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

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

July 21, 2015

Exemption No. 12098
Regulatory Docket No. FAA–2015–1011

Mr. Paul Hoff
CEO
Agribotix, LLC
2983 Sterling Court
Boulder, CO 80301

Dear Mr. Hoff:

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 6, 2015, you petitioned the Federal Aviation Administration (FAA) on behalf of Agribotix, LLC (hereinafter petitioner or operator) for an exemption. The petitioner requested to operate an unmanned aircraft system (UAS) to conduct operations and development of new UAS, and advanced imaging and analysis for precision agriculture services as well as monitor crops.

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 an Agribotix Hornet Drone and a Agribotix Enduro Quad.

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 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, Agribotix, 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.

[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, Agribotix, 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 Agribotix Hornet Drone and an Agribotix Enduro Quad(s) 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

Paul Hoff
Agribotix CEO

Abribotix, LLC
2983 Sterling Ct.
Boulder, CO 80301
Tel (971) 303-9981

The Honorable Anthony R. Foxx
Office of the Secretary
US Department of Transportation
1200 New Jersey Ave., SE
Washington, DC 20590

The Honorable Michael P. Huerta
Office of the Administrator
Federal Aviation Administration
800 Independence Avenue SW
Washington, DC 20591

April 6, 2015

RE: Agribotix LLC sUAS Airworthiness Exemption Petition for FMRA Sec 333 Exemption

Gentlemen:

Agribotix LLC ('Agribotix') hereby petitions the FAA for regulatory relief pursuant to Section 333 of P.L. 112–95 333 and 14 C.F.R. Sec. 11.81 to conduct commercial flights with Agribotix sUAS and to pursue research and development of Agribotix sUAS within defined areas of operation in rural farmland. Attached, therefore, is a request for exemption from airworthiness and specific Title 14 C.F.R. provisions for the types of sUAS and sUAS operations described in this Section 333 exemption petition. The FAA has issued grants of exemption in circumstances similar in all material respects to those presented in this petition, specifically Exemptions No. 11136, 11193, 11170, 11194, 11192, 11177, and 11166; and we therefore request that our petition be granted without delay.

Agribotix was founded after a fortuitous collaboration with the Denver Zoo to construct a quadcopter for wildlife observation in Mongolia. Subsequently, Agribotix projects have ranged from mapping glaciers with the University of Wellington in New Zealand, to developing a fixed wing airframe enabling the Denver Zoo, to surveying Argali Sheep, and educating elementary school students about unmanned aviation.

Agribotix builds fixed wing and multirotor aircraft, provides data analysis for agricultural applications including mapping crops, and provides full-service field management in the Midwest United States.

Agribotix manufactures two airframes for use in agriculture; the Agribotix Hornet Drone and the Agribotix Enduro Quad. The Hornet is designed and engineered to perform reliably and safely in the agricultural environment while the Enduro Quad is a multi-purpose platform for precision agriculture in small areas or for high-resolution imagery requirements. In addition to manufacturing sUASs, Agribotix provides a full turn-key data analysis service for precision agriculture.

This petition seeks authorization to operate the Agribotix sUAS described in this petition within remote, restricted-access areas. These areas of operations are located in rural, agricultural areas, similar to areas described in Exemption No. 11136, 11193, 11170, 11194, 11192, 11177, and 11166, and will generally fall within conditions of the blanket COA provided with the 333 grant. For any other operation, a COA will be sought.

Generally, Agribotix sUAS operations will be below an altitude of 400 ft. AGL, within specific access-restricted areas, either within Class G airspace or with the permission of the ATC, using sUAVs operated by Agribotix-qualified sUAS pilots, and within the visual line of sight of the operator and observer. These operational limitations are in accordance with both recently granted petitions as well as the Small UAS NPRM release February 15th, 2015. The UAVs described in this proposal are of small size and weight (less than 55 lb.), capable of relatively slow speeds (top speed of a UAV to be deployed under this petition is less than 100 mph.) and, as demonstrated in this petition and accompanying General Operating Manual (provided confidentially under separate cover), do not pose a threat to the safety of the NAS, persons on the ground, or national security.

This petition seeks authorization to conduct commercial and R&D flights according to the terms of this petition and the Agribotix General Operations Manual ('Agribotix Manual') which is composed of (1) an operations manual, (2) flight manuals for each of the Agribotix models; (3) an Operator Training Manual, and (4) a Maintenance and Inspection Manual. Please note that the Agribotix Manual (including all of the above listed components) are clearly marked "Confidential" on each page and contain confidential commercial and proprietary information that Agribotix has not and will not share with others who are not subject to a "Nondisclosure Agreement" (NDA). Therefore, the Agribotix Manual (including all components) are not available to the public and contain operating conditions, procedures and other information that are protected from public release or disclosure under the Freedom of Information Act 5 USC Sec. 552 et seq.

