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

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

May 13, 2015

Exemption No. 11574
Regulatory Docket No. FAA–2015–0352

Mr. Bret Lucas
Agri Tech Systems, LLC
12871 Geneva Street
Indianola, IA 50125

Dear Mr. Lucas:

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.

The Basis for Our Decision

By letter dated February 4, 2014, you petitioned the Federal Aviation Administration (FAA) on behalf of Agri Tech Systems, LLC (hereinafter petitioner or operator) for an exemption. The petitioner requested to operate an unmanned aircraft system (UAS) to conduct research on the applicability of sUAS for field mapping, prescriptive chemical application mapping, comprehensive crop analysis, field moisture mapping, collision avoidance, cell tower inspection, pipeline inspection and power line inspection.

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

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

Airworthiness Certification

The UAS proposed by the petitioner is a Pulse Aerospace, PA-01 Vapor.

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, Agri Tech Systems, 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, Agri Tech Systems, 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 Pulse Aerospace, PA-01 Vapor 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 May 31, 2017, unless sooner superseded or rescinded.

Sincerely,

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

February 4, 2014

U.S. Department of Transportation
Federal Docket Management System
1200 New Jersey Avenue, S.E.
Washington, D.C. 20590

Re: Petition of Agri Tech Systems, LLC. for an Exemption Pursuant to Section 333 of the FAA Modernization and Reform Act of 2012

Dear Sir or Madam:

Pursuant to section 333 of the FAA Modernization and Reform Act of 2012 (the "FMRA"), 49 U.S.C. § 44701 and 14 C.F.R. Part 11, Agri Tech Systems, LLC ("Agri Tech Systems" or "Petitioner"), a spin-out of Agri Tech Aviation Inc.("Agri Tech Aviation"), hereby requests an exemption to permit small unmanned aircraft system ("sUAS") operations as described in this petition. Agri Tech Systems requests an exemption for the purpose of conducting research on the applicability of sUAS for field mapping, prescriptive chemical application mapping, comprehensive crop analysis, field moisture mapping, collision avoidance, cell tower inspection, pipeline inspection and power line inspection.

sUAS operations will assist the agriculture sector in providing safer, faster and more cost effective alternatives to manned operations, both ground and air. Agri Tech Systems, requests an exemption, specifically, to research the application of sUAS in the agriculture industry and to distinguish those benefits from the current use of manned air and ground operations. Petitioner will investigate benefits for numerous sUAS applications including, but not limited to, field mapping, prescriptive chemical application mapping, comprehensive crop analysis, and field moisture mapping. Agri Tech Systems also wishes to partner with cell Tower, pipeline and power Line inspection companies to develop safe practices for sUAS use in these fields. This research will allow petitioner to assist regulators in setting standards for safe and effective operations of sUAS within agriculture and other industries. Petitioner intendeds to share all information learned with the Department of Transportation ("DOT") and the Federal Aviation Administration ("FAA").

The aerial application community has a vested interest in the safe operation of sUAS due to their existing, high tempo use of manned aircraft at low altitude for aerial application. The risks associated with the use of sUAS are of paramount concern to aerial applicators and Agri Tech Systems is uniquely positioned to evaluate these risks. Exploring the use of sUAS for agriculture applications and working with cell tower, pipeline and power line inspectors who often operate in the same airspace as aerial applicators will be critical to providing safety feedback to the DOT, FAA and others in the aerial application industry.

As described in detail below, Petitioner's proposed sUAS operations will follow the requirements set forth at section 333 of the FMRA. They will also provide invaluable information to the DOT and FAA as they create rules and policy for public commercial use of sUAS.

Agri Tech Systems' proposed operations will comply with strict safety standards. Operations will take place in sparsely inhabited, rural locations or within cell tower, pipeline or power line easements, involve highly trained, licensed pilots, occur at altitudes under 400 feet, and use a sUAS weighing 35 pounds,

complying with FMRA's cut-off weight of 55 pounds. In addition to the uses outlined above, ultimately, the use of sUAS will reduce the amount of chemicals used in aerial application and enhance and maximize agriculture operations for farmers, reducing environmental impact. The current use of manned aircraft for these operations is nearly cost prohibitive and ground based observation can be relatively ineffective. Agri Tech Systems' proposed operations will not have an impact on any citizen's privacy rights and will be in compliance with all privacy laws. Therefore, granting Agri Tech Systems' exemption request would be in the public's interest.

