August 25, 2014

U.S. Department of Transportation
Docket Management System
1200 New Jersey Ave., SE
Washington, DC 20590

Re: Exemption Request Under Section 333 of the FAA Reform Act and Part 11 of the Federal Aviation Regulations

Dear Sir or Madam:

Pursuant to Section 333 of the FAA Modernization and Reform Act of 2012 (the "Reform Act") and 14 C.F.R. Part 11, Aeryon Labs Inc. ("Aeryon"), the developer and operator of the Scout and SkyRanger small Unmanned Aircraft Systems ("sUAS") seeks an exemption from the Federal Aviation Regulations ("FARs") listed below and discussed in Appendix A. Details of Aeryon and the SkyRanger sUAS are described in Appendix B. Attached as Appendix C is a summary of this request.

The requested exemption would permit Aeryon commercial operation of Aeryon's SkyRanger (see details in Appendix B), which weighs 6 lbs. with imaging payload, to perform market research, aerial surveys, mapping, and inspections that consist of still photographs, video, and other data taken by onboard sensors. The SkyRanger produces high quality imagery and data that can be used independently - or in the case of surveying and modelling, can be combined to produce precision digital point clouds, triangle models, and contour maps of the surveyed area. Applications for these sUASs include inspection of sensitive infrastructure including oil and gas pipelines and flare stacks, power lines and towers, wind turbines, and surveying tasks such as precision agriculture, mining, transportation, and forestry. Use of the SkyRanger for these inspection and surveying applications reduces the need to operate conventional aircraft, providing data more quickly, accurately, economically, safely, and with reduced environmental impact.

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

While Aeryon is filing this exemption request on its own behalf, it anticipates that its customers, in the future, will file exemption applications to allow them to operate the SkyRanger in commercial operations at their own facilities, farms, mines, and other sites that require aerial data for inspections and surveys. Wherever possible, those filings will be substantially similar to this exemption application.

As described more fully below, the requested exemption would authorize Aeryon to perform market

research and commercial operations of aerial inspections and surveys using the SkyRanger[1], which at 6 lbs. is small in size and powered electrically by battery. The SkyRanger will be operated under controlled conditions at low altitude in airspace that is limited in scope, as described more fully herein; it will have automated control features, as described below. The Aeryon SkyRanger is designed to be operated by one person but flight operations generally involve two people: an operator and an observer. The operator is responsible for flying the sUAS, monitoring its status and flight dynamics while maintaining visual line of sight, and keeping the flight within the specified factory limits (in terms of wind, flight range, battery life, etc) to ensure safe operation of the sUAS itself. The observer is responsible for monitoring the airspace for other aircraft and hazards and instructing the operator before and during flight as necessary to ensure safe separation/de-confliction with these aircraft and hazards. The operator also will be an individual who has passed an FAA approved or equivalent ground training exam and authorized Aeryon training program for the SkyRanger. Finally, the airspace in which the SkyRanger will operate will be disclosed to and approved, as needed, by the FAA in advance.

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

The name and address of the applicant are:

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The regulations from which the exemption is requested are as follows:
14 C.F.R. Part 21;
14 C.F.R. 45.23(b);
14 C.F.R. 61.113(a) & (b);
14 C.F.R. 61.133(a);
14 C.F.R. 91.7(a);
14 C.F.R. 91.9(b)(2) & (c);
14 C.F.R. 91.103;
14 C.F.R. 91.109(a);
14 C.F.R. 91.119;

[1] Aeryon and its customers have been granted many flight operation certificate to operate the Aeryon SkyRanger, and its predecessor the Aeryon Scout - including Special Flight Operation Certificates in Canada for commercial use, and Certificates of Waiver or Authorization (COA) in the US for public agency use.

14 C.F.R. 91.151(a);
14 C.F.R. 91.203(a) & (b);
14 C.F.R. 91.405(a);
14 C.F.R. 91.407(a)(1);
14 C.F.R. 91.409(a)(2);
14 C.F.R. 91.417(a).

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

THE APPLICABLE LEGAL STANDARD UNDER SECTION 333

Aeryon submits that grant of this exemption application for use of the SkyRanger in market research, surveying, mapping and inspection operations will advance the Congressional mandate in Section 333 of the Reform Act to accelerate the introduction of sUASs into the national airspace system ("NAS") if it can be accomplished safely. This law directs the Secretary of Transportation to consider whether certain sUASs may operate safely in the NAS before completion of the rulemaking required under Section 332 of the Reform Act. In making this determination, the Secretary is required to determine which types of sUASs do not create a hazard to users of the NAS or the public or pose a threat to national security in light of the following:

- The sUAS's size, weight, speed, and operational capability;
- Operation of the sUAS in close proximity to airports and populated areas; and
- Operation of the sUAS within visual line of sight of the operator.

