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

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

May 20, 2015

Exemption No. 11632
Regulatory Docket No. FAA–2015–0574

Mr. Dan H. Metcalf
Engineering Resources LLC
415 N. Center Street, Suite 4
Longview, TX 75601

Dear Mr. Metcalf:

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 March 5, 2015, you petitioned the Federal Aviation Administration (FAA) on behalf of Engineering Resources LLC (hereinafter petitioner or operator) for an exemption. The exemption would allow the petitioner to operate an unmanned aircraft system (UAS) to conduct precision aerial surveys.

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 are the SenseFly eBee and Sensefly eBee RTK.

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. 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, Engineering Resources LLC 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, Engineering Resources LLC 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 SenseFly eBee and Sensefly eBee RTK 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 5 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 May 31, 2017, unless sooner superseded or rescinded.

Sincerely,

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

Enclosures

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March 5, 2015

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 CFR Part 11, Engineering Resources LLC ("ER"), an engineering consulting firm, seeks an exemption from the Federal Aviation Regulations ("FARs") listed below and discussed in Appendix A. Attached as Appendix B is a summary of this request.

The requested exemption would permit commercial operation of both the eBee and eBee RTK (hereinafter jointly referred to as "eBee"), fixed wing UASs, manufactured by SenseFly Ltd (A Parrot Company, Route de Geneve 38, 1033 Cheseaux-Lausanne, Switzerland). The SenseFly eBee, which has a nominal take-off weight less than 2.0 lbs., will perform precision aerial surveys that consist of still photographs taken by onboard cameras. The eBee takes a series of high quality, still digital images that are used to produce precision digital point clouds, triangulated models, and contour maps of the surveyed area.

Mapping applications with the eBee may include agricultural applications, mining, construction and survey/GIS operations. The reason why the eBee solution has been very successful worldwide (thousands of operations in more than 50 countries) is that there are many operational benefits related to the use of this solution:

- The eBee brings safety to daily survey operations: there is no need for the humans to access dangerous working areas anymore (mines, quarries, or polluted sites). The missions can be programmed and reproduced reliably as often as needed for regularly updated maps.

- The eBee is a cost-effective solution. It is cheaper to operate a UAS rather than an aircraft or other ground systems for the same results. Moreover, small UAS like the eBee can help Ag businesses and farmers face the growing needs of the population while reducing operational costs. The eBee also enables the ability to take up new challenges -like water or environmental management through analysis of vegetation index maps.

- Users can save time and work more efficiently by using the eBee. A mission does not need a long preparation time or long deployment constraints, or long waiting time for

perfect weather conditions unlike, for example, the use of satellites. Initial results are accessible directly on-site, which is impossible with images provided by satellites or manned aircrafts.

- The eBee has social benefits too: it is eco-friendly (electric-powered), and its affordability allows many high-valued applications like data gathering for sustainability projects (agribusiness, reforestation) or post-disaster management missions.

- Use of the eBee for aerial surveys reduces the need to operate conventional aircraft for the same purpose and provides very high quality imagery at a fraction of the cost of surveys using conventional aircraft. These savings result in enhanced efficiency and productivity for the affected activities, as well as environmental benefits.

Operations under the exemption will be subject to strict operating requirements and conditions to ensure at least an equivalent level of safety to currently authorized operations using manned aircraft and under conditions as may be modified by the FAA as required by Section 333.

As described more fully below, the requested exemption would authorize commercial operations of aerial surveys using the eBee, which at less than 2.0 lbs. is small in size. The eBee has completed an airworthiness assessment, at the New Mexico State University Physical Science Laboratory's Unmanned Aircraft Systems Flight Test Center. The eBee will be operated under controlled conditions at low altitude in airspace that is limited in scope, as described more fully herein; it will have automated control features, as described below. The eBee also will be operated by an individual who holds a private pilot certificate and completed the manufacturer's training program for the UAS. Finally, the airspace in which the UAS will operate will be disclosed to the FAA in advance.

Engineering Resources respectfully submits that because this small, unmanned aerial vehicle - the eBee - will be used in lieu of comparatively hazardous operations now conducted with fixed wing and rotary conventional aircraft, the FAA can have confidence that the operations will achieve at least an equivalent level or greater level of safety. Approval of this exemption would thereby enhance safety and fulfill the Secretary of Transportation's (the FAA Administrator's) responsibilities under Section 333(c) of the Reform Act to "establish requirements for the safe operation of such aircraft systems in the national airspace system."