Why we require an exemption

Agribotix requires exemption from 14 CFR airworthiness and other requirements for both commerical operations and development of new UAS.

Commercial Operation

Commerical operations require an exemption because current FAA regulations do not allow for the commercial use of sUAS lacking airworthiness certificates in the NAS. Agribotix requests an airworthiness exemption for the specific types of sUAS described in this petition in order to carry sensor packages, e.g. film and video equipment, under the conditions and operating limitations outlined below and described in the Agribotix Manual. Agribotix intends to operate these sUAS to provide precision agriculture services to farms in the Midwestern United States in order to increase crop yields, reduce pesticide and water use, and enhance agricultural efficiency. It is imperative for the economic well-being of US farmers that the low-risk application of efficiency-enhancing and cost-reducing UAS technology in US agriculture be permitted, especially during drought conditions such as are being faced in many areas today.

Research and Development

In addition to providing commercial data analysis services, Agribotix designs and manufactures UAS for precision agriculture and therefore needs to be able to rapidly iterate upon and test our innovative designs. Unlike manned aircraft testing, which generally only requires airspace away

from air traffic above low-risk areas and which is mainly indifferent to the terrain; testing our sUAS requires acccess to real farms in order to evaluate the low-altitude, terrain-and-crop-dependent performance of both our aircraft and our sensors. Multiple, real-world farms growing multiple varieties of crops are a requirement for the functional testing of our aircraft.

Unfortunately, FAA Order 8130.34C for a Special Airworthiness Certificate: Experimental Category does not authorize the necessary variations in aircraft characteristics, systems, or test ranges to meaningfully test these sUAS and to iterate efficiently.

Therefore, to gain the meaningful data about sUAS features necessary for developing a program for safe and efficient sUAS operations, an exemption is required that authorizes R & D: 1) across a range of Agribotix models and prototypes, 2) in a variety of locations (subject to the restrictions outlined in this petition), and 3) for iterating on the systems, sensors, and airframes on an ongoing basis. Without this exemption the regulatory requirements for a Special Airworthiness Certificate, Experimental Category (SAC-EC) are overly burdensome because they forbid the necessary R & D; i.e. rapid iterations on early prototypes. Finally, as the FAA is well aware, the SAC-EC does not authorize commercial operations of the type described above such are required for Agribotix research and development.

The types of sUAS for which SkyWard requests exemptions

Agribotix designs and manufacturers sUAS that are low kinetic energy; these sUAS are approximately equivalent in size and performance to the US Air Force "Micro UAS" class of UAS. Specifically, these sUAS are small (< 2 meter in largest dimension), light-weight ($\sim$ 55 lb. or less), slow-moving (less than 100 mph) and operate close to the ground ($<$ 500 ft. AGL).

We believe that Agribotix sUAS meet the standard provided by Section 333 of the FMRA for a UAS to operate safely within the National Airspace prior to the completion of FMRA's required rule-making. Section 333 describes seven minimum criteria to determine whether an sUAS may operate safely in the NAS without creating a hazard or posing a threat to national security. These criteria comprise size, weight, speed, operational capability, operation in close proximity to airports, operation in close proximity to people, and operation within visual line of sight. Agribotix's sUAS are of a type and scale that meet these criteria and are equivalent to those for which FAA has recently granted Sec 333 exemptions (see Ex. No. 11136, 11193, 11170, 11194, 11192, 11177, 11166) and, similarly, are not anticipated to create a hazard to users of the National Airspace System ("NAS"), persons on the ground, or pose a threat to national security. Basic characteristics of the Agribotix UAVs are summarized below.

The Agribotix Intended Use

Agribotix, LLC. (hereinafter referred to as "Agribotix") is a drone-enabled software company that aims to provide advanced imaging and analysis for precision agriculture services as well as turn-key solutions for clients who wish to monitor crops utilizing unmanned aircraft.

Agribotix unmanned systems simplify and increase the accuracy of data collection in precision agriculture. High-resolution, high-frequency crop inspection and monitoring of agricultural farmland increases yearly yield; potentially saving the agriculture industry hundreds of thousands of dollars with minimal carbon footprint, and precision monitoring enables better use of scarce or expensive resources, such a water or pesticides.

Agribotix seeks to commercially operate its Hornet, Hornet LR and Enduro Quadcopter UAS in order to achieve the above uses and benefits.

Priority Safety Issues

Priority safety issues and resolution strategies are outlined in the Agribotix Manual. These include sUAS reliability and safe operations, Command and Control lost-link, and "See and Avoid" (also known as "Detect and Avoid" in the context of UAVs) requirements.