Contents

I. Description of Agri Tech Aviation and Agri Tech Systems, LLC

A. Agri Tech Aviation Inc.

Agri Tech Aviation is a leading U.S. agriculture aerial applicator in the Midwest. Established in 1947 as Laverty Sprayers, with the first application flight in Iowa by Weston Sharp. Today Agri Tech Aviation is owned by his son Terry Sharp and grandsons Jay and Weston. With years of experience and an impeccable safety record, Agri Tech Aviation has been recognized as a prominent force in the aerial application industry. The company has received numerous awards including: The Agrinaut Award (national award for outstanding contributions to the agriculture aviation industry) presented to Terry Sharp (owner), The John Robert Horne Award (national award for safest pilot with less than 5 years experience) presented to Van Lucas (Chief Pilot), and the Pro Patria Award (presented to 1 small business per year for supporting guard and reserve employees). Agri Tech Aviation records over 1500 hours of aerial application each year with no incidents or accidents.

B. Agri Tech Systems, LLC

Agri Tech Systems was created as a spin-out company for purposes of research and development of sUAS systems for agricultural use. The principal members in Agri Tech Aviation, through Agri Tech Systems, will use their knowledge and experience in the field of aerial application to develop the use of sUAS systems to enhance the safe integration of sUAS in the low altitude airspace. Agri Tech Systems will demonstrate applicability of the sUAS to the application and agronomy industries for potential spot treatments of pesticides, GPS mapping, field maintenance and problem detection. Agri Tech will also evaluate the use of sUAS in cell tower. pipeline and power line inspection within, what is often, shared airspace. While accomplishing these tasks, Agri Tech Systems intends to test and evaluate collision avoidance systems on the sUAS while agricultural airplanes are in the vicinity. Thereby creating a safer work environment for aerial application pilots who are most at risk to sUAS operating in rural agricultural areas.

The Petitioner's name and contact information is:

Agri Tech Systems, LLC
Attn: Bret Lucas
12871 Geneva Street
Indianola, IA 50125
Telephone: 515-961-4026
Email: bret@agritechsystems.com

II. Statutory and Regulatory Authority for Granting Petitioner's Request for an Exemption

A. Section 333 of the FMRA

Section 333 of the FMRA provides:

> The Secretary of Transportation shall determine if certain unmanned aircraft systems may operate safely in the national airspace system before completion of the plan and rulemaking required by section 332 of this Act or the guidance required by section 334 of this Act.2

Section 333 also states:

> If the Secretary determines under this section that certain unmanned aircraft systems may operate safely in the national airspace system, the Secretary *shall* establish requirements for the safe operation of such aircraft systems in the national airspace system (NAS).

The Secretary is required to determine whether certain sUAS operations should be permitted before issuance of the sUAS regulations required under section 332 of the FMRA. If the Secretary determines that the operations are safe, the Secretary must decide what the requirements will be for such operations. In other words, the Secretary is required to apply conditions for the safe operation of the sUAS in instances where the Secretary has determined that the system may operate safely in the NAS. The FAA has interpreted section 333, as a grant of limited statutory flexibility to expedite requirements for the safe operation of certain aircraft systems in the NAS.

Section 333 further states that when the Secretary of Transportation makes a determination under subsection (a), the Secretary must consider which types of sUAS would not create a hazard to others using the NAS or the public or pose a threat to national security. The Secretary is required to consider the following sUAS specifications and operational factors:

- Size
- Weight
- Speed
- Operational capability
- Proximity to airports and populated areas
- Operation with visual line of sight

If, upon consideration of the factors enumerated above, the proposed sUAS operations do not pose a threat to others using the NAS or to national security, the Secretary, acting through the FAA, may approve the proposed operations. As shown below, Agri Tech Systems' proposed sUAS operations will in no way create a hazard to the NAS or pose a threat to national security based on the factors set forth in section 333.