The name and address of the applicant are:

Engineering Resources LLC
Attn: Dan H. Metcalf, P.E.
Ph: 903-234-4570
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The regulations from which the exemption is requested are as follows:

14 CFR Part 21;
14 CFR 45.23(b);
14 CFR 61.113(a) & (b);
14 CFR 61.133(a);
14 CFR 91.7(a) & (b);
14 CFR 91.9(b)(2);
14 CFR 91.109(a);
14 CFR 91.119;
14 CFR 91.151(a);
14 CFR 91.203(a) & (b);
14 CFR 91.319(a)(1)
14 CFR 91.405(a);
14 CFR 91.407(a)(1);
14 CFR 91.409(a)(2);
14 CFR 91.417(a).

Appendix A discusses each rule listed above and explains why exemptions pursuant to the proposal set forth in this letter are appropriate, provide an equivalent level of safety, and are in the public interest.

THE APPLICABLE LEGAL STANDARD UNDER SECTION 333

Engineering Resources submits that grant of this exemption application for use of the eBee in precision aerial surveys will advance the Congressional mandate in Section 333 of the Reform Act to accelerate the introduction of UASs into the national airspace system ("NAS") if it can be accomplished safely. This law 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 Reform Act. In making this determination, the Secretary is required to determine 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 the following:

- Very light weight
    - The eBee is so light (less than 2 lbs) that the operator can launch it by hand and let it land on almost any surface without requiring a parachute or landing net (belly land). Its low kinetic energy (60 Joules ("J") at cruise speed) also significantly reduces the risk of hazardous situations. Finally, the wings of the eBee are detachable and made of flexible foam with no sharp or hard edges and almost no internal strengthening structure.

- Electric-powered
    - The eBee is electric-powered. A brushless engine technology makes it silent and reliable. The propeller is attached with two rubber bands to the body of the plane so that it can easily flex away in case of contact with any object.

- Semi-automatic flight
    - The artificial intelligence incorporated within the eBee autopilot system continuously analyzes data from the Inertial Measurement Unit and from the

onboard GPS and takes care of all the aspects of the flight, even in the absence of radio connection with the laptop. Take-off and landing phases are also fully controlled by the autopilot.

- Option for Manual control
  - Additionally, the eBee provides an override capability that allows the operator to take manual actions during the flight (Go to Home, Go Land, Hold and Resume the mission) and also suspend automated operations and take manual control of the aircraft should it become necessary to respond to emergency circumstances, thanks to the remote controller provided with the system.

- No operation of the UAS in within 5 nautical miles of the geographical center of an airport, without a letter of agreement with the airport's management;

- No operation of the UAS over congested or densely populated areas; and

- Operation of the UAS within visual line of sight of the operator.

Reform Act §333(a)(1). If 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).[1]

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, from the requirement that all civil aircraft must have a current airworthiness certificate and those regulations requiring commercial pilots to operate aircraft in commercial service:

> The Administrator may grant an exemption from a requirement of a regulation prescribed under subsection (a) or (b) of this section or any of sections 44702-44716 of this title if the Administrator finds the exemption is in the public interest.

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

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

Airworthiness of the eBee

SenseFly has demonstrated their respective airworthiness through many and varied national and international projects, involving state/federal agencies or universities (among others the New Mexico State University: http://newscenter.nmsu.edu/Articles/view/10208/nmsu-uas-flight-test-center-conducts-ebee-airworthiness-assessment, and the US Army Corps of Engineers ("USACE") New Orleans, who coordinated with the Department of Army and the FAA to obtain all authorizations required in order to operate the eBee (UAS). Moreover, SenseFly has obtained flight approvals for the eBee from the national civil aviation authority in many countries, including:

Switzerland (flight approval for Visual Line of Sight "VLOS" operations)
Canada (flight approval for VLOS operations)
Australia (flight approval for VLOS operations)
France (flight approval for Extended-VLOS operations)
Germany (flight approval for VLOS operations)
United Kingdom (flight approval for VLOS operations)
Norway (flight approval for VLOS operations)
Sweden (flight approval for VLOS operations)
Denmark (flight approval for VLOS operations)

Mandatory Operating Conditions

Grant of the exemption to Engineering Resources will 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 Authorization, with additional restrictions:

- All operations to occur in Class G 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) of the PIC.
- Operations to occur during daylight hours.
- Above Ground Level (AGL) altitude to be restricted to 500 feet.
- No operation will be conducted within 5 NM of an airport, without authorization.
- Operation will be in accordance with the NOTAM as required by the operator's COA.
- All required permissions and permits will be obtained from territorial, state, county or city jurisdictions, including local law enforcement, fire, or other appropriate governmental agencies.