Reform Act § 333(a)(1). If the Secretary determines that such vehicles "may operate safely in the national airspace system, the Secretary shall establish requirements for the safe operation of such aircraft in the national airspace system." *Id.* §333(c) (emphasis added).[2]

The Federal Aviation Act expressly grants the FAA the authority to issue exemptions. This statutory authority, by its terms, includes exempting civil aircraft, as the term is defined under §40101 of the Act, from the requirement that all civil aircraft must have a current airworthiness certificate and those regulations requiring commercial pilots to operate aircraft in commercial service:

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

49 U.S.C. §44701(f). *See also* 49 USC §44711(a); 49 USC §44704; 14 CFR §91.203(a)(1).

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

Airworthiness of the SkyRanger

A critical element of the exemption application involves evidence of the airworthiness of Aeryon sUAS including the SkyRanger. Aeryon believes that it has shown compliance through a history of granted flight operations and successful flights - including many operations with public agencies. The list of granted applicants includes: Michigan State Police, US Navy Spawar, Mass Development (Joint Base Cape Cod), Unmanned Experts (NIJ Partnership), Western Washington University, Aetos (via

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

Northwest Michigan College), University of Alaska Fairbanks, University of New Mexico, Kansas State University, and Virginia Tech University. The AkyRanger has also successfully completed the Department of Homeland Security RAPS Trial in 2013. In Canada, Aeryon has obtained 19 Special Flight Operations Certificates (SFOCs) from Transport Canada over 5 years and its customers have received multiple certificates to perform demonstration, research and development, public and commercial operations. The criteria set forth in the Order specify the substantive showings of the device's safety and fitness for operation to ensure that the FAA has sufficient basis to evaluate the aircraft's safety[3]. The SkyRanger also has a significant set of automated features to ensure safe takeoff, flight and landing in many conditions, further details of operation can be found in Appendix B.

Mandatory Operating Conditions

Grant of the exemption to Aeryon will be subject to the following mandatory conditions, which are based upon operating conditions set forth for operation of sUAS by public entities pursuant to Certificates of Authorization, with additional restrictions:

- All operations to occur in Class G airspace.
- Operations to avoid congested or populated areas, which are depicted in yellow on VFR charts.
- Operations to be conducted over private or controlled-access property.
- Permission from land owner/controller required before commencing any flight.
- Operations to occur during Visual Flight Rules Meteorological Conditions (VMC).
- Aircraft to remain within Visual Line of Sight (VLOS).
    - VLOS guaranteed with a cylinder of operation around operator of ½ nautical miles (NM).
    - Cylinder walls may be expanded by observer with ability to control aircraft.
- Operations to occur during daylight hours.
- Above Ground Level (AGL) altitude to be restricted to 400 feet.
- All operations conducted in vicinity of airport to remain more than 2.5 NM from centerline azimuth of runway centerline measured from runway thresholds.
- Operator will file a NOTAM for each flight.
- All required permissions and permits will be obtained from territorial, state, county or city jurisdictions, including local law enforcement, fire, or other appropriate governmental agencies.
- All operations will include one pilot for flight control and one observer for VLOS enhancement of surrounding area near the aircraft

Operator Requirements

Aeryon respectfully proposes that operator requirements should take into account the characteristics of the particular sUAS. Certain sUASs, such as the Aeryon SkyRanger, are characterized by a high degree of pre-programmed control and various built-in technical capabilities that limit the potential for operation outside of the operating conditions set forth above. The SkyRanger sUAS also provides many built-in functional and safety features to assist the operator in safe and reliable operation.[4]

[3] Aeryon can submit under confidentiality the following documents in support of this exemption application for the SkyRanger: 1) Aeryon SkyRanger User Guide (Exhibit 1) which includes Safety and PreFlight Checklists; and 2) Training Manual (Exhibit 2).

[4] As of July 2014, Aeryon staff and customers have performed over 5681 flights, logging 623 hours of flight time with the SkyRanger with both development and release versions. The previous generation product, Scout, achieved over 7197 flights and 839 hours of flight time globally by Aeryon and its customers. This is a significant amount of flight time collected to understand and refine the Aeryon sUAS products.

The Aeryon SkyRanger provides two semi-autonomous flight modes using a point-and-click map and video interface. The user clicks on a map to direct the SkyRanger to fly to the point on the map where the operator is pointing, or programmed flight plans may be entered for a series of waypoints or grid-based area. Additional navigation aids including landing zones and flight areas may be designated to ensure the SkyRanger operates only within user-specified flight parameters. All flight operations are GPS controlled making the system easy to navigate, and the flight control system also employs a variety of sensors including sonar, barometric pressure, temperature, wind speed and others to ensure the high stability and reliability in challenging weather conditions. At all times during flight operations, the operator can intervene a programmed flight and take immediate control.

