lack of flammable fuel, and the fact that the aircraft is carried to the location and not flown there all establish the equivalent level of safety. The petitioner states that the SkyRanger construction with energy absorbent material provides at least an equivalent level of safety compared to operations being conducted with conventional aircraft that would be orders-of-magnitude larger and would be carrying passengers, cargo, and flammable fuel.

With respect to the fuel requirements, the petitioner notes that, in order to meet the 30 minute reserve requirements in 14 CFR 91.151, UAS flights would have to be limited to approximately 20 minutes. The petitioner states that limiting SkyRanger flights to 20 minutes would greatly reduce their utility. The petitioner argues that, given the limitations on the UA's proposed operations and the location of those proposed operations, a longer time frame for flight in daylight VFR conditions is reasonable. The petitioner believes that an equivalent level of safety can be achieved by maintaining 10 minutes of reserve fuel, which, allowing 40 minutes of flight time, would be more than adequate to return the UAS to its planned landing zone from anywhere in its operating area.

## Public Interest

The petitioner states that, given the small size of the UA involved and the restricted sterile operating environment, its proposed operation "falls squarely within that zone of safety (an equivalent level of

safety) in which Congress envisioned that the FAA must, by exemption, allow commercial operations of sUAS to commence immediately.” Also because of the size of the UA and the restricted areas in which they will operate, approval of the application presents no national security issue. The petitioner argues that, given the clear direction in Public Law 112–95 § 333, the strong equivalent level of safety surrounding the proposed operations, and the significant public benefit, including enhanced safety and reduction in environmental impacts, granting the requested exemptions is in the public interest.