Operator Requirements

Engineering Resources respectfully proposes that operator requirements should take into account the characteristics of the particular UAS. Certain UASs, such as the SenseFly eBee, are characterized by a high degree of pre-programmed control and various built-in technical capabilities that limit the potential for operation outside of the operating conditions set forth above.

The eBee is an ultra-light UAV platform made of flexible foam with no sharp or hard edge characterized by a high level of pre-programmed control and various built-in technical capabilities (programming of a geo-fence, automatic wind detection) that prevent the operator doing a mission outside of the operating limits. All flights are pre-programmed with GPS guidance and do not require human intervention; nevertheless human override is possible by clicking on one of the multiple "action" buttons or by using the remote controller provided with each eBee system. In the case of unplanned events, either the autopilot reacts immediately or the operator can choose between different pre-programmed or manual actions. Those procedures include a Flight Termination System (emergency landing procedure, triggered by the autopilot or the operator in charge: given its very light weight, the eBee will initiate a gliding approach to the ground at very low speed around the current location). Moreover, the kinetic energy of the aircraft is 60 J in-flight at cruise speed. In comparison, the kinetic energy of a football is about 110 J when thrown by hand.

Given those safety features, recognized by the U.S. Army Corps of Engineers and the national aviation authority of several countries, Engineering Resources requests an exemption from the airworthiness certification requirements in Part 21 and the concomitant requirements in 14 CFR 91.7(a) and 91.203 to operate an airworthy aircraft.

Given these safety features, Engineering Resources proposes that operator (PIC) of the eBee should not be required to hold a commercial pilot certification. Instead, operator should be required to:

- hold a private pilot certificate and a third-class airman medical certificate;
- have completed the manufacturer's training program for operation of the UAS.

Engineering Resources notes that the FAA has found that safety factors permitted operation of UASs by operators with these qualifications in the case of operations pursuant to public COAs 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). The FAA has the statutory authority to grant exemptions to the requirements for and privileges associated with the grant of airmen's certificates. 49 USC §44701(f).

In summary, applicant seeks an exemption from the FARs set forth above and in Appendix A to allow commercial operations of a small unmanned vehicle conducting precision aerial surveys.

Approval of the exemption allowing commercial operations of the eBee for precision survey work will enhance safety by reducing risk. Conventional aerial survey operations, using jet or piston-powered aircraft present risks associated with vehicles that weigh in the neighborhood of 5,000 to 7,000 lbs., or more, carry large quantities of fuel, passengers, and, in some cases, cargo. Such aircraft must fly to and from the survey location. In contrast, an eBee weighing less than 2 lbs. and powered by batteries eliminates a portion of that risk given the reduced mass and lack of combustible fuel carried on board. The eBee is carried to the survey location, not flown there. The eBee will carry no passengers or crew and, therefore, will not expose any individuals to the risks associated with manned aircraft flights.

Additionally, no national security issue is raised by the grant of the requested exemptions. Given the size, load carrying capacity, speed at which it operates, and the fact that it carries no explosives or other dangerous materials, the eBee poses no threat to national security.

The operation of the eBee, weighing less than 2 lbs., for precision surveys in accordance with the strict conditions outlined above, will provide an equivalent level of safety supporting the grant of the exemptions requested herein, including exempting Engineering Resources LLC from the requirements of Part 21 .

The eBee's satisfaction of the criteria set forth in Section 333 of the Reform Act - size, weight, speed, operating capabilities, lack of proximity to airports and populated areas, operation within visual line of sight, and national security - and its showing of an equivalent level of safety as it may relate to the requirement for a pilot's license, provide more than adequate justification for the grant of the requested exemptions allowing commercial operation of the eBee in the commercial precision aerial survey business.