Reliability, Safety and Operation ofsUAS:

Operations in Class G airspace below 500 ft AGL 5 Miles or More From an Airport The region of operations for sUAS is below 500 ft AGL, in Class G airspace and 5 miles or more from an airport or otherwise in coordination with ATC. The airspace used will be wholly with the underlying property owner's written consent. Aircraft separation will be accomplished by flying under VFR rules during the day with a pilot and an observer both of whom are qualified according to the Agribotix Manual. See Pilot Requirements (section). In addition, the Agribotix Manual details fail-safe mechanisms including automatic return to home, slow descent and auto-land functions.

Operations in controlled Airspace (B, C, D), Below 500 Ft. AGL This region of operation of sUAS is below 500 ft AGL, in Class B, C, and D airspace. Two-way communication with ATC will be established before operations commence or before the sUAS enters controlled airspace. These operations will be wholly with the underlying property owner's written consent. Aircraft separation will be accomplished by flying under VFR rules during the day with a pilot, who is qualified and current according to the Agribotix Manual. See Pilot Requirements (section). In addition, the Agribotix Manual details fail-safe mechanisms including return to home, slow descent and auto-land.

Command and Control (C2) link failure modes, mitigation strategies. In addition to the area of operations safe-guards outlined above, lost link mitigation is achieved by redundant failure operation, auto-land, return-to-home, and geo-fencing to reduce the probability and mitigate the severity of a C2 failure. Risk assessment and mitigation procedures for spectrum interference, as well as weather, obstacles, and unforeseen events, are detailed in the Agribotix Manual.

14 CFR Sec. 91.113 Right of Way, See and Avoid Requirements Mitigation for reduced "See and Avoid" capability is that all proposed operations under this petition are at 500 AGL and below. In this near-surface airspace, the only other legally operating aircraft are other approved UAVs or those operating with a special use certificate (Life Flight, fire watch contractors etc.), or helicopters. Further risk mitigations include a PIC on all UAS operations, qualified according to the Agribotix Manual, to avoid aerial conflicts. Further, the proposed UAVs will fly only within visual line-of-sight of the PIC, under VFR conditions, and during daylight hours. We believe that types of sUAS and operations together with the protocols and characteristics outlined in this petition and detailed in the accompanying Agribotix Manual maintain the current high level of safety in the NAS and do not pose additional hazard to persons and property.

Pilot Requirements

In accordance with the knowledge requirements in Exemption No. 11062, and as described in detail in the Agribotix Manual, an A Pilot in Command (PIC) must:

- Be qualified and current according to the Agribotix Manual and passed the Private Pilot FAA Ground School knowledge test.
- Have flown and logged a minimum of 500 flight cycles and 25 hours of total time as a sUAS pilot for a given category of sUAS (rotorcraft or fixed-wing) and at least 10 hours logged as a sUAS pilot with a similar UAS type (single blade or multi-rotor).
- Have flown and logged a minimum of five hours as UAS pilot with the make and model of the Agribotix sUAS as well as three take-offs and landings in the preceding 90 days.

Documentation for pilot and observer qualification and currency will be maintained as per the Agribotix Operating Manual and will be available upon the FAA's request.

Information Supporting this Petition as Specified in 14 C.F.R. Sec. 11.81

This section responds to the specific requirements of 14 CFR Sec 11.81. The attached Exhibit A presents an analysis of the CFRs for which exemptions are requested.

(a) Mailing address and other contact information such as a fax number, telephone number, or email address copy.

Agribotix, LLC
ATTN: Paul Hoff 2983 Sterling Ct.
Boulder, CO 80301

Email: paul@agribotix.com

(b) The specific section or sections of 14 C.F.R. from which Agribotix seeks an exemption

- PART 61 CERTIFICATION: PILOTS, FLIGHT INSTRUCTORS, AND GROUND INSTRUCTORS
- PART 67 Medical Standards and Certification
- §91.109 Flight instruction; Simulated instrument flight and certain flight tests.
- §91.119 Minimum safe altitudes: General.
- §91.121 Altimeter settings.
- §91.151 Fuel requirements for flight in VFR conditions.
- §91.405 Maintenance required.
- §91.407 Operation after maintenance, preventive maintenance, rebuilding, or alteration.
- §91.409 Inspections.
- §91.413 ATC transponder tests and inspections.
- §91.215 ATC transponder and altitude reporting equipment and use.
- §91.417 Maintenance records.

- §91.7 Civil aircraft airworthiness.