Additional automated safety functions and safety enhancing features of the SkyRanger include the following:

- Automated pre-flight system performance checks
- User pre-flight checklist
- Automated condition or fault detection, warnings, and pre-defined responses to a number of flight and system conditions.
  - High winds with system and user defined safety thresholds
  - Low battery with system and user defined safety thresholds
  - High temperature or other system safety thresholds
  - Lost-link communication
- Pre-defined responses include behavior such as attempting to re-establish radio communication, return to home position and hover, return to home position and land, or land in current position
- In the case of lost GPS, a manual user flight mode is enabled which allows the operator to provide manual navigation inputs to assist in landing the vehicle.

Given these safety features, Aeryon proposes that operators of the SkyRanger should not be required to hold a commercial or private pilot certification. Instead, operators should be required to:

- have successfully completed, at a minimum, FAA private pilot ground instruction and passed the FAA Private Pilot written examination or FAA-recognized equivalents including commercial or private license and ground school issued from an ICAO recognized country;
- have completed Aeryon's authorized training program for operation and maintenance of the sUAS.

Aeryon notes that the FAA has found that safety factors permitted operation of sUASs by operators with these qualifications in the case of operations pursuant to public COAs when the mandatory operating conditions specified above were present. *See* Federal Aviation Administration, Notice N-8900.227, Unmanned Aircraft Systems (UAS) Operational Approval, at 20-21 (July 30, 2013). The FAA has the statutory authority to grant exemptions to the requirements for and privileges associated with the grant of airmen's certificates. 49 USC §44701 (f).

In summary, applicant seeks an exemption from the FARs set forth above and in Appendix C to allow market research and commercial operations of a small unmanned vehicle in surveying, mapping and inspection operations .

Approval of the exemption allowing commercial operations of the SkyRanger for surveying, mapping and inspection operations will enhance safety by reducing risk. Conventional aerial survey and

inspection operations using manned aircraft involve very heavy aerial vehicles carrying significant quantities of combustible fuels, and a multi-person crew in piloting and observation roles. These operations require transit to and from the location of the activity, and often take place in congested environments including proximity to physical obstacles and/or presence of the general public. By contrast, the Skyranger weighs 6 lbs including payloads and uses a battery for power, is carried to/from the area of activity, removes the need for airborne pilots/observers, and poses less risk to people and infrastructure on the ground.

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

The operation of the SkyRanger for market research, surveying, mapping and inspection operations in accordance with the strict conditions outlined above, will provide an equivalent level of safety supporting the grant of the exemptions requested herein, including exempting Aeryon from the requirements of Part 21.

The SkyRanger's satisfaction of the criteria set forth in Section 333 of the Reform Act—size, weight, speed, operating capabilities, lack of proximity to airports and populated areas, operation within visual line of sight, and national security – and its showing of an equivalent level of safety as it may relate to the requirement for a pilot's license, provide more than adequate justification for the grant of the requested exemptions allowing Aeryon commercial operation of the SkyRanger in market research, surveying, mapping and inspection operations.

Very truly yours,

Dave Kroetsch
Aeryon Labs Inc.

APPENDIX A

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

Aeryon requests an exemption from the following regulations as well as any additional regulations that may technically apply to the operation of the SkyRanger:

14 C.F.R. Part 21, Subpart H: Airworthiness Certificates
14 CFR § 91.203(a)(1)

Section 91.203(a)(1) requires all civil aircraft to have a certificate of airworthiness. Part 21, Subpart H, entitled Airworthiness Certificates, establishes the procedural requirements for the issuance of airworthiness certificates as required by FAR § 91.203(a)(1). Given the size of the aircraft (6 lbs.) and the limited operating area associated with its utilization, it is unnecessary to go through the certificate of airworthiness process under Part 21 Subpart H to achieve or exceed current safety levels.

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

In this case, an analysis of these criteria demonstrates that the SkyRanger operated without an airworthiness certificate, under the conditions proposed herein, will be at least as safe, or safer, than a conventional aircraft (fixed wing or rotorcraft) with an airworthiness certificate. The SkyRanger weighs 6 lbs. fully loaded. It will not carry a pilot or passenger, will not carry flammable fuel, and will operate exclusively within an area pre-disclosed and in compliance with conditions set forth herein. Operations under this exemption will be tightly controlled and monitored by both the operator, pursuant to the conditions set forth above, and by local public safety requirements. The FAA will have advance notice of all operations through the filing of NOTAMs. Receipt of the prior permission of the land owner, the size of the aircraft, the lack of flammable fuel, and the fact that the aircraft is carried to the location and not flown there all establish the equivalent level of safety. The SkyRanger provides at least an equivalent, and most likely exceeds[5], level of safety to that of such operations being conducted with conventional aircraft that would be orders-of-magnitude larger and would be carrying passengers, cargo, and flammable fuel. The automated safety features including redundant sensor systems as described in Appendix B and throughout this document highlight the design intentions towards safety and reliability on SkyRanger.

