



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

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

April 22, 2015

Exemption No. 11412  
Regulatory Docket No. FAA-2015-0181

Dr. W. Richard Laton  
Ms. Rene Perez  
President, Principal Consultant  
Earth Forensics, Inc.  
12532 Vista Panorama  
North Tustin, CA 92705

Dear Dr. Laton and Ms. Perez:

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 January 17, 2015, you petitioned the Federal Aviation Administration (FAA) on behalf of Earth Forensics, Inc. (hereinafter petitioner or operator) for an exemption. The exemption would allow the petitioner to operate an unmanned aircraft system (UAS) to conduct aerial photo services to quickly assess potentially hazardous conditions (landslide and flooding) that may pose as a detriment to the public safety.

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 DJI Phantom 2 Vision+.

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, Earth Forensics, Inc. 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, Earth Forensics, Inc. 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 DJI Phantom 2 Vision+ 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.nts.gov](http://www.nts.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 April 30, 2017, unless sooner superseded or rescinded.

Sincerely,

/s/

John S. Duncan

Director, Flight Standards Service





January 17, 2015

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

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

Dear Sir or Madam:

Pursuant to Section 333 of the FAA Modernization and Reform Act of 2012 (the "Reform Act") and 14 CFR Part 11, Earth Forensics ("EFI"), seeks an exemption from Federal Aviation Regulations ("FARs") detailed below for the PHANTOM 2 Vision+ quad-copter ("PHANTOM") unmanned aircraft system (UAS) manufactured by DJI Innovations.

EFI is comprised of a team of geologists, hydrogeologists, engineers, and professional educators hired by public entities and private industry around the globe to investigate, identify, and implement solutions to geologic, hydrologic, and environmental concerns. Currently, EFI provides aerial blimp photo services to use in the assessment of natural hazard and integration into Geographic Information Systems (GIS) for private and public agencies. With the integration of unmanned aircraft technology into EFI's aerial photo services, it will provide another tool for the quick assessment of potentially hazardous conditions (landslide and flooding) that may pose as a deterrent to the public safety.

Dr. W. Richard Laton, the owner and Principal Scientist of EFI, has been operating a lighter-than-air unmanned aircraft system "blimp" for the past 25 years for the use of natural hazard assessment. Dr. Laton is a licensed geologist and hydrogeologist in 11 US states. Dr. Laton is also a professor at Cal State Fullerton University and has incorporated the use of blimp aerial photography into his research and course work in the assessment of natural hazards and environmental analysis. EFI's blimp is used in photogrammetry and aerial photo assessment in areas where there is a potential for harm to the public or environment. Though the blimp is tethered, Dr. Laton understands the regulations of operating a manned aircraft and the potential of unmanned aircraft technology that can be used in a safe manner under the FAA's approval.

Dr. Laton and Rene Perez another employee at EFI, have flown UAS for a hobby over the past 4 years without any incidents. Currently, remote controlled UAS's are legally operated by unmonitored amateur hobbyists that do not have the same restrictions placed on them as those for commercial use. EFI feels that by gaining FAA approval to this exemption will result in the safe operation of UAS by EFI that will far exceed those safety protocol that most hobbyist currently adhere to.

Approval of EFI's request comports with the Secretary of Transportation's (FAA Administrator's) responsibilities and authority to not only integrate UAS's into the national airspace system, but to "...establish requirements for the safe operation of such aircraft systems [UAS's] in the national airspace system" under Section 333(c) of the Reform Act specific to the use of UAS's for assessment of natural hazards and environmental analysis.. Further EFI will conduct operations in compliance with the protocols described herein or as otherwise established by the FAA

### *Small Unmanned Aircraft System (sUAS)*

EFI will be operation a DJI Phantom 2 Vision + (“PHANTOM”). Safety features included in PHANTOM provide a level of safety that far exceeds those required by the FAA, The PHANTOM contains state of the art features such as programmability, GPS navigation, return home capability, airport vicinity no-fly feature and restricted altitude feature, as well as differentiating radio frequency (rf) for aircraft controller/receiver and for the camera. (See The PHANTOM is flight is controlled by the rf control receiver while the onboard camera is controlled by the DJI Vision APP for a smart phone or tablet (“APP”). See Attachments: User Manual.