Very truly yours,
ENGINEERING RESOURCES LLC

Dan H. Metcalf, P.E.
Engineering Manager

APPENDIX A

EXEMPTION REQUEST AND EQUIVALENT LEVEL OF SAFETY SHOWINGS UNDER APPLICABLE RULES SUBJECT TO EXEMPTION

Engineering Resources LLC requests an exemption from the following regulations as well as any additional regulations that may technically apply to the operation of the eBee:

14 CFR §45.23(b) – Display of marks; general

The regulation provides:

> 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 eBee has no entrance to the cabin, cockpit, or pilot station on which the word "Experimental" can be placed. Given the size of the eBee (38-in wingspan), two-inch lettering will be impossible. The word "Experimental" will be placed on the forward fuselage in compliance with §45.29(f).

The equivalent level of safety will be achieved by having the eBee marked on its forward fuselage as required by §45.29(f) where the pilot, observer, and others working with the UAV will see the identification of the UAS as "Experimental."

14 CFR Part 21, Subpart H - Airworthiness Certificates
14 CFR §91.203(a)(1) – Civil Aircraft: Certifications Required

Section 91.203(a)(1) requires all civil aircraft to have a certificate of airworthiness. Part 21, Subpart H, entitled Airworthiness Certificates, establishes the procedural requirements for the issuance of airworthiness certificates as required by FAR §91.203(a)(1). Given the size of the aircraft (less than 2.0 lbs.) and the limited operating area associated with its utilization, it is unnecessary to go through the certificate of airworthiness process under Part 21 Subpart H to achieve or exceed current safety levels.

Such an exemption meets the requirements of an equivalent level of safety under Part 11 and Section 333 of the Reform Act. The Federal Aviation Act and Section 333 of the Reform Act both authorize the FAA to exempt aircraft from the requirement for an airworthiness certificate, upon consideration of the size, weight, speed, operational capability, and proximity to airports and populated areas of the UAS involved.

In this case, an analysis of these criteria demonstrates that the eBee operated without an airworthiness certificate, under the conditions proposed herein, will be at least as safe, or safer, than a conventional aircraft (fixed wing or rotorcraft) with an airworthiness certificate. The eBee weighs less than 2 lbs. fully loaded. It will not carry a pilot or passenger, will not carry flammable fuel, and will operate exclusively within an area pre-disclosed and in compliance with conditions set forth herein. Operations under this exemption will be tightly controlled and monitored by both

the operator, pursuant to the conditions set forth above, and by local public safety requirements. The FAA will have advance notice of all operations through the filing of a NOTAM in accordance with the operator's COA. Receipt of the prior permission of the land owner, 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 eBee construction with absorbent material provides at least an equivalent level of safety to that of such operations being conducted with conventional aircraft that would be orders-of-magnitude larger and would be carrying passengers, cargo, and flammable fuel.

Additionally, SenseFly has demonstrated their respective airworthiness through many and varied national and international projects, involving state/federal agencies or universities (among others the New Mexico State University: http://newscenter.nmsu.edu/Articles/view/10208/nmsu-uas-flight-test-center-conducts-ebee-airworthiness-assessment, and the US Army Corps of Engineers ("USACE") New Orleans, who coordinated with the Department of Army and the FAA to obtain all authorizations required in order to operate the eBee (UAS).

14 CFR §61.113(a) & (b) - Private pilot privileges and limitations: Pilot in command; 14 CFR §61.133(a) - Commercial pilot privileges and limitations.

Section 61.113(a) & (b) limit private pilots to non-commercial operations. Unlike a conventional aircraft that carries a pilot, passengers, and cargo, the eBee in this case is remotely controlled with no passengers or property of others on board. Section 61.133(a) requires an individual with a commercial pilot's license to be pilot in command of an aircraft for compensation or hire. Engineering Resources respectfully proposes that operator requirements should take into account the characteristics of the particular UAS. SenseFly's eBee has a high degree of pre-programmed control and various built-in technical capabilities that strictly limit the potential for operation outside of the operating conditions set forth in the exemption application. Additional automated safety functions and safety enhancing features of the eBee include the following:

- Very light weight
    - The eBee is so light (less than 2 lbs) that the operator can launch it by hand and let it land on almost any surface without requiring a parachute or landing net (belly land). Its low kinetic energy (60 Joules ("J") at cruise speed) also significantly reduces the risk of hazardous situations. Finally, the wings of the eBee are detachable and made of flexible foam with no sharp or hard edges and almost no internal strengthening structure.