[5] An Aeryon internal report compares the crash kinetic energy dissipation rate of a commercial airline versus the Aeryon SkyRanger. The report found the MTTF of SkyRanger needs to only be > 2.3 hours to equal the energy dissipation of the gold standard commercial aircraft. Transport Canada, has issued a report on low energy RPA and determined the Aeryon Scout, at a typical max kinetic energy of 1.45J/cm2, to be well below the recommended peak energy level of 12J/cm2 on impact, since the SkyRanger is similar in construction it could be considered to be below this threshold as well.

14 C.F.R. § 45.23 & 91.9(c): Marking of the Aircraft

Regulation 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.

Regulation 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 SkyRanger has no entrance to the cabin, cockpit, or pilot station on which the markings can be placed. Given the size of the sUAS, two-inch lettering will be impossible. Official marking systems for small UAS have not yet been established for operations inside the NAS. The SkyRanger is currently marked with a fixed label containing Aeryon Labs SkyRanger measuring 1.5" x 0.5" as well as a serial number located under the removable camera payload. Aeryon is prepared to mark the inspection system with the name of the organization and location or origin and fulfill any other request by the FAA to this topic in accordance to § 45.29(f) where the pilot, observer, and others working with the sUAS will see the identification of the sUAS.

The FAA has issued the following exemptions to this regulation, see Exemption Nos. 8738, 10167, 10167A and 10700.

14 C.F.R. § 61.113(a) & (b); 61.133(a): Private Pilot Privileges and Limitations; Pilot in Command; Commercial Pilot Privileges and Limitations.

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

The SkyRanger has an all-digital software platform with advanced features previously restricted to full size unmanned aircraft. Automated features and advanced fly-safe controls enable safe, reliable operation, as well as advanced networking capabilities and system extensibility.

- Plan your flight or fly ad-hoc: The system can autonomously fly a programmed flight path or fly in manual mode
- Smart batteries and charger: Flight time and battery minutes are displayed at all times. The system will return home and land automatically if user-configurable limits are reached.

Flight safety is a priority, no matter the operating environment or project. The SkyRanger offers superior safety over manned aircraft by removing the need for people to be onboard in potentially dangerous situations. With multiple built-in safety features, the Aeryon platform leads other sUAS with respect to safety.

- Intelligent fault handling: The system automatically detects potential issues - with configurable automated response behavior such as a return-home-and-land routine
- Automatic pre-flight checks: The system self-calibrates all of its sensors and performs self-tests prior to takeoff to check for errors
- No-fly zones: The system has the ability to set up visual no-fly zones
- Self-monitoring: Monitoring battery levels, in-flight wind speeds, and other system and environmental conditions are automatically handled by the system
- Battery communication: Battery minutes and flight time are displayed at all times.The system will return home and land automatically if user-configurable limits are reached.

Additional automated safety functions and safety enhancing features of the SkyRanger include the following:

- Auto detection of lost GPS warns the pilot and initiates an immediate landing.
- Low battery on the SkyRanger triggers a Non Fatal Warning alarm to return home, land and replace the battery
- Very low battery on the SkyRanger triggers an Fatal Error alarm and initiates an emergency high speed descent landing.
- If the SkyRanger detects a lost-link to the basestation the vehicle will perform its pre-defined Non-Fatal Condition Response.

Given these safety features, Aeryon proposes that operators of the SkyRanger should not be required to hold a commercial or private pilot certification. Instead, operators should be required to:

- have successfully completed, at a minimum, FAA private pilot ground instruction and passed the FAA Private Pilot written examination or FAA-recognized equivalents including ICAO issued commercial, private license and ground school;
- have completed Aeryon's training program for operation of the sUAS.

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

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

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

14 C.F.R. § 91.7(a): Civil aircraft airworthiness.

This regulation requires that no person may operate a civil aircraft unless it is in airworthy condition. Should the exemption be granted allowing commercial operation of the SkyRanger without an airworthiness certificate, no standard will exist for airworthiness of the SkyRanger. Given the size of the aircraft and the previous COAs issued for Aeryon's Scout and SkyRanger, an equivalent level of safety will be achieved by ensuring compliance with the Aeryon manuals prior to each flight.

14 C.F.R. § 91.9(b)(2): Civil Aircraft Flight Manual in the Aircraft.

The regulation provides:

> No person may operate a U.S.-registered civil aircraft …
>
> (2) For which an Airplane or Rotorcraft Flight Manual is not required by §21.5 of this chapter, unless there is available in the aircraft a current approved airplane or Rotorcraft Flight Manual, approved manual material, markings, and placards, or any combination thereof.

