



23 July 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 Reform Act and Part 11 of the Federal Aviation Regulations

Dear Sir or Madam:

Pursuant to Section 333 of the FAA Modernization and Reform Act of 2012 (the "Reform Act") and 14 C.F.R. Part 11, Advanced Aviation Solutions LLC ("ADAVSO"), seeks an exemption from Federal Aviation Regulations ("FARs") detailed below for the eBee Ag Unmanned Aircraft System manufactured by SenseFly SA of Switzerland.

The requested exemption would support an application for a commercial Certificate of Authorization to use the system to support agriculture. The eBee Ag system consists of a lightweight (1.5 lb) battery operated aircraft, a PC-based ground control station, and associated communications equipment. The aircraft carries an onboard geo-referenced still camera that allows it to conduct precision photogrammetry and crop scouting at the resolutions necessary for precision agriculture. This high-resolution data can direct variable seeding rates as well as the precise application of fertilizer and chemicals reducing their use. This data helps farmers to maximize yields while reducing costs and impacts to the environment. By approving these exemptions, the FAA will create benefits to both agriculture and the environment which are ultimately in the public interest.<sup>1</sup>

The aircraft will be operated in the field with both a Pilot in Command (PIC) and a ground-based Visual Observer (VO) in accordance with FAA Policy N 8900.227 Section 14 "Operational Requirements for UAS" with the following additional restrictions:

- All operations will occur in Class G airspace at no more than 400' AGL
- Operations will be operated over private property with the permission of the land owner
- All required permits will be obtained from state and local government prior to operation
- The aircraft will not be operated over urban or populated areas
- The aircraft will not be operated at air shows or over an open-air assembly of people
- The aircraft will not be operated over heavily trafficked roads
- The aircraft will not be operated within 5 NM of an airport or heliport
- Operations will be limited to day, visual meteorological conditions
- Aircraft will remain within Visual Line of Sight at no greater than 1/2 NM of the PIC at all time
- While the aircraft is airborne, the VO will be positioned within voice distance to the PIC
- PIC will file a NOTAM providing radial/DME, radius, and a date/time group for each operation

The PIC and VO will meet the requirements outlined in FAA Policy N 8900.227 Section 16 Personnel Qualifications. Additionally, the PIC and VO will perform maintenance on the system

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<sup>1</sup> We will provide an explanation of equivalent level of safety for each exemption request, but will point back to the benefits to agriculture and the environment to justify why the requests are in the public interest.



and will complete a course of maintenance instruction as part of their initial training. Due to the simplicity of the system, we do not anticipate the need for a supplemental pilot.

We submit that the combination of the aircraft's light weight, historically demonstrated flight performance, fully qualified flight crew and strict operation under the guidelines established in 8900.227, the FAA can have confidence that the operation will have an equivalent or greater level of safety of manned aircraft performing the same mission.

The name and contact information of the applicant are:

Advanced Aviation Solutions LLC  
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The regulations from which the exemption is requested are as follows:

- 14 CFR Part 21
- 14 CFR 91.203
- 14 CFR 45.23, 45.29
- 14 CFR 91.9
- 14 CFR 61.113, 61.133
- 14 CFR 91.109, 91.119
- 14 CFR 91.121, 91.151
- 14 CFR Subpart E (91.401 - 91.417)
- FAA Policy 8900.227 Paragraph 16(c)(4) and Paragraph 16(e)(1)

We are prepared to modify or amend any part of this request to satisfy the need for an equivalent level of safety. We look forward to working with your office. Please contact us at any time if you require additional information or clarification.

Sincerely,

Bradley J. Ward  
Vice President

Appendices:

- A. Exemption Request and Equivalent Level of Safety
- B. Privacy Issues
- C. Safety Case
- D. Maintenance Procedures
- E. User Manual
- F. Training Program
- G. Aviation Experience

## EXEMPTION REQUESTS AND EQUIVALENT LEVEL OF SAFETY

Advanced Aviation Solutions requests an exemption from the following regulations as well as any additional regulations that may technically apply to the operation of the SenseFly eBee Ag:

### 14 CFR Part 21, Subpart H: Airworthiness Certificates

This part establishes the procedures for the issuance of an airworthiness certificate. While the FAA continues to work to develop airworthiness standards for UAS, we request an experimental certificate be issued for the SenseFly eBee Ag under either or both of the following provisions:

21.191 Experimental certificates.

Experimental certificates are issued for the following purposes:

**(a) *Research and development.*** Testing new aircraft design concepts, new aircraft equipment, new aircraft installations, new aircraft operating techniques, or new uses for aircraft.

**(b) *Showing compliance with regulations.*** Conducting flight tests and other operations to show compliance with the airworthiness regulations including flights to show compliance for issuance of type and supplemental type certificates, flights to substantiate major design changes, and flights to show compliance with the function and reliability requirements of the regulations.