- Electric-powered
    - The eBee is electric-powered. A brushless engine technology makes it silent and reliable. The propeller is attached with two rubber bands to the body of the plane so that it can easily flex away in case of contact with any object.

- Semi-automatic flight
    - The artificial intelligence incorporated within the eBee autopilot system continuously analyzes data from the Inertial Measurement Unit and from the onboard GPS and takes care of all the aspects of the flight, even in the absence of radio connection with the laptop. Take-off and landing phases are also fully controlled by the autopilot.

- Option for Manual control
    - Additionally, the eBee provides an override capability that allows the operator to take manual actions during the flight (Go to Home, Go Land, Hold and Resume the mission) and also suspend automated operations and take manual control of the aircraft should it become necessary to respond to emergency circumstances, thanks to the remote controller provided with the system.

Given these safety features, Engineering Resources proposes that operators of the eBee should not be required to hold a commercial pilot's license. Instead, operators should be required to:

- possess at least a private pilot's certificate and at least a current third-class airman medical certificate;

- have completed the manufacturer's training program for operation of the UAS.

Engineering Resources notes that the FAA has found that safety factors permitted operation of UASs by operators with these qualifications in the case of operations pursuant to public COAs where the mandatory operating conditions specified above are present. *See* Federal Aviation Administration, Notice N-8900.227, Unmanned Aircraft Systems (UAS) Operational Approval, at 20-21 (July 30,2013). The FAA has the statutory authority, granted at 49 U.S.C.§44701(f) to waive the pilot requirements for commercial operations.

Given these conditions and restrictions, an equivalent level of safety will be provided by allowing operation of the eBee without a commercial pilot's certificate, under the conditions set forth herein.

The risks associated with the operation of the eBee (given its size, speed, operational capabilities, and lack of combustible fuel) are so diminished from the level of risk associated with private pilot operations or commercial operations contemplated by Part 61 with conventional aircraft (fixed wing or rotorcraft), that allowing operations of the UAS as set forth above meets or exceeds the present level of safety provided under 14 CFR §61.113(a) & (b) and does not rise to the level of requiring a commercial pilot to operate the aircraft under §61.133(a).

14 CFR §91.7(a) & (b) - Civil aircraft airworthiness.

This regulation requires that "no person may operate a civil aircraft unless it is in airworthy condition".

A confidential document, *Justification of airworthiness and safety assessment,* is submitted separately to justify granting an exemption to the requirements of 14 CFR §91.7(a) An exemption should be granted allowing commercial operation of the eBee without an airworthiness certificate based on the information contained in this technical documentation. An equivalent level of safety will be achieved by insuring compliance with the eBee user manual prior to each flight.

14 CFR §91.9(b)(2) - Civil aircraft flight manual, marking, and placard requirements

The regulation provides:

> No person may operate a U.S.-registered civil aircraft ...
>
> (2) For which an Airplane or Rotorcraft Flight Manual is not required by §21.5 of this chapter, 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.

Given the size and configuration of the eBee, it has no ability or place to carry such a flight manual on the aircraft, not only because there is no pilot on board, but because there is no room or capacity to carry such an item on the aircraft.

The equivalent level of safety will be achieved by keeping the flight manual at the ground control point where the pilot flying the UAS will have immediate access to it.

14 CFR §91.109(a) - Flight instruction; Simulated instrument flight and certain flight tests
14 CFR §91.319(a)(1) – Aircraft having experimental certificates: Operating Limitations:

These regulations provide 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 eBee is a remotely piloted aircraft and by design, 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. The flight plan is pre-programmed into the auto pilot before flight and only in unusual circumstances will the pilot input control functions to alter the pre-programmed flight. If instruction is accomplished through a training program, an equivalent level of safety will be assured. 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. The equivalent level of safety will be achieved by the manufacturer providing the training as outlined in the "eBee Training Documentation" and through the use of experienced and qualified pilots familiar with the eBee.