B. 49 U.S.C. Sections 40109 and 44701

Section 44701 requires the FAA Administrator to promote safe flight of civil aircraft by prescribing standards for aircraft and aircraft parts, inspecting, servicing and overhauling aircraft,

maximum hours for airmen, and other practices or procedures necessary for safety and national security. However, subsection (f) states that the FAA 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." In addition, Section 40109 authorizes the Administrator to "grant an exemption from a [safety] regulation prescribed in carrying out sections 40103(b)(l) and (2), 40119, 44901, 44903, 44906, and 44935-44937 of [49 U.S.C.] when the Administrator decides the exemption is in the public interest." Consequently, under the plain language of pertinent U.S. aviation law, the Administrator is expressly authorized to grant exemptions from the F AA's safety regulations where it would be in the public interest. As set forth in further detail below, granting Agri Tech Systems' petition for an exemption would be in the public interest.

C. 14 C.F.R. Part 11

The FAA's regulations state that, using a petition for exemption, an entity may ask FAA to grant it relief from current regulations in title 14 of the Code of Federal Regulations. 14 C.F .R. Part 11 provides the bases for requesting exemptions. The petitioner is required to state (1) the specific sections of Title 14 from which it seeks an exemption, (2) the extent of relief it seeks and (3) the reasons why granting the request would be in the public interest and 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 the petition seeks an exemption). As set forth below, Petitioner has fulfilled each of these criteria by demonstrating that granting its exemption will serve the public interest and not adversely affect safety.

III. Agri Tech Systems' Proposed Operations

A. Proposed sUAS Platform

Agri Tech Systems seeks an exemption permitting operations of a Pulse Aerospace, PA-01 Vapor sSUAS rotorcraft that weighs 35 pounds, including its imaging/mapping payload.

Geometry & Weights	Main Rotor Diameter	65 in
	Dimensions	51 x 25 x 19.4 in
	MaximumTakeoff Weight	35 lbs
	Empty Weight	16 lbs
	Payload Weight	5 lbs
	Data Link	2.4 GHz & 900 MHz
Performance	Endurance (Hover)	45 Minutes
	Endurance (Cruise)	60 Minutes
	Operational Radius	5 Miles
	Cruise Speed	25 mph
	Ceiling	15,000 ft
	Take Off Type	Automatic Vertical Take Off
	Landing Type	Automatic Vertical Landing

The Pulse Aerospace VAPOR has a proven track record of safety built on 4 years of operations and thousands of flight hours, operating in temperatures from 0-110F, at altitudes from seal level through 9,000 feet. The reliability and safety of the VAPOR UAS is founded upon the flight control system, which has been utilized for more than a decade on hundreds of various platforms, rotary and fixed wing aircraft, ranging from 5 to 1,200 lbs. Pulse has continued to improve the safety and reliability of the system by integrating industry leading safety features that have improved the robustness and reliability of the system. These include:

- emergency automatic autorotation (during powertrain failure or battery depletion),
- automatic RPM setting for various altitudes (currently demonstrated up to 12,000 ft AMSL)
- automatic sensor fault detection
- Automatic magnetic declination setting
- automatic engagement of GPS denied failsafe control system,
- automatic smart return to home (smarter way to return to home waypoint, given obstacles in path)
- redundant GPS+Glonass for robust satellite communication
- wide stance landing gear to mitigate dynamic rollover possibilities
- ease of use (high level of flight control and tasking automation)

The Vapor utilizes, aviation certified inertial sensors, professional, survey grade GPS/GLONASS and redundant flight control systems. Additionally, the Vapor is programmed with robust safety features including automatic autorotation and “auto-home” functions.

The Vapor utilizes a special algorithm which allows it to slow down as it enters turns and dramatically reduces the amount of over-flight required compared to fixed wing mapping, and other mapping platforms. This leads to a much smaller footprint to map a given area than other available platforms. This has the following benefits:

- More efficient flights - more area in less time
- The ability to fully cover a property without encroaching on neighboring properties
- It is easier to keep the aircraft within visual line of sight of the operator while covering a large mapping area

Finally, the control system for the Vapor allows the pilot in command to enter the parameters for each flight prior to takeoff, and simulate each flight prior to launch. This provides the pilot an additional layer of safety not normally available with manned flight.

The Vapor is substantially automated and constantly communicates flight status with the pilot in command throughout the duration of flight. This automation and the rigorous preflight planning and inspection ensure the safest possible conditions for each flight.