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

The equivalent level of safety will be achieved by keeping the flight manual (*see*, *e.g.*, User Guide, Exhibit 1) at the ground control point where the pilot flying the sUAS will have immediate access to it. The FAA has issued to others the following exemptions to this regulation: Exemption Nos. 8607, 8737, 8738, 9299, 9299A, 9565, 9565B, 10167, 10167A, 10602, 32827, and 10700.

14 C.F.R. § 91.103: Preflight action

This regulation requires each pilot in command to take certain actions before flight to insure the safety of flight. As FAA approved rotorcraft flight manuals will not be provided for the aircraft an exemption will be needed. An equivalent level of safety will be provided as set forth in the SkyRanger User Manual (exhibit 1) under the 'Getting Ready to Fly' section. The PIC will take all actions including reviewing weather, flight battery requirements, landing and takeoff distances and aircraft performance data before initiation of flight.

14 C.F.R. § 91.109(a) & 91.319(a)(1): Flight Instruction

These regulations provide that no person may operate a civil aircraft (except a manned free balloon) that is being used for flight instruction unless that aircraft has fully functioning dual controls.

The SkyRanger is a remotely piloted aircraft and by design, does not have fully functional dual controls. Flight control is accomplished through the use of a control box that communicates with the aircraft via radio communications. The flight plan is either manually controlled through point-and-click touchscreen navigation or pre-programmed as way points or an AutoGrid into the auto pilot before or during flight and only in unusual circumstances will the pilot input control functions to alter the pre-programmed flight. If instruction is accomplished through a training program, as set forth in Exhibit 2, an equivalent level of safety will be assured. The FAA has approved exemptions for flight training without fully

functional dual controls for a number of aircraft and for flight instruction in experimental aircraft. *See* Exemption Nos. 5778K & 9862A. The equivalent level of safety will be achieved by the manufacturer providing the training as outlined, for example, in Exhibit 2 and through the use of experienced and qualified pilots familiar with the SkyRanger.

14 CFR § 91.119: Minimum Safe Altitudes

Section 91.119 establishes safe altitudes for operation of civil aircraft. Specifically, 91.119(c) limits aircraft flying over areas other than congested areas to an altitude of 500 feet above the surface, except over open water or sparsely populated areas. In those cases, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure.

As set forth herein, the SkyRanger will never operate at higher than 400 feet AGL. It will, however, be operated to avoid congested or populated areas that are depicted in yellow on VFR sectional charts. Because aerial survey, mapping and inspection work must be accomplished at relatively low altitudes and at altitudes less than 500 feet AGL, an exemption from Section 91.119(c) is needed.

The equivalent level of safety will be achieved given the size, weight, speed, and material with which the SkyRanger is built. Also, no flight will be taken without the permission of the land owner or those who control the land. Because of the advance notice to the landowner, all affected individuals will be aware of the flights. Compared to aerial survey operations conducted with aircraft or rotorcraft weighing far more than 6 lbs. and carrying flammable fuel, any risk associated with these operations will be far less than those currently allowed with conventional aircraft operating at or below 500 feet AGL. Indeed, the low-altitude operations of the sUAS will maintain separation between these sUAS operations and the operations of conventional aircraft that must comply with Section 91.119.

14 C.F.R. § 91.151(a): Fuel Requirements for Flight in VFR Conditions

This regulation prohibits an individual from beginning "a flight in an airplane under VFR conditions unless (considering wind and forecast weather conditions) there is enough fuel to fly to the first point of intended landing and, assuming normal cruising speed – (1) During the day, to fly after that for at least 30 minutes; or (2) At night, to fly after that for at least 45 minutes."

The SkyRanger batteries provide approximately 50 minutes of powered flight. Without an exemption from § 14 CFR 91.151, the sUAS's flights would be limited to approximately 20 minutes in length. Given the limitations on its proposed operations and the location of those proposed operations, a longer time frame for flight in daylight VFR conditions is reasonable.

Aeryon believes that an exemption from 14 CFR § 91.151(a) is safe and within the scope of a prior exemption. *See* Exemption 10673 (allowing Lockheed Martin Corporation to operate without compliance with 91.151(a)). Operating the sUAS, without 30 minutes of reserve fuel does not engender the type of risks that Section 91.151(a) was meant to prevent given the size and speed at which the sUAS operates. The fact that it carries no pilot, passenger, or cargo also enhances its safety. Additionally, limiting SkyRanger flights to 20 minutes would greatly reduce their utility. In the unlikely event that the SkyRanger should run out of fuel, it would simply land. Given its weight and construction material, the risks are less than contemplated by the current regulation.

Aeryon believes that an equivalent level of safety can be achieved by maintaining 10 minutes of reserve fuel, which, allowing 40 minutes of flight time, would be more than adequate to return the sUAS to its

planned landing zone from anywhere in its operating area.