The hobby grade radio controlled UAV that has the capacity for software upgrades. It is light, less than 3 pounds including battery and camera. Incorporated into the programming of the Phantom is an automatic return home feature that automatically directs the craft back to point of takeoff should communication with the transmitter be lost. The Phantom has a cruising speed of 15 knots, with a maximum speed of 29 knots. Maximum flight time is 25 minutes. Gross weight is 2.86 pounds.

The Phantom has an additional communication link between the camera and craft on a different rf for a smart phone connection. Allowing the operator or Pilot in Command (PIC) to monitor battery level, altitude (AGL), distance from PIC, camera imagery, and control camera angle.

The software for the Phantom allows the operator or PIC to set maximum altitude AGL for each flight, allowing customization of flights to no higher than 100 feet, 150 feet, or 250 feet AGL as an examples. The 400 foot maximum AGL can be programmed into the sUAS software pre-flight to insure compliance with FAA standards. Adding to the safety capabilities of this sUAS. This sUAS is programmed to remain in position when controls are released. Maintaining altitude and GPS location.

One additional feature included in the APP is the capability to monitor battery levels on the ground. The APP will warn the PIC when the battery life has reaches 20 percent or when the UAV is reaching a point where it will not be able to returned to home point. At which point alarms start sounding and the App will ask if the UAV should return to its home point. Even though these features exist as a safe guard, EFI does not envision using them since the sUAS will always operate with at least 30% battery life remaining.

The Phantom has an altitude and radar monitoring function that allows the operator more precise determination of height, direction of flight and distance from the operator PIC. The operator or PIC can monitor GPS lock status while sUAS is in flight, with the ability to anticipate loss of GPS locking so the operator or PIC can land the sUAS as a precaution.

The aircraft onboard GPS enabled still camera that allows it to conduct precision photogrammetry at the resolutions necessary for assessment of landslide movement and flood monitoring. This high-resolution data can be used to calculate differential ground movement as a safe distance from a potentially dangerous ground movement event. Another use of the data is for the quick assessment of accumulation of sediment in basins in order to minimize the potential for flooding to occur and endanger public safety. This data would help private and public entities in assessing the potential for earth movement and potential adverse effect to the public safety quickly. By approving these exemptions, the FAA will create benefits to both the public and private sectors and enhance public safety which are ultimately in the public’s best interest.

The requested exemption would support an application for a commercial Certificate of Authorization to use the system to support quick geologic hazard assessment; namely landslide and flood assessment. The PHANTOM system consists of a lightweight (3 lb) battery operated Unmanned Aircraft (UA), ground-based remote controller, a tablet-based ground control station, and associated communications equipment.

### *Unmanned Aircraft Pilot in Control (PIC)*

Because the UA will not carry a pilot or passengers, the proposed operations can achieve the equivalent level of safety of current operations by requiring the PIC operating the aircraft to have a private pilot's license rather than a commercial pilot's license to operate this small UAS. Unlike a conventional aircraft that carries the pilot and passengers, the sUAS is remotely controlled with no living thing on board. The risks associated with the operation of the sUAS are so diminished from the level of risk associated with commercial operations contemplated by Part 61 when drafted, that allowing operations of the sUAS as requested with a private pilot as the PIC exceeds the present level of safety achieved by 14 CFR §§61.113 (a) & (b).

#### *Operation of the Unmanned Aircraft (UA)*

EFI's exemption will not adversely affect safety and will operate at a level of safety at least equal to existing rule. The limitations and conditions to which EFI agrees to be bound when conducting commercial operations under an FAA issued exemption include:

- EFI's UA weighs less than 3 lbs.
- The UA will be piloted through remote control only in line of sight up to a distance of 1,000 feet.
- All operations will occur in Class G airspace at no more than 400' AGL.
- Minimum crew for each operation will consist of the UA Pilot, and the Visual Observer.
- UA Pilot will be an FAA licensed airman with at least a private pilot's certificate and third class medical certificate. The observer will hold at least a third class certificate.
- PIC and observer will have been trained in operation of UA generally and received up-to-date information.
- The UA is equipped with a GPS flight safety feature whereby the UA will return to take off point and slowly lands if communication with the remote control pilot is lost.
- The UA will operate in reasonably safe environment that are strictly controlled, are away from power lines, elevated lights, airports and actively populated areas.
- EFI will conduct extensive pre-flight inspections and protocol, during which safety carries primary importance. These pre-flight measures include but not limited to reviewing existing topographic maps, google earth imagery, and inspection of the flight area before UA take-off.
- All required permits will be obtained from state and local government prior to operation.
- The UA will not be operated at air shows or over an open-air assembly of people.
- The UA will not be operated over heavily trafficked roads.
- The UA will not be operated within 5 NM of an airport or heliport.
- Operations will be limited to day, visual meteorological conditions.
- The UA will not be operated over urban or populated areas.