Additional, detailed information on the Vapor is included in Attachment “A” and it is requested that “Attachment A” be treated as a confidential proprietary document.

B. Aircraft Design and operational characteristics

All Vapor design features are included in Attachment “A” and should remain confidential.

Operational characteristics are outlined above and additional, specific characteristics are outlined in "Attachment A"

C. Aircraft inspection and maintenance

Aircraft inspection and maintenance are outlined in Attachment "A" and include general cleaning and maintenance. Additional information is included for more robust maintenance to be performed after every 10 hours of flight time. A maintenance log will be kept with the aircraft at all times.

D. Pilot and spotter qualification

The pilot in command of the Pulse Aerospace Vapor will be a licensed FAA pilot with a minimum rating of Private Pilot and current Third Class medical certificate. Both the pilot and spotter will complete the Pulse Aerospace training program for operation and maintenance of the Vapor. Recurrent training will be accomplished by performing a minimum of 3 takeoffs and landings every 90 days as well as reviewing any supplemental information provided by the manufacturer.

The pilot and spotter will be familiar with all applicable FAR's and sUAS operation. The following pilots will be trained in, and operate the Vapor should the exemption be granted:

Name	Rating	FAA Certificate Number
Terry Sharp-	Commercial, CFII	2209453CFI
Jay Sharp-	Commercial	3220260
Mark Kickbush -	Commercial	349649759
Van Lucas-	Commercial, A&P	2746079
Weston Sharp-	Private Pilot	3540161
Bret Lucas-	Private Pilot	2863760

All mapping and inspection payloads are tied into the automatic flight control system to enable automatic camera triggering to achieve desired image overlaps and provide precision georeference metadata for each image taken. The metadata includes GPS position, attitude angles, and a time-stamp. This automation eliminates the need for a third operator of the Vapor as the pilot can focus solely on aircraft operation and the spotter can observe the Vapor and scan for other aircraft.

E. Scope of operations

1. Area of operation

The area of operation will be rural Central Iowa over uninhabited areas of farmland. Express permission from the land owner or tenant farmer will be obtained prior to any operation. Operation will be limited to the following additional restrictions:

a. All flights will be operated below 400ft AGL in Class G airspace.
b. All flights will be operated during daytime VFR conditions.

c. All flights will be operated at least 3 miles from any public airport unless the following conditions are met:
    1. The airport manager approves flight within 3 miles of the airport
    2. A NOTAM is issued for that airport
    3. Two-way VHF communication over UNICOM can be maintained from the ground station to all manned aircraft so equipped
d. A NOTAM will be filed for operations providing the date, time and location of all sUAS activity.
e. The aircraft will not be operated over urban or populated areas.
f. The aircraft will not be operated over any person, group of people or at air shows. (All operations will be done consistent with the 14 C.F.R section 137 certificate held by Agri Tech Aviation)
g. The aircraft will be operated within visual line of sight of both the pilot and spotter at a distance no greater than ½ nautical mile.
h. The aircraft will not be operated over any heavily trafficked road or highway.
i. The maximum flight time will be 50 minutes or when battery power reaches 10%, whichever is shorter.
j. All flights will yield right of way to all manned aircraft operations.

2. Flight Planning and Briefing

A flight plan will be established for each area to be over flown by the sUAS. The flight plan will be used to determine the safest routes of flight, flight boundaries and identify any potential obstacles. Additionally, the PIC will get a current weather report and determine if any potential hazards exist for each planned flight. A safety briefing will be held prior to each flight to identify potential landing areas in the event of emergency and to discuss lost link procedures for the given location.

3. Communications (PIC and Spotter)

The pilot and spotter will always maintain voice communication with one another but with the ability to communicate by radio in the event of an emergency which does not permit voice communication.

4. Communication and Coordination with ATC

As stated above, a NOTAM will be filed for operations providing the date, time and location of all sUAS activity.

5. Flight limits

a. The sUAS will be operated at speeds under 30 knots.
b. The sUAS will not be operated in winds exceeding 25 knots, consistent with the manufacturer's recommendation.
c. All flights will be operated below 400ft AGL in Class G airspace.
d. All flights will be operated during daytime VFR conditions.

e. The aircraft will be operated within visual line of sight of both the pilot and spotter at a distance no greater than ½ nautical mile.