Since the experimental certificate can be used for commercial purposes such as market surveys, sales demonstrations, and customer crew training, we would expect that an experimental certificate would permit our commercial purpose as well.

The aircraft will not carry persons or property, will not carry fuel, and will only fly under strict operational requirements. Combined with the fact that the aircraft weighs only 1.5 pounds and is constructed primarily out of foam, we propose that the eBee Ag will be at least as safe, if not safer, than a conventionally certificated aircraft performing the same mission.

If an experimental airworthiness certificate is not appropriate for this application, then we request an exemption of 14 CFR Part 21, Subpart H, and the requirement for an airworthiness certificate in general, citing the equivalent level of safety outlined in the previous paragraph.

### 14 CFR 91.203(a) & (b) Civil aircraft: Certifications required.

The regulation provides that an airworthiness certificate, with the registration number assigned to the aircraft and a registration certificate must be aboard the aircraft. Additionally, subparagraph (b) provides that the airworthiness certificate be "displayed at the cabin or cockpit entrance so that it is legible to passengers or crew." At 1.5 lbs, the eBee is too small to carry documentation, does not have an entrance, and is not capable of carrying passengers or crew.

To obtain an equivalent level of safety and meet the intent of 91.203, we propose that documents deemed appropriate for this aircraft by the FAA will be co-located with the crew at the ground control station and available for inspection upon request. In order to identify the aircraft, we propose that the information found on airworthiness and registration certificates be permanently affixed to the aircraft via placard:

Manufacturer: SenseFly SA  
Model: eBee Ag  
Serial Number: 14-XXXX

Registered to:  
Advanced Aviation Solutions LLC  
8111 Moerkle Street  
Anytown, OH 12345

If found please contact: (800)-555-1234.

#### **14 CFR 45.23 Display of marks; general and 45.29 Size of marks.**

These regulations provide that each aircraft must display "N" and the aircraft's registration number in letters at least 3 inches high. Additionally, the aircraft must display the word "EXPERIMENTAL" in letters at least 2 inches high near the entrance to the cabin, cockpit, or pilot station. The 1.5 pound eBee Ag does not have an entrance in which the word "EXPERIMENTAL" can be placed, and may not have a registration number assigned to it by the FAA.

We propose to achieve an equivalent level of safety by including the word "EXPERIMENTAL" on the top of the aircraft, where the PIC, VO and others in the vicinity of the aircraft while it is preparing for launch will be able to see the designation. Additionally, we feel that the permanent placard discussed in the previous paragraph will provide the aircraft's registration information should it be found on the ground. Finally, we will display at the ground station a high contrast flag or banner that contains the words "Unmanned Aircraft Ground Station" in letters 3 inches high or greater. Since the aircraft will operate within 1/2 NM of the ground station, the banner should be visible to anyone that observes the aircraft and chooses to investigate its point of origin.

#### **14 CFR 91.9 Civil aircraft flight manual, marking, and placard requirements.**

This regulation provides that no person may operate an aircraft unless a current, approved flight manual is in the aircraft. We assume that the intent of this requirement is to ensure that flight manual information is available to the aircrew while operating the aircraft. We request an exemption to this requirement since the aircraft is not only too small to carry documentation, the documentation would not be available to the crew.

To obtain an equivalent level of safety and meet the intent of 91.9, we propose that a current, approved Airplane Flight Manual (appendix E) must be available to the crew at the ground station anytime the aircraft is in, or preparing for, flight.

#### **14 CFR 61.113 Private pilot privileges and limitations: Pilot in Command and 61.133 Commercial pilot privileges and limitations.**

The regulation provides that no person that holds a private pilot certificate may act as pilot in command of an aircraft for compensation or hire. Subparagraph (b) allows a private pilot to act as pilot in command 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.

Our proposed operations meet the requirements of 8900.227 para 16(c)(2)(c) "Operations without a pilot certificate" in which the PIC is required to complete "FAA private pilot ground instruction" and pass "the FAA Private Pilot written examination." Since there are currently no means available for the pilot of a UAS to gain the experience in an equivalent category and class in order to apply for a commercial pilot's license, we propose to generate an equivalent level of safety by requiring our pilots to complete, at a minimum, FAA commercial pilot ground instruction and pass the FAA Commercial Pilot written examination in addition to completing the private pilot requirements. Since the aircraft cannot carry passengers or property, we feel we meet the intent of 61.113 Subparagraph (b) even though the intent of this application is to conduct a business.