The FAA has granted similar exemptions to others, including Exemptions 2689F, 5745, 10673 and 10808.

14 C.F.R. § 91.203 (a) & (b): Carrying Civil Aircraft Certification and Registration

This regulation provides as follows:

> (a) … no person may operate a civil aircraft unless it has … an appropriate and current airworthiness certificate.
> (b) No person may operate a civil aircraft unless the airworthiness certificate required by paragraph (a) of this section or a special flight authorization issued under §91.715 is displayed at the cabin or cockpit entrance so that it is legible to passengers or crew.

The SkyRanger fully loaded weighs approximately 6 lbs. As such, there is no ability or place to carry certification and registration documents or to display them on the sUAS. In addition, there is no pilot on board the aircraft.

An equivalent level of safety will be achieved by keeping these documents at the ground control point where the pilot flying the sUAS will have immediate access to them. The FAA has issued numerous exemptions to this regulation. A representative sample of other exceptions includes Exemption Nos. 9565, 9665, 9789, 9789A, 9797, 9797A, 9816A, and 10700.

14 C.F.R. § 91.405(a); 407(a)(1); 409(a)(2); 417(a): Maintenance Inspections

Section 91.405(a) requires that an aircraft operator or owner “shall have that aircraft inspected as prescribed in subpart E of this part and shall between required inspections, except as provided in paragraph (c) of this section, have discrepancies repaired as prescribed in part 43 of this chapter ...” Section 91.407 similarly makes reference to requirements in Part 43; Section 91.409(a)(2) requires an annual inspection for the issuance of an air worthiness certificate. Section 91.417(a) requires the owner or operator to keep records showing certain maintenance work that has been accomplished by certificated mechanics, under Part 43, or licensed pilots and records of approval of the aircraft for return to service.

The SkyRanger is nearly maintenance free, it performs automatic pre-flight checks and the failure of any check will prevent take-off. Checks which cannot be done by the system will be performed by a qualified person prior to each flight and at predefined intervals as part of the Maintenance Schedule in the User Manual (see Exhibit 1).

Pre-flight checklist includes:

1. Visual inspection of the airframe
2. Visual inspections of rotor integrity
3. Check charge of all batteries (aerial vehicle, command station, radio repeater station)

An equivalent level of safety will be achieved because the sUAS is small in size, will carry no external payload, will operate only in restricted predetermined areas and is not a complex mechanical devise. As provided in the attached User Guide (System Maintenance section), the operator of SkyRanger will ensure that the sUAS is in working order prior to initiating flight, perform required maintenance, and

keep a log of any maintenance that is performed. Moreover, the operator is the person most familiar with the aircraft and is best suited to maintain the aircraft in an airworthy condition and to ensure an equivalent level of safety.

The SkyRanger's Maintenance guidelines ensure an equivalent level of safety to the maintenance requirements in Part 91. In addition, any component failure detectable by the system will be reported to the control station and will cause the UAV to perform a Fatal Condition Response (FCR) or Non-Fatal Conditioned Response (NFCR), depending on the type of failure.

APPENDIX B

SMALL UNMANNED AERIAL SYSTEM DESCRIPTION

Aeryon Corporate Overview: Aeryon Labs, Inc. is a Canadian company located in Waterloo Ontario. Aeryon is focused on providing micro unmanned aerial system and is globally recognized as the market and technology leader in this space. Key customers range from military organizations such as Canadian Special Operations and US Special Operations; key government agencies such as NOAA, Environment Canada and the US Coast Guard; world leading universities in the unmanned space such as University of Alaska Fairbanks and Kansas State University; police agencies such as the RCMP and OPP; and global enterprises such as BP, UK Power Networks and Fortune 500 companies in the chemical, oil/gas and security markets. Aeryon systems have accumulated over 5000 hours in global flight operations. This number does not include military flight hours which increase the numbers further.

Aeryon systems have a been approved by the FAA for research COAs and have a demonstrated safety track record. The Aeryon sUAS platforms were the first to officially fly at one of the FAA's UAS Test Sites (UAF Alaska). Many customers from military, to education to police and even commercial operations have been given approval to fly in US, Canada, UK, Australia, Japan, and others airspaces.

SkyRanger Overview: Aeryon unmanned systems have been used to fight terrorism in Iraq, Afghanistan and Nigeria, monitor hostile borders between Saudi Arabia and Yemen, ensure the safety of world leaders at the G50 Nuclear Summit in Seoul, escort a fuel tanker and ice breaker into a remote Alaskan community, monitor wildlife on the Aleutian Islands, map remote communities in South America, keep our highways clear and safe; and provide volumetric analysis for open pit mines.