(c) The extent of relief Agribotix seeks, and the reason Agribotix seeks the relief

A Section 333 exemption is required because current FAA regulations do not allow commercial use of sUAS in the NAS, or for appropriate research and development of sUAS. Agribotix requests an airworthiness exemption for the specific types of sUAS described in this petition to carry sensor packages for commercial applications such as videography and precision agriculture under the conditions and operating limitations outlined below and described in the Agribotix Manual. In addition, Agribotix is developing sUAS and sUAS software, so that sUAVs may fly safely and predictably in the NAS. In order to develop and test these sUAS under the variety of operational conditions that a sUAS will face in the NAS, it is necessary to test variations on aircraft characteristics, operating systems, and management systems in different, and real-world test environments. FAA regulations in FAA Order 8130.34C for a Special Airworthiness Certificate: Experimental Category do not authorize the necessary rapid modifications of aircraft characteristics and associated systems to sufficiently and efficiently test these sUAS.

Therefore, to gain meaningful data about the necessary features for safe and efficient sUAS operations, an exemption is necessary : 1) to operate a range of sUAS models and prototypes, 2) in a variety of locations (subject to the restrictions outlined in this petition), 3) to be permitted to adjust the systems and airframes tested on an ongoing basis, and 4) for both research and commercial use. Finally, as the FAA is well aware, the exemption is necessary because the SAC-EC does not authorize commercial operations of the type sought here, which is required for Agribotix to develop accurate data about the types of sUAS that are best suited for safe and effective operations. The attached document "Information Supporting Petition" details the extent of relief and reason for each FAR.

(d) The reasons why granting Agribotix's request would be in the public interest; that is, how it would benefit the public as a whole

The proposal is designed to establish a reasonable methodology to test specific types and platforms of sUAS, in a variety of environments, and to enable the safe and efficient deployment of commercial sUAS for agricultural purposes. The outputs of safe, reliable, and regulatory compliant operations of sUAS provide economic benefits historically unparalleled since the invention of flight, benefitting stakeholders at every level, both public and private. Lawful, safe aerial robotics operations will create new high-tech employment that will stimulate city and state governments; improve agriculture, create new small and large businesses; infuse new interest in STEM for children; and increase the safety of citizens through enhanced first-responder capabilities.

Specifically, sUAS-supported precision agriculture has the promise of dramatically increasing crop yields by identifying which crops are ready to be harvested, reducing farming uncertainty by providing better data to inform yield estimates, and reducing inefficiencies in inputs by identifying precisely where and when crops need to be treated with pesticide or irrigated. Crops can even be protected from depredation by birds by harmlessly shepherding the birds away from the fields. This is a much more sustainable method of mitigating the impact of wildlife to crops than other methods. And these are only a few of the many benefits that sUAS enabled precision agriculture will create and are creating now.

Grant of this petition would enable the research and operational development of sUAS to enable the safe and efficient acceleration of these significant public benefits to the American farmers and to the United States public as a whole.

(e) The reasons why granting the exemption would not adversely affect safety, or how the exemption would provide a level of safety at least equal to that provided by the rule from which Agribotix seeks the exemption

Agribotix operations will provide a level of safety that is equivalent to current aviation standards. Agribotix's safety procedures, risk assessments, and flight operations standards are described in detail in the accompanying Agribotix Operations Manual. In brief, the following procedures that apply during operations conducted under this exemption request, establish an equivalent level of safety (ELOS) as follows:

1. The Agribotix sUAS are less than 55 pounds and are battery powered.
2. All Agribotix sUAS will be U.S. registered and display marks either in accordance with 14 C.F.R. Part 45, Subpart C or approved alternative markings.
3. Agribotix sUAS operations under this exemption will be generally conducted within the visual line of sight of the pilot operator, at less than 400 feet AGL, and within Class G airspace. In addition, operations in controlled B,C, or D airspace will be conducted in coordination with FSDO and ATC with prior permission.
4. Consistent with the recently issued Section 333 Exemption No. 11062 (Astraeus Aerial) and others, Agribotix operations will be conducted in defined regions and over property authorized for this use by the landowner. All operations will remain within the geographic boundaries of the operating area. However, it is anticipated that most Agribotix operations may be conducted within the limitations of the blanket COA authorization provided with 333 grants as of 3–23–2015.
5. sUAS operations under this exemption will be conducted under the supervision of a designated pilot in command (PIC) who has final responsibility for the operation and in accordance with 14 C.F.R. 91.3. See the Pilot Requirements section below. All sUAS operators and observers must have completed training on the normal, abnormal, and emergency procedures in the Agribotix Manual, demonstrated proficiency with the sUAS being operated, and passed the Private Pilot FAA Ground School knowledge test. All Agribotix pilots will be required to pass a background check as provided by the TSA PreCheck program.
6. Operators and engineers will maintain the sUAS system in a condition for safe operation according to the Agribotix Manual and associated manufacturer's maintenance manuals, including pre-flight and post-flight inspections.
7. The PIC and observers will maintain situational awareness and perceive, process, and perform risk management prior to and during each operation as described in the Agribotix Manual. The PIC will terminate the operation in accordance with the Agribotix Manual if hazards that cannot be acceptably mitigated are observed.
8. sUAS will safely stop operating and either return home or auto-land at a location along the flight path if the control link is lost.
9. For each sUAS, the PIC will have the ability to force a controlled landing at any time.