6. Lost Link contingencies

Should "Lost Link" occur, the Vapor will wait for a user defined timeout period (usually 10 sec). The Vapor will then return to HOME waypoint and land. Home waypoint is at takeoff location.

7. Emergency flight termination procedures

Depending on the flying location, possible actions are dead reckoning navigation recovery, engine shutdown/autorotation or controlled crash. A detailed list of potential emergency situations and the recommended procedures for each are included in Attachment "A".

F. Incident and Accident Reporting

Any incident or accident will be reported to the National Transportation Safety Board (NTSB) consistent with the provisions outlined in the Aeronautical Information Manual (AIM) 7-6-2.

IV. Regulations from which exemption is requested

Petitioner requests an exemption from the below-provisions governing aircraft operations within Title 14 of the Code of Federal Regulations in order to conduct research on the applicability of sUAS to research on the applicability of sUAS for agricultural field mapping, prescriptive chemical application mapping, comprehensive crop analysis, and field moisture mapping. Exemptions are requested from provisions within Parts 21, 45, 47, 49, 61 and 91 of Title 14. Petitioner addresses each relevant regulation below and provides a basis for requesting an exemption. Petitioner also provides the basis for achieving a level of safety that is either equal to, or greater than, the level of safety provided by the regulation from which an exemption is requested. Agri Tech Systems meets the requirements at Part 11 for exemptions, and, as set forth at section V, below, granting these exemptions are in the public interest as required under 49 U.S.C. section 44701(f).

14 C.F.R. Part 21 (Aircraft Certification).

14 C.F.R. Part 21, Subpart H sets forth requirements for airworthiness certificates as required by 14 C.F.R. § 91.203(a)(l). As explained above at section III (A) and (B), the Vapor's airworthiness has been proven. Further, given the size of the aircraft, low speed for operation, sparsely populated areas of operation, and the operation restrictions outlined above in section III (E), an exemption from Subpart H meets the equivalent level of safety under section 333 of the FMRA and 14 C.F.R. Part 11. The operations proposed in this petition will be as safe as, or safer than operations involving manned aircraft or rotorcraft operating with an airworthiness certificate and without the restrictions that Petitioner has proposed in this petition.

14 C.F.R. Part 45, subpart C and 14 C.F.R. 91.9 (Aircraft Marking).

Section 45.23 provides:

(a) Each operator of an aircraft must display on that aircraft marks consisting of the Roman capital letter "N" (denoting United States registration) followed by the registration number of the aircraft. Each suffix letter used in the marks displayed must also be a Roman capital letter.

(b) When marks include only the Roman capital letter "N" and the registration number is displayed on limited, restricted or light-sport category aircraft or experimental or provisionally certificated aircraft, the operator must also display on that aircraft near each entrance to the cabin, cockpit, or pilot station, in letters not less than 2 inches nor more than 6 inches high the words "limited" "restricted" "light-sport" "experimental," or "provisional," as applicable.

Section 91.9(c) provides

No person may operate a U.S.-registered civil aircraft unless that aircraft is identified in accordance with part 45 of this chapter.

The Vapor has no cabin, cockpit or pilot station, and, therefore, no entrance to any of these areas, on which the markings can be placed. Given the size of the Vapor, two-inch lettering will be impossible.

The Vapor Agri Tech Systems operates will be marked with the word “Experimental” on the sides of the front covering in letters as large as the covering will allow. Additionally, the Vapor will be marked with a serial number provided by the manufacturer and will also be marked with the words “Agri Tech Systems”. Agri Tech Systems will abide by any request by the FAA concerning this issue, within the limitations created by the size of the Vapor, in accordance with section 45.29(f). Due to the size of sUAS, the smaller size of lettering will not negatively impact safety, and will provide an equivalent level of safety to aircraft operating without an exemption.