14 CFR §91.119 - Minimum Safe Altitudes

Section 91.119 establishes safe altitudes for operation of civil aircraft. Specifically, 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 eBee will never operate at higher than 500 feet AGL. It will, however, be operated to avoid congested or populated areas that are depicted in yellow on VFR sectional charts. Because aerial survey work must be accomplished at relatively low altitudes and at altitudes 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 eBee is built. Also, no flight will be taken without the permission of the land owner or

those who control the land. Because of the advance notice to the landowner, all affected individuals will be aware of the survey flights. Compared to aerial survey operations conducted with aircraft or rotorcraft weighing far more than 2 lbs. and carrying flammable fuel, any risk associated with these operations will be far less than those currently allowed with conventional aircraft operating at or below 500 feet AGL. Indeed, the low-altitude operations of the UAS will maintain separation between these small-UAS operations and the operations of conventional aircraft that must comply with Section 91.119.

14 CFR §91.151(a) - Fuel Requirements for Flight in VFR Conditions

This regulation 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."

As the eBee is electric-powered, this requirement is inapplicable. In any event, given the area of operation for the eBee, Engineering Resources believes that an equivalent level of safety is already achieved with the specific procedure preventing the eBee to accept a take-off order if the battery level is below a given value. Moreover, Sense Fly has integrated "low" and "critical" battery level warnings and implemented a "return to Home" (and "Go Land") actions in these situations.

Engineering Resources believes that an exemption from 14 CFR §91.151(a) is safe and within the scope of a prior exemption. *See* Exemption 10673 (allowing Lockheed Martin Corporation to operate without compliance with §91.151(a)). Operating the small UAS, without 30 minutes of reserve fuel does not engender the type of risks that Section §91.151(a) was meant to prevent given the size and speed at which the UAS operates. The fact that it carries no pilot, passenger, or cargo also enhances its safety.

14 CFR §91.203 (a) & (b) - Civil aircraft: Certifications Required

This regulation provides as follows:

> (a) . . . no person may operate a civil aircraft unless it has ... an appropriate and current airworthiness certificate.
> (b) No person may operate a civil aircraft unless the airworthiness certificate required by paragraph (a) of this section 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.

The eBee fully loaded weighs no more than 2 lbs. As such, there is no ability or place to carry certification and registration documents or to display them on the UAS. In addition, there is no pilot on board the aircraft.

An equivalent level of safety will be achieved by keeping these documents at the ground control point where the pilot flying the UAS will have immediate access to them. The FAA has issued numerous exemptions to this regulation.

14 CFR §91.405(a) – Maintenance required
14 CFR §407(a)(1) – Operation after maintenance, preventive maintenance, rebuilding, or alteration;
14 CFR §409(a)(2) - Inspections;
14 CFR §417(a) - Maintenance records

Section 91.405(a) requires that 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 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 the owner or operator to 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.

Engineering Resources proposes that the maintenance of the eBee will be accomplished by the owner or the operator according to the eBee user manual. An equivalent level of safety will be achieved because the eBee is small in size, it is not a complex mechanical device and does carry any external payload. 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. Finally, before every flight, the eBee automatically runs a sequence of pre-flight tests to make sure that every sensor and every critical part is operating properly. If a problem is detected, the eBee will not be able to be switched-on and a message error is displayed on the main screen of eMotion. The owner or the operator can then refer to the eBee user manual to troubleshoot this issue. Several parts of the eBee are easily interchangeable (propellers, wings), which allows the operator to make sure the wings and propulsion system are always airworthy when a mission is initiated.

APPENDIX B

Summarized for purposes of Federal Register publication:

Applicant seeks an exemption from the following rules:
14 CFR Part 21; 14 CFR 45.23(b); 14 CFR 61.113(a) & (b); 14 CFR 61.133(a); 14 CFR 91.7(a) & (b); 14 CFR 91.9(b)(2); 14 CFR 91.109(a); 14 CFR 91.119; 14 CFR 91.151(a); 14 CFR 91.203(a) & (b); 14 CFR 91.319(a)(1) 14 CFR 91.405(a); 14 CFR 91.407(a)(1); 14 CFR 91.409(a)(2); 14 CFR 91.417(a) to operate commercially a small unmanned vehicle (55lbs or less) augmenting its engineering and surveying operations.