In addition to the above, Agribotix has implemented a Safety Management System. The Agribotix Safety Manager is responsible for conducting safety audits, investigations, and inspections and is authorized to stop or prohibit any activity or operations which is considered unsafe. Full details are available in the Agribotix Manual.

Agribotix seeks this exemption to conduct commercial operations and supporting R&D of sUAS within restricted-access areas in the NAS. Without this exemption, sUAS innovation will be suppressed, the public economic benefits derived from increased sUAS development will be denied, and the Congressional directive to accelerate the integration of UAS into the NAS will be impeded. Agribotix sUAS physical and operational characteristics are compliant with those described in the FMRA and FAA's guidance for Sec 333 exemptions. Agribotix respectfully requests that the FAA grant its petition for exemption from airworthiness.

Please do not hesitate to contact Andrew McCollough, the Regulatory Services POC, via email at exemption@skyward.io if you have any questions or concerns.

Very Respectfully Yours,

Paul Hoff
Agribotix CEO

Agribotix sUAS Airworthiness Exemption Petition

Information Supporting Petition v1.0

April 6, 2015

Table of Contents

Table of Contents iii

List of Tables 1

1 Petition Justifications 3

2 Specific Exemption Requests 5

2.1 Part 61, Certification: Pilots, Flight Instructors, and Ground Instructors . . . 5

2.1.1 Extent of Relief . . . 5

2.1.2 Reason for Relief . . . 5

2.1.3 Public Benefit . . . 6

2.1.4 Equivalent Level of Safety . . . 6

2.2 §61.113 Private pilot privileges and limitations: Pilot in command. . . . 6

2.2.1 Extent of Relief . . . 6

2.2.2 Reason for Relief . . . 6

2.2.3 Public Benefit . . . 6

2.2.4 Equivalent Level of Safety . . . 6

2.3 Part 67, Medical Standards and Certification . . . 6

2.3.1 Extent of Relief . . . 6

2.3.2 Reason for Relief . . . 7

2.3.3 Public Benefit . . . 7

2.3.4 Equivalent Level of Safety . . . 7

2.4 §91.7 Civil aircraft airworthiness. §91.203 Airworthiness Certificates . . . 7

2.4.1 Extent of Relief . . . 7

2.4.2 Reason for Relief . . . 7

2.4.3 Public Benefit . . . 7

2.4.4 Equivalent Level of Safety . . . 7

2.5 §91.109, Flight instruction; Simulated instrument flight and certain flight tests. . . . 8

2.5.1 Extent of Relief . . . 8

2.5.2 Reason for Relief . . . 8

2.5.3 Public Benefit . . . 8

2.5.4 Equivalent Level of Safety . . . 8

2.6 §91.119, Minimum safe altitudes: General. . . . 8

2.6.1 Extent of Relief . . . 8

2.6.2 Reason for Relief . . . 8

2.6.3 Public Benefit . . . 8

2.6.4 Equivalent Level of Safety . . . 8

2.7 §91.121 Altimeter Settings . . . 9

2.7.1 Extent of Relief . . . 9

2.7.2 Reason for Relief . . . 9
2.7.3 Public Benefit . . . 9
2.7.4 Equivalent Level of Safety . . . 9
2.8 §91.413, ATC transponder tests and inspections. §91.215, ATC transponder and altitude reporting equipment and use. . . . 9
2.8.1 Extent of Relief . . . 9
2.8.2 Reason for Relief . . . 9
2.8.3 Public Benefit . . . 9
2.8.4 Equivalent Level of Safety . . . 9
2.9 §91.151, Fuel requirements for flight in VFR conditions. . . . 10
2.9.1 Extent of Relief . . . 10
2.9.2 Reason for Relief . . . 10
2.9.3 Public Benefit . . . 10
2.9.4 Equivalent Level of Safety . . . 10
2.10 91.405, 91.407 91.409 91.417; Inspection and Maintenance Programs . . . 10
2.10.1 Extent of Relief . . . 10
2.10.2 Reason for Relief . . . 10
2.10.3 Public Benefit . . . 10
2.10.4 Equivalent Level of Safety . . . 11

List of Tables

1.1 Exemption Justifications 4

Section 1

Petition Justifications

Exemption Justifications (Table 1.1), below, describes our general reasoning for each exemption request, the public good derived, and why we believe our operations nonetheless provide an equivalent level of safety to the manned aviation regulations. Detailed justifications are provided for specific requests in Specific Justifications (Section 2).