14 C.F.R. Part 47 (Aircraft Registration) and Part 49 (Recordation of Aircraft Title and Security Documents).

14 C.F.R. Part 47 sets forth various aircraft registration requirements. Specifically, section 47.3(b) states that no person may operate an aircraft eligible for registration unless the aircraft has been registered by its owner. 14 C.F .R. Part 49 requires recordation of any conveyances affecting title to, or interest in, aircraft. Petitioner intends to register the Vapor sUAS pursuant to this section, however, in the event registration is denied for some unforeseen reason, petitioner seeks an exemption from the registration requirements outlined in Part 47. Additionally, petitioner intends to record its interest in the Vapor sUAS consistent with Part 49 of this section. Again, in the event registration is denied for some unforeseen reason, petitioner seeks an exemption from the recording requirements outlined in Part 49.

Whether the Vapor is able to be registered and the title recorded, or not, an equivalent level of safety can be achieved as that of a registered aircraft .

14 C.F.R. § 61.3(d) (Requirement of Certificate for Flight Instruction).

This regulation requires that only those holding a flight instructor certificate issued under the FAA's regulations can give training required to qualify a person for solo flights.

As no rating currently exists for the operation of sUAS, petitioner requests exemption from this requirement. All listed operators in this request for exemption hold, at minimum, a private pilot certificate and have each received mandated flight instruction for their respective ratings. Pulse Aerospace will provide all

operators with a rigorous 3 day training on the operation of the Vapor sUAS by qualified Vapor operators. This instruction, coupled with the operators existing aeronautical knowledge consistent with their rating, will grant them the necessary knowledge for safe operation of the Vapor sUAS.

The substantial degree of automation built into the Vapor's flight system and the ratings and training of the operators are equivalent to the requirements of 14 C.F.R. § 61.3(d) and will provide the same level of safety.

14 C.F.R. § 61.31(d)(2) (Aircraft category, class, and type ratings).

This provision requires the pilot in command of an aircraft to possess an appropriate category and class rating for the aircraft he or she operates. As stated above, no rating currently exists for the operation of sUAS, and substantial training will be given to the pilots operating the Vapor in addition to the ratings currently held by the pilots.

Because existing category and class limitations do not apply to sUAS operations, and the pilots will be highly trained in Vapor operation, exempting the Vapor pilots from the category and class requirement at section 61 .31 (d)(2) will provide an equivalent level of safety.

14 C.F.R. § 61.113(a) & (b) (Private Pilot Restrictions on Compensation).

Section 61.113(a) and (b) prohibit private pilots from operating an aircraft for compensation or hire. Generally, a person must possess a Commercial pilot certificate, which requires a minimum of 250 hours as well as additional FAA testing. Although all but two of the anticipated pilots currently possess a commercial rating, this requirement is unnecessary to operate the Vapor as proposed. The proposed operational restrictions outlined in section III (E) above, in conjunction with the Vapor-specific training that each sUAS pilot receives, will achieve more than an equivalent level of safety to manned operations with a Commercial rating. Because the Vapor does not carry a pilot, passengers, or cargo, and is controlled via remote station, there is no risk to persons or cargo as anticipated by a Commercial rating. Commercial pilot certification is also unnecessary because of the autonomous characteristics of the Vapor outlined above and in Attachment "A", as well as the limited locations of proposed operations.

Operations under the proposed restrictions outlined above, the Vapor's integrated safety features, and the experience of the proposed pilots, an equivalent level of safety will be attained by allowing operation of the Vapor with a private pilot's certificate.

14 C.F.R. § 91.7(a) (Airworthiness Requirement).

This regulation states that no person may operate a civil aircraft unless it is in an airworthy condition. The airworthiness of Pulse Aerospace's Vapor has been established in section III, above and in Attachment "A". The vapor has a proven track record of safe flight. This record, coupled with the limited operations over nearly uninhabited farmland or utility easements will provide an equivalent level of safety.

14 C.F.R. § 91.9(b)(2) (Flight Manual on Aircraft).

This 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.

The nature of sUAS operation dictates the pilot in command, and spotter, operate the sUAS from a position on the ground. Due to these different operating conditions, an equivalent level of safety will be achieved by keeping the flight manual for the Vapor at the ground control station, and exemption from this regulation is requested.

14 C.F.R. § 91.105 (Crewmembers at Stations; Seatbelts).

Section 91.105 requires flight crew members to be at their stations with seatbelts fastened during landing and takeoff. The proposed operations do not involve flight crew members aboard the aircraft. An exemption from this provision is appropriate under the conditions proposed in this petition.