The Aeryon SkyRanger can carry payloads up to 600 g. The SkyRanger flies with a maximum wind threshold of 40 M.P.H. for sustained winds and wind gusts up to 55 M.P.H.. What is unique about the Aeryon SkyRanger is the system automatically compensates for wind versus relying on the operator's 'sense of feel' for what the impact of the wind is at the altitude the system is flying. The end result is a system capable of gathering high quality aerial intelligence at much higher wind thresholds. A trait that is imperative for many aerial inspection operations.

The SkyRanger has an operational range of up to 3 km (1.6 NM) with the standard offering and up to 5 km (2.7 NM).

All flight operations are GPS controlled making the system extremely easy to navigate. At any point if the operator is not explicitly commanding the system to move, the system automatically holds its GPS position (i.e. GPS hold for reliable location hover). Camera positioning is also GPS controlled allowing for the most sophisticated camera targeting available. The flight control system employs not only GPS positioning but a variety of sensors including sonar, barometric pressure, temperature, wind speed and others to ensure the most stability of any system in its class-regardless of the wind.

The Aeryon SkyRanger can be operated in both semi and fully autonomous flight modes. Creating preplanned flight paths to fly in autonomous mode is as simple as clicking on the map to create a preplanned flight path. In semi-autonomous mode, the operator clicks on the map and the Aeryon SkyRanger automatically flies to the point on the map where the operator is pointing. Pre-mission waypoints, Landing zone points and flight area dimensions can all be entered during preflight ensuring the SkyRanger operates only within specified parameters.

The Aeryon SkyRanger includes many advanced safety features that makes the SkyRanger the safest choice for both urban and non-urban environments. Built-in intelligent fault handling allows the SkyRanger to detect a system fault while in the air, and to automatically fly back to its take-off location and land. Faults that can be detected include: loss of communication; pre-set wind thresholds exceeded; and low battery levels. In addition, the operator can create no fly zones or maximum flight ranges and altitudes so the system cannot enter areas deemed unsafe or unnecessary to fly over. And before every take-off automated flight checks ensure the system is flight ready before it takes off.

The Aeryon SkyRanger can be operated entirely by a touch-screen, map based interface. This means The operator only needs to command the system where to go, and the system does all the flying for the operator. Maps can be saved and flight plans can be made or recalled with no internet connection required.

SkyRanger Operating Manual - System user manual available upon request.

Physical Characteristics

Measurements – 40” diameter deployed, 20x10” folded

Weight (without payload) – 2.4kg (5.3 lbs)

Fuel – Lithium polymer batteries are self-contained high duration systems with “SMART” intelligence on-board. This includes cycle charge times, locations, GPS antenna, chemical management, and real-time data feeds to ensure maximum flight duration and sub-system safety processes. Charging is done in the included Aeryon Battery charger and can be charged via standard wall outlet, or via a vehicle.

Landing style/type – Autonomous vertical lift

Propulsion System

- Engines – The SkyRanger is powered by 4 electric brushless DC motors.
- Batteries – Lithium polymer batteries are self-contained high duration systems with SMART intelligence on-board. This includes cycle charge times, locations, GPS antenna, chemical management, and real-time data feeds to ensure maximum flight duration and sub-system safety processes. Charging is done in the included Aeryon Battery charger and can be charged via standard wall outlet, or via a vehicle.

Performance Characteristics

- Maximum Altitude – 1500 ft.
- Maximum Endurance – 50 minutes
- Maximum Range – 3 km
- Weather Minimums -
- Winds Maximum – 40 MPH sustained, 55 mph gusts
- Minimum ceiling: 500 ft
- Minimum visibility: 1 SM
- Icing conditions – no icing conditions
- Precipitation – no visible moisture

Maintenance – The UAS is nearly maintenance free, it performs automatic pre-flight checks and the

failure of any check will prevent take-off. Checks which cannot be done by the system will be performed by a qualified person prior to each flight.

Pre-flight checklist includes:

- Visual inspection of the airframe
- Visual inspections of rotor integrity
- Check charge of all batteries (aerial vehicle, command station, radio repeater station)

Reliability – The system is designed for maximum reliability and to maintain performance over its life. The only components experience routine wear are rotors, batteries, motors, and legs. Battery and motor conditions are monitored by the system with deviations reported to the operator.

Contact with other objects during flight may cause other components, particularly rotors, and motor arms, to become damaged. Damaged components are likely to be detected during the full visual inspection of the airframe performed before each flight. Structural damage affecting flight characteristics will be detected by on-board sensors.

The UAV system detects numerous conditions which may make flying unsafe, such as reduced GPS accuracy, magnetic anomalies, low battery charge, battery cell imbalances, temperature fluctuations. Automatic pre-flight checks prevent the UAV from taking off if such conditions are present; or, if the condition is detected during flight, the system will trigger a Fatal Conditioned Response.