TABLE 1.1: EXEMPTION JUSTIFICATIONS

Item	Justification
Reason for Requesting Regulatory Relief	Integration of sUAS into the NAS requires rapid, iterative testing. It is an unreasonable burden to require airworthiness certification for each iteration, modification, or enhancement of each test airframe. In addition, the commercial use of Agribotix sUAS is not allowed under current FARs, even though the benefits are numerous and risks minimal. Thus, we required regulatory relief in order to build, test, and commercially operate our sUAS.
Public Benefit	The safe and reliable operation of sUAS will provide economic benefits historically unparalleled since the invention of flight to stakeholders at every level of public and private enterprise. sUAS operations will be able to create new high-tech jobs that will stimulate city and state governments, create new small and large businesses, infuse new interest in STEM for our children, increase the safety of citizens through enhanced first-responder capabilities, and enable precision agriculture to improve crop yields. Agribotix sUAS provide critical information to farmers to reduce agricultural inputs and enhance the efficiency of their farms. Especially in a time of drought, efficiency-enhancing tools to reduce water use are vital to agriculture. Agribotix sUAS and data services are exactly that tool.
Safety Equivalence	Agribotix operates at a level of safety equivalent to that of professional manned aviation. As stated above, our safety procedures, risk assessments, and flight operations standards will be submitted directly to AIR–200 or other appropriate FAA division for evaluation (local FSDO, etc.) as necessary; and are submitted under seperate cover with this petition. We are confident that our procedures meet professional aviation standards. In addition, Agribotix sUAS that are low-weight, operate at low velocity, and at low altitudes do not pose a probable risk of injury to persons or property.

Section 2

Specific Exemption Requests

Agribotix's reasons and explanation for requesting each exemption are presented below. In addition, we describe how we will maintain an equivalent level of safety to existing regulations for manual operation of manned aircraft, insofar as existing regulations apply to sUAS or sUAS operations.

2.1 PART 61, CERTIFICATION: PILOTS, FLIGHT INSTRUCTORS, AND GROUND INSTRUCTORS

2.1.1 EXTENT OF RELIEF

Part 61, all sections.

2.1.2 REASON FOR RELIEF

Agribotix believes that part 61 as written is not applicable to sUAS. The size, weight, and maximum velocity of sUAS ensures an equivalent level of safety with sUAS operators trained specifically on the operational capabilities of their sUAS. In addition, the sUAS category is not a specified category in part 61, hence compliance is not possible. Furthermore, actual control of the flight surfaces, rotors, motors, etc. is provided by the autopilot; sUAS operators simply specify heading or altitude direction to the autopilot. As a result, expertise in control of the sUAS can be obtained rapidly compared to manual operation manned aircraft. In addition, we believe that the operation of a manned aircraft is fundamentally different to that of the operation of a sUAS and therefore requires a skills set which is not addressed under part 61. Finally, it is the policy of Agribotix, as described in the operations manual, to require operators to have completed FAA ground instruction, passed the FAA written examination or equivalent, and become qualified with the specific sUAS flown. All pilots will have successfully completed the Agribotix education and training program.

Manned aviation pilot certification requirements, particularly of the "stick and rudder" variety are neither necessary nor appropriate for sUAV operators. Agribotix believes that the FAA has the statutory power under the FMRA to waive private pilot certification at their discretion, as indicated by the authorization to consider which certificates, including airworthiness etc. would "at a minimum" be required. The Federal Aviation Act, Subsection (t) of section 44701 provides the Administrator with broad authority to grant an exemptions and waivers should the exemption be in the public interest. In addition, the FAA has waived private pilot certification for flying vehicles much larger than sUAS, such as manned ultralight vehicles.

Agribotix believes that our pilot training, as well as the autopilot and failsafe technology, provide a better than equivalent level of safety for sUAS operations than the manned aviation pilot training applicable to a private pilot certificate and therefore a part 61 exemption should be granted.

2.1.3 PUBLIC BENEFIT

See Exemption Justifications (Table 1.1).

2.1.4 EQUIVALENT LEVEL OF SAFETY

All operations will be conducted under the supervision of a pilot in command that either possesses a sport pilot's license or has completed FAA ground instruction and passed the FAA written examination or equivalent. In addition, operators of Agribotix sUAS are required to demonstrate proficiency in the normal, abnormal, and emergency operating procedures of each sUAS flown. These operating procedures are defined in the Agribotix operations and training manual.

2.2 §61.113 PRIVATE PILOT PRIVILEGES AND LIMITATIONS: PILOT IN COMMAND.

2.2.1 EXTENT OF RELIEF

Relief from requirement to possess a private or commercial pilot's license for aerial work such as aerial survey and mapping.