14 C.F.R. § 91.109 (Flight Instruction).

This regulation provides 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 Vapor is a remotely piloted and semi autonomous aircraft, and, by design, does not have dual controls. Flight is controlled via ground station controller and the flight profile which is uploaded to the Vapor prior to flight. In the event of emergency, the Vapor can be controlled by remote control and said controller can easily be handed to the Vapor instructor should that become necessary. This will provide an equivalent level of safety to section 91.109 requiring dual controls.

14 C.F.R. § 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 stated above, the Vapor, under the proposed waiver, will not operate higher than 400 feet AGL, and flights will occur within areas of farmland (consistent with Part 137) or cell tower, pipeline and power line easements. No flights will be conducted near persons, vehicles or vessels, and flights will be away from congested or populated areas. Aerial mapping, crop inspection work and utility inspection, however, is unique, and must be done at altitudes below 500 feet AGL and within 500 feet of structures, necessitating an exemption from Section 91.119.

The operation restrictions outlined above in section III(E) coupled with the pilot's existing familiarity with 14 C.F.R. §137 will provide an equivalent level of safety.

14 C.F.R. § 91.121 (Altimeter Settings).

14 C.F .R. § 91.121 requires persons operating aircraft to maintain certain cruising altitudes or flight levels by reference to an altimeter that is set "to the elevation of the departure airport or an appropriate altimeter setting available before departure." The Vapor operates with relative altitudes. Zero altitude is where the GPS becomes valid at a pre-defined PDOP (Position Dilution of Precision) accuracy value. The Vapor computes the reference altitude always with respect to the START waypoint:

Reference altitude waypoint X = altitude waypoint X – altitude START waypoint

Petitioner requests an exemption to this provision as the level of altitude accuracy provided by the Vapor system will achieve an equivalent level of safety to the use of an altimeter.

14 C.F.R. § 91.151 (Fuel Requirements).

This regulation states “No person may begin a flight in a rotorcraft 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, to fly after that for at least 20 minutes."

The Vapor batteries provide approximately 60 minutes of powered flight, and battery power is communicated “real time” to the ground station. An exemption from 14 C.F .R. §91.151 is necessary to allow flights greater than 40 minutes in length. A reduction to 10 minutes or 10% battery power is requested.

With the restrictions proposed above in Section III(E), specifically, the ½ Nautical Mile operating range, 10 minutes of reserve battery power will provide an equivalent level of safety as that contemplated by §14 C.F .R. 91.151.

14 C.F.R. § 91.203(a) and (b) (Display of Certificates).

Sections 91.203(a) and (b) requires all civil aircraft to have within them an appropriate and current airworthiness certificate and an effective U.S. registration certificate issued to its owner, which are displayed at the cabin or cockpit entrance so that it is legible to passengers or crew. By design, the Vapor does not have a cockpit or cabin. The size of the Vapor would not permit carrying these documents. Should the exemption to 14 C.F.R. § 91.7(a) (Airworthiness Requirement) above, be granted, the display of an airworthiness certificate would become moot.

Additionally, an exemption to 14 C.F.R. Part 47 (Aircraft Registration) and Part 49 (Recordation of Aircraft Title and Security Documents) is requested above. Agri Tech Systems intends to register the Vapor and, if successful, will keep the aircraft registration with the ground control station. However, if registration is not possible, and an exemption approved, compliance with Sections 91.203(a) and (b) would not be necessary and would provide an equivalent level of safety.

14 C.F.R. § 91.405 (Maintenance Required); 14 C.F.R. § 91.407(a)(l) (Operation after Maintenance).

14 C.F.R. § 91.405 states “Each owner or operator of an aircraft- 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 14 C.F.R. part 43 of this chapter.

Maintenance will be performed consistent with the flight manual in Attachment "A" and be performed or supervised by an Airframe and Power Plant Mechanic (A&P). While the flight control systems and programming of the Vapor are quite complex, the mechanical parts of the aircraft are relatively simple. Prior to each flight, the Vapor will be visually inspected for wear or broken parts. The Vapor is then powered up and the Vapor performs dozens of software/firmware "self checks" to ensure all systems are functioning properly.

Should the Vapor fail either the preflight inspection or the self checks, the flight will be aborted until mechanical parts can be replaced or the Vapor can be returned to Pulse Aerospace for software/firmware repairs.