Fault Tolerance - The key feature of the UAV fault tolerance is its mechanical simplicity. It uses four fixed pitched rotors, each mounted on a separate motor. No control surfaces or other actuators are required for the UAS to fly. Any component failure detectable by the system will be reported to the control station and will cause the UAV to perform a Fatal Condition Response (FCR) or Non-Fatal Conditioned Response (NFCR), depending on the type of failure.

Command and Control Systems

The SkyRanger Ground Control station allows the operator simultaneous control over aircraft and payloads. The touch screen control allows for quick navigation and data entry while the display screen provides all essential flight data to the operator. Telemetry data is transmitted to the command station at least once per second.

Displayed on GCS:

- UAS Position
- Navigation Route
- UAS Tail Number
- UAS Position
- UAS Altitude
- UAS Heading
- North Seeking Arrow
- Range to Target
- Calculated target position
- Date/time
- Sensor heading and orientation relative to UAS

On-board Flight Instruments – The UAV is equipped with an Inertial Navigation System (3-axis gyroscope, 3-axis magnetometer, GPS receiver, and static pressure sensor) and a sonar sensor for precision AGL altitude measurement.

On–board computer systems – The UAS is equipped on-board computer systems to monitor (sensors, battery, etc.), control (speeds, altitude, position, etc.), and communicate (control, telemetry, etc.).

On-board guidance and navigation equipment – The UAS can operate autonomously; it does not require any input from ground-based equipment, or from the pilot to hover in place.

Frequency Allocations – 900 MHz, 2.4 GHz, 5.8 GHz, custom

Flight termination link – to prevent a "fly away" or other potentially dangerous situation a flight termination link is available to the operator at the GCS.

Takeoff and Landing – The SkyRanger has vertical lift autonomous launch and recovery. A Landing Zone "LZ" is designated by the operators and identified in the GCS software. For launch procedures the aircraft will takeoff and hover 3 meters directly above the LZ and hold until further operator instruction is given. The aircraft will automatically adjust for wind during this period.

Navigation System – Specific maps can be downloaded to the display screen (such as air sectional and geographic maps) which are overlaid with GPS positional data. Waypoints can be created before and during flight operation creating specific locations and sequences for the aircraft.

Redundant Systems – The UAS combines the input from a multitude of sensors. Even though the data from all sensors is required for optimal system performance, a single sensor malfunction is likely to result in degraded performance rather than leading to a catastrophic failure.

Emergency Procedures and System Failures
Failure Handling – The UAS has extensive failure detection and handling capabilities. All failures are deeded to be either fatal or non-fatal. Failures classified as fatal result in a Fatal Condition Response (FCR); and failures classified as non-fatal result in a Non-Fatal Condition Response (NFCR).

Sensor Failure – Failure of on-board flight instruments/sensors will degrade the UAS performance and will result in either a FCR or a NFCR, depending on their severity. If the UAS becomes unstable due to sensor failure, it will stop all four motors and free fall to avoid a fly away condition.

Motor Failure – The UAS flight performance will degrade significantly if one or more motors fails.

Airframe Failure – If airframe is damaged in ways that impacts flight characteristics, the UAS will behave similar to if an on-board flight instrument failed.

Navigation System Failure – In a navigation system failure, degraded GPS will result in FCR or NFCR 's depending on failures.

Power Failure – A complete battery failure which results in power loss to the UAS will result in degraded flight performance.

Low Battery Condition – Operator will be alerted of a low battery condition and will land the aircraft as soon as able.

Low Battery Condition – Operator will be alerted of a low battery condition and will land the aircraft as

soon as able.

Line-of-Sight Loss – All flight operations will be conducted with the UAS within visual sight of the pilot. If the pilot's view becomes obstructed and line-of-sight is lost, the pilot may instruct the UAS to hover in place until line-of-sight is reestablished, to return to the take-off position, or to land at the current position.

Security
The system and communication links are encrypted by the manufacturers proprietary software.

APPENDIX C

SUMMARY OF AERYON SECTION 333 EXEMPTION REQUEST

Aeryon hereby provides pursuant to Part 11 a summary of its exemption application to allow commercial operation of the SkyRanger small unmanned system in market research, precision aerial survey work, mapping and inspections. An exemption is requested from the following regulations:

14 C.F.R. Part 21;
14 C.F.R. 45.23(b);
14 C.F.R. 61.113(a) & (b);
14 C.F.R. 61.133(a);
14 C.F.R. 91.7(a);
14 C.F.R. 91.9(b)(2) & (c);
14 C.F.R. 91.103;
14 C.F.R. 91.109(a);
14 C.F.R. 91.119;
14 C.F.R. 91.151(a);
14 C.F.R. 91.203(a) & (b);
14 C.F.R. 91.405(a);
14 C.F.R. 91.407(a)(1);
14 C.F.R. 91.409(a)(2);
14 C.F.R. 91.417(a).