#### **14 CFR 91.109 Flight instruction; Simulated instrument flight and certain flight tests**

The regulation provides that "No person may operate a civil aircraft that is being used for flight instruction unless that aircraft has fully functioning dual controls." The eBee ground control station is based on a small hand-held computer and while it does not offer a second set of "controls", both the student and instructor can, and will, operate the single set of controls simultaneously. With both student and instructor having "hands-on" the controls during flight, we feel that this technique meets the intent 91.109 and provides an equivalent level of safety.

#### **14 CFR 91.119 Minimum safe altitudes: General.**

The regulation provides that over sparsely populated areas the aircraft cannot be operated closer than 500 feet to any person, vessel, vehicle, or structure. Since the aircraft will be operating at a maximum of 400 feet AGL, we cannot comply with this requirement.

To provide an equivalent level of safety we will only fly over private property with the permission of the land owner. The land owner will be briefed of the expected route of flight and the associated risks to persons and property on the ground. We maintain that due to the small size of the eBee Ag, the hazard to persons, vessels, vehicles, and structures is not comparable to manned aircraft and should be considered in granting the exemption. (see appendix C section 6.4.1 Consideration about risks related to ground impacts)

The aircraft will not be operated over congested areas nor over any open air assembly of persons. The aircraft will be operated at an altitude allowing, if a power unit fails, an emergency landing without undue hazard to persons or property on the surface.

#### **14 CFR 91.121 Altimeter settings.**

The regulation provides that aircraft shall maintain cruising altitudes by reference to an altimeter setting available within 100 nautical miles of the aircraft. The aircraft will fly below 400 feet AGL and will not need to maintain hemispherical cruising altitudes in order to de-conflict with other aircraft. As such, an appropriate altimeter measurement presented to the pilot should be Above Ground Level and should be based on the barometric pressure at the point of launch. To provide an equivalent level of safety, the UAS's AGL altimeter will be set to zero on the ground prior to every flight. Since the aircraft will fly no more than 50 minutes, even rapid changes in barometric pressure will have limited affect on the safety of the flight.

**14 CFR 91.151 Fuel requirements for flight in VFR conditions.**

The regulation provides that no person may begin a flight in an airplane under day-VFR conditions unless there is enough fuel to fly to the first point of intended landing and to fly after that for at least 30 minutes. We feel the intention of this paragraph is to provide a reserve of energy as a safety buffer for go-arounds and other delays to landing.

The eBee Ag is battery operated and the maximum duration of flight from a single battery charge is 50 minutes. Since the aircraft will never fly more than 1/2 nm from the point of intended landing, a full battery charge at launch will ensure that we meet the reserve energy requirement of this paragraph. We request an exemption to the word "fuel" and ask for an equivalent interpretation with the word "energy".

**14 CFR Subpart E (91.401 - 91.417) - Maintenance, Preventive Maintenance, and Alterations**

The regulation provides that the operator is primarily responsible for maintaining the aircraft in an airworthy condition, including compliance with part 39 and 43. Paragraphs 91.407 and 91.409 require that the aircraft be "approved for return to service by a person authorized under 43.7" after maintenance and inspection. It is our intention that the PIC perform maintenance and inspection of the aircraft and "be authorized to approve the aircraft for return to service."

As provided in the attached Maintenance Procedures (appendix D), the PIC will ensure that the aircraft is in an airworthy condition prior to flight and conduct detailed inspections after every 10 hours. Maintenance performed by the PIC is limited to repairing small cracks, replacing a propeller, and updating software and firmware. All other maintenance will be performed by the manufacturer. The PIC will document work performed in accordance with 91.417. We feel that due to the size, construction, and simplicity of the aircraft, the PIC can ensure an equivalent level of safety.

**8900.227 Paragraph 16(c)(4) PIC Medical. and Paragraph 16(e)(1) Observer Medical.**

This policy provides that both the PIC and VO must have a valid FAA second-class medical certificate issued under part 67 in order to perform as a pilot or observer. The aircraft weighs 1.5 pounds and is constructed out of foam. Requiring the crew to meet the same medical requirements as a commercial pilot carrying passengers in a large aircraft is an unnecessary burden.

We propose that the minimum medical requirements be vision corrected to 20/20 and a valid, state-issued driver's license. Due to the size and weight of the aircraft, the greatest hazard of our proposed operation will be driving to the launch site. A licensed driver is medically qualified to operate a much larger vehicle. The 20/20 vision requirement will ensure that the PIC and VO can see and avoid air traffic. Given the unlikely event that both the PIC and VO become medically incapacitated while the aircraft is in flight, the eBee Ag will recover autonomously to the landing location designated prior to launch without crew intervention. It is our intention to hire and train military veterans that have experience operating electric UAS of similar size. Some of these veterans are disabled. Despite their disability, they cannot only safely operate the aircraft, they will bring invaluable operational experience ultimately making our operations safer. This request is in the public interest as it opens aviation related jobs to a section of the public that would not otherwise be medically qualified without introducing additional risk.