14 C.F.R. § 91.407(a)(l) prohibits operation of any aircraft that has undergone maintenance, preventive maintenance, rebuilding, or alteration unless—It has been approved for return to service by a person authorized under § 43.7 of this chapter.

At the conclusion of any maintenance or repair, the Vapor will again be inspected by an A&P mechanic and the system will perform the self checks to ensure safe flight.

The combination of pilot inspection and the Vapor self checks will provide an equivalent level of safety to the maintenance requirements in 14 C.F.R. § 91.405 and 91.407(a)(l) and exemption is requested.

14 C.F.R. § 91.409(a)(1) and (a)(2) (Inspections).

This section states, in pertinent part, "no person may operate an aircraft unless, within the preceding 12 calendar months, it has had— An annual inspection in accordance with part 43 of this chapter and has been approved for return to service by a person authorized by § 43.7 of this chapter; or an inspection for the issuance of an airworthiness certificate in accordance with part 21 of this chapter.

The Vapor will be routinely inspected by a licensed A&P mechanic and will be thoroughly inspected prior to each flight. Additionally, the Vapor will perform diagnostic self checks prior to each flight and this combination of inspections will provide an equivalent level of safety to the requirements of 14 C.F.R. §91.409(a)(1) and (a)(2).

14 C.F.R. § 91.417(a) and (b) (Maintenance Records).

Section 91.417 outlines a number of requirements for maintenance records for aircraft. Agri Tech Systems will maintain records of maintenance performed as well as a log of any faults recorded during any Vapor self checks, and subsequent repairs performed. However, compliance with 14 C.F.R. § 91.417(a) and (b), as written, would not be possible, and exemption from this section is requested.

An equivalent level of safety will be achieved through the inspection and maintenance outlined above and by the records of repair that will be kept as outlined in this section.

V. Agri Tech Systems' Proposed Operations are in the Public Interest

Agri Tech Systems' proposed sUAS operations will limit the use of sUAS to relatively small tracts of land used for agricultural purposes, and within easements surrounding cell towers, pipelines and power lines. There will be no over-flight of any areas not designated for inspection and mapping as would occur with airport based operations.

The Vapor carries no fuel, is small in size, quiet, and carries a number of redundant safety features. The proposed operations outlined in this petition will provide a greater level of safety than similar operations performed in manned aircraft. Ultimately, the use of sUAS as proposed will provide invaluable data to farmers to tailor the use of chemicals on their crops through the use of prescriptive chemical application maps. This data will reduce costs for farmers and consumers, and minimize environmental impact through the reduced use of agriculture chemicals. Additionally, sUAS use for cell tower, pipeline and power line inspection will reduce noise and pollution and provide an additional level of safety not currently available with manned operations. It is also in the public interest to research aircraft de-confliction and the operations proposed in this petition are best suited for this research due to the shared airspace utilized by aerial applicators and utility inspectors.

As stated above, petitioner intendeds to share all information learned with the Department of Transportation and the Federal Aviation Administration to assist in developing comprehensive rules and regulations for UAS operations. This will enhance safety for, not only, aerial applicators and other pilots, but the public as a whole.

VI. Privacy

The operations outlined in this petition will not raise any privacy concerns. Operations will be conducted over nearly uninhabited areas of farmland and within cell tower, pipeline and power line easements. There will be no over-flight over any known person or group of people and the data collected will be used solely for the purpose of enhancing farming operations and utility inspection. No data collected will be made public.

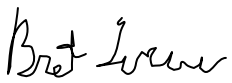
VII. Summary

For the reasons outlined above, petitioner has demonstrated it is equipped and committed to safe operation of sUAS under the restrictive conditions set forth herein. Agri Tech Systems's use of the Vapor under the restrictive conditions proposed will provide an equivalent level of safety and will not implicate any privacy or National Security concerns. The anticipated benefits of sUAS operations are in the public interest and the exemptions requested should be granted.

IX. Request for Relief

Based on the information provided in this petition, Agri Tech Systems requests exemption from the C.F.R's outlined above, and any other exemptions the Secretary deems appropriate, for sUAS operation consistent with the terms proposed.

Respectfully,



Bret Lucas
Agri Tech Systems, LLC

Attachment