2.2.2 REASON FOR RELIEF

§61.113 (a) stipulates that a holder of a private pilot certificate may not act as a pilot in command of an aircraft for compensation or hire; (b) states that a private pilot may act as PIC if the flight is incidental to business and does not carry passengers or property. Furthermore, N–8900.227 "Unmanned Aircraft Systems (UAS) Operational Approval" paragraph 16(c)(2)(c) "Operations without a pilot certificate" states that a operations which conform to said paragraph may be performed by a PIC that does not possess a private pilots license but that has completed FAA private pilot ground instruction and passed the FAA Private Pilot written test. In addition, there is no means currently of obtaining a commercial rating for UAS. Thus, we require relief in order to perform aerial work.

2.2.3 PUBLIC BENEFIT

See Exemption Justifications (Table 1.1).

2.2.4 EQUIVALENT LEVEL OF SAFETY

Our operations fullfill all the requirements in N–8900.227 16(c)(2)(c) for operations without a private pilots license. See Exemption Justifications (Table 1.1).

2.3 PART 67, MEDICAL STANDARDS AND CERTIFICATION

2.3.1 EXTENT OF RELIEF

Part 67, all provisions.

2.3.2 REASON FOR RELIEF

Manned aircraft pilot medical qualifications are stringent due to the great responsibility, physical demands, and safety concerns. sUAS in ultralight class of less than 55 lb. operating at low velocity and no more than 400 ft AGL do not pose the same level of risk and therefore, may be operated by individuals with medical qualifications at a different standard, namely, that of a Class C driver's license. Requiring individuals to possess a First, Second, or Third Class Medical certificate to operate a 5 lb. vehicle below 400 ft flying at less than 100 mph places an unreasonable burden on both individuals as well as the FAA. In addition, our use case is similar to that of Exemptions No. 11223, 11222, 11237, 11228 and others, for which no medical certification other than a valid United States driver's license was required.

2.3.3 PUBLIC BENEFIT

See Exemption Justifications (Table 1.1).

2.3.4 EQUIVALENT LEVEL OF SAFETY

Class C drivers license medical requirements, verified by possession of a valid driver's license.

2.4 §91.7 CIVIL AIRCRAFT AIRWORTHINESS. §91.203 AIRWORTHINESS CERTIFICATES

2.4.1 EXTENT OF RELIEF

Exemption from all provisions of part 91.7 for aircraft airworthiness or certification requirements.

2.4.2 REASON FOR RELIEF

Airworthiness certification is unneccessary given the size, weight, speed, and operational characteristics of Agribotix aircraft. In addition, the formal certification process would pose an unneccessary economic burden, hamper innovation, and reduce Agribotix competitiveness in the existing market.

2.4.3 PUBLIC BENEFIT

See Exemption Justifications (Table 1.1).

2.4.4 EQUIVALENT LEVEL OF SAFETY

Airworthiness certification for aircraft are intended to reduce the likelihood of injury to persons or property. sUAS of this size and performance characteristics pose no probable risk of injury to persons or property. Nonetheless, Agribotix will: 1) operate sUAS only under the authority of a pilot in command; 2) operate sUAS only under VFR in VMC, more than 5 nm from airports, in class G airspace and only when given authorization by the owner of the property from which the sUAS will take off, land, or fly over. These operating restrictions will provide equal or greater safety as those outlined §91.319. In addition, the low kinetic energy profile of this sUAS class ($<$ 10 lb. MTOW) indicate no probable harm to persons or property. Furthermore, adherence to Agribotix SOP procedures provide a professional aviation standard that mitigates operational risk. See Exemption Justifications (Table 1.1).

2.5 §91.109, FLIGHT INSTRUCTION; SIMULATED INSTRUMENT FLIGHT AND CERTAIN FLIGHT TESTS.

2.5.1 EXTENT OF RELIEF

§91.109, all provisions.

2.5.2 REASON FOR RELIEF

Agribotix sUAS are operated from a ground station and are, by design, not operable with multiple ground station controllers. Manned aviation equipment requirements such as dual controls, dual flight instruments, and seats are either unnecessary for the operation of or impossible to incorporate in sUAS. Flight instruction, therefore, is accomplished with the instructor standing next to the operator and providing direction as needed.

2.5.3 PUBLIC BENEFIT

See Exemption Justifications (Table 1.1).

2.5.4 EQUIVALENT LEVEL OF SAFETY

Agribotix sUAS operators will be trained to the standard described in the Agribotix Operations, Training, and Maintenance Manual. Manuals will be provided for inspection by the relevant FAA divisions. Instructional rigor will be proved by instructors experienced on the Agribotix sUAS.

2.6 §91.119, MINIMUM SAFE ALTITUDES: GENERAL.

2.6.1 EXTENT OF RELIEF

Section 91.119 establishes safe altitudes for operation of civil aircraft. 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.

2.6.2 REASON FOR RELIEF

Agribotix sUAS, as described above, will never be operated at greater than 400 ft AGL and as such, §91.119 is inappropriate to apply. sUAS aerial work in general, including Agribotix precision agriculture, aerial survey & mapping, oil and gas inspection, etc. is typically done at low altitude to realize the benefits that sUAS operations may provide.

2.6.3 PUBLIC BENEFIT

See Exemption Justifications (Table 1.1).

2.6.4 EQUIVALENT LEVEL OF SAFETY

See Exemption Justifications (Table 1.1).

2.7 §91.121 ALTIMETER SETTINGS

2.7.1 EXTENT OF RELIEF

§91.121

2.7.2 REASON FOR RELIEF

The sUAS Ground Control Station (GCS) uses both GPS and a barometric altimeter. The GPS provides location and altitude information and informs the barometer. The barometer is automatically calibrated with respect to pressure at the ground on start before takeoff. The current altitude is visible on the ground control station.

2.7.3 PUBLIC BENEFIT

See Exemption Justifications (Table 1.1).

2.7.4 EQUIVALENT LEVEL OF SAFETY

The altitude information will be provided to the sUAS PIC through a digitally encoded telemetric data feed. See also Exemption Justifications (Table 1.1).

2.8 §91.413, ATC TRANSPONDER TESTS AND INSPECTIONS. §91.215, ATC TRANSPONDER AND ALTITUDE REPORTING EQUIPMENT AND USE.

2.8.1 EXTENT OF RELIEF

§91.413 and §91.215.

2.8.2 REASON FOR RELIEF

ATC transponders are unnecessary for sUAS operating under 400 ft, VFR. Agribotix sUAS will be operated outside of Class A, B, and C airspace. In addition, the transponder adds unneeded weight to the aircraft reducing payload and flight performance.

2.8.3 PUBLIC BENEFIT

See Exemption Justifications (Table 1.1).

2.8.4 EQUIVALENT LEVEL OF SAFETY

The pilot in command and observer will deconflict airspace within VLOS. The PIC will communicate with ATC if required; however, operations will remain well outside a 5 nm radius around airports. See also Exemption Justifications (Table 1.1).

2.9 §91.151, FUEL REQUIREMENTS FOR FLIGHT IN VFR CONDITIONS.

2.9.1 EXTENT OF RELIEF

§91.151, all provisions.

2.9.2 REASON FOR RELIEF

The provision requires fuel sufficient for one half hour flight beyond the destination. The model sUAS flown by Agribotix are powered by a set of batteries and have a maximum flight duration of between 13 minutes and 80 minutes under optimal flight conditions, depending on the Agribotix UAS. Requiring a reserve of one half hour would reduce the effective endurance by nearly 40%, which is disproportionate to the size, speed, and operational limitions of the Agribotix aircraft. This limitation would make commercial operation unreasonably difficult, and therefore relief is required.

2.9.3 PUBLIC BENEFIT

See Exemption Justifications (Table 1.1).

2.9.4 EQUIVALENT LEVEL OF SAFETY

Even in the case of low battery power insufficient to return home, the sUAS will simply gradually land under control. Agribotix believes that an equivalent level of safety can be provided by reserving a minimum of 20% battery power to return home. In addition, as the home location is always within direct, unaided line of sight, 20% of battery is more than enough to enable any Agribotix aircraft to return home and land safely.

2.10 91.405, 91.407 91.409 91.417; INSPECTION AND MAINTENANCE PROGRAMS

2.10.1 EXTENT OF RELIEF

Part 91.405, Maintenance required; §91.407, Operation after maintenance, preventive maintenance, rebuilding, or alteration; §91.409, Inspections; and §91.417, Maintenance records.

2.10.2 REASON FOR RELIEF

The part 91 provisions are not applicable to a sUAS of the described weight class. Furthermore, there are no FAA certified mechanics for sUAS, so full compliance is not possible. In addition, the sUAS flown are mechanically simple, low-cost, and modular so that entire components including engines and propellers are minor replacements rather than major repairs. Finally, continuous minor alterations and payload reconfigurations of sUAS are designed and required for the normal operation of sUAS and do not negatively impact airworthiness.

2.10.3 PUBLIC BENEFIT

See Exemption Justifications (Table 1.1).

2.10.4 EQUIVALENT LEVEL OF SAFETY

Agribotix has developed inspection and maintenance manuals to maintain their sUAS in airworthy condition. Each sUAS is maintained according to Agribotix's standard by technicians proficient in the building, repair, and maintenance of the sUAS. Inspection and Maintenance manuals utilized by Agribotix contain all aircraft-relevant items. Maintenance records are maintained in the Agribotix Operations Database, and are therefore immediately auditable by regulators on demand.