#### **1. 14 CFR 11.81 (a) Contact Information:**

Earth Forensics, Inc.  
 Attn: Dr. W. Richard Laton  
 Ph: 714-296-4055 or 714-612-3046  
 Fax: 714-771-2620  
 Email: [wlaton@earthforensics.com](mailto:wlaton@earthforensics.com) or [rperez@earthforensics.com](mailto:rperez@earthforensics.com)

#### **2. 14 CFR 11.81 (b) – Exemptions Requested:**

The FAA considers unmanned aircraft as "aircraft" flown by a "pilot" regardless of the location of the pilot. All aircraft and pilots must comply with applicable sections of Title 14 of the Code of Federal Regulations (14 CFR) and other rules/regulations to operate within the National Airspace. Unmanned aircraft are unable to comply with certain sections of 14 CFR as the regulations were written prior to the consideration of small UAS integration within the national airspace. Therefore, EFI is respectfully requesting an exemption from certain parts of 14 CFR cited below,

in addition to such further exemptions and relief as the FAA may determine is necessary to permit the operations described herein.

14 CFR Part 21 Subpart H – Airworthiness certification

14 CFR Part 45.23 & 45.29 – Display of marks; general & Size of Marks

14 CFR Part 61.113 (a) and (b) – Private pilot privileges and limitations: Pilot in command

14 CFR Part 91.7 – Civil Aircraft Airworthiness

14 CFR Part 91.9 (b) – Civil aircraft flight manual, marking and placard requirements

14 CFR Part 91.103 – Pre-flight action

14 CFR Part 91.109 – Flight Instruction

14 CFR Part 91.119 – Minimum safe altitudes

14 CFR Part 91.121 – Altimeter settings

14 CFR Part 91.151 – Fuel requirements for flight in VFR conditions

14 CFR Part 91.203 (a) and (b) – Civil Aircraft; Certifications Required

14 CFR Part 91.405 – Maintenance required

14 CFR Part 91.407 – Operation after maintenance, preventive maintenance, rebuilding or alteration

14 CFR Part 91.409 – Inspections

14 CFR Part 91.417 – Maintenance Records U.S. DOT-FAA-Air Traffic Organization Policy

### **3. 14 CFR Part 11.81 (c) – The extent of relief EFI seeks, and the reason EFI seeks the relief:**

EFI seeks relief pursuant to this exemption from applicable parts of the Federal Aviation Regulations and other rules/regulations to the extent necessary to permit civil flight operations within the national airspace. EFI seeks authorization to conduct small UAS flight operations within the perimeters of this exemption request.

#### **a. 14 CFR Part 21 Subpart H (Airworthiness Certificates)**

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 and limited operating area associated with the aircraft to be utilized by the Applicant, an exemption from Part 21 Subpart H meets the requirements of an equivalent level of safety under Part 11 and Section 333 of the Reform Act. The Federal Aviation Act (49 U.S.C. §44701 (f)) 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 particular UAS. In all cases, an analysis of these criteria demonstrates that the UAS operated without an airworthiness certificate, in the restricted environment and under the conditions proposed will be at least as safe, or safer, than a conventional aircraft (fixed wing or rotorcraft) operating with an airworthiness certificate without the restrictions and conditions proposed.

The sUAS to be operated hereunder is less than 55 lbs. fully loaded, carries neither a pilot nor passenger, carries no explosive materials or flammable liquid fuels, and operates exclusively within a secured area as set out in the Manual. Unlike other civil aircraft, operations under this exemption will be tightly controlled and monitored by both the operator, pursuant to the Manual's requirements, and under the requirements and in compliance with local public safety requirements, to provide security for the area of operation as is now done with conventional filming. The FAA will have advance notice of all operations. These safety enhancements, which already apply to civil aircraft operated in connection with motion picture and television production, provide a greater degree of safety to the public and property owners than conventional operations conducted with airworthiness certificates issued under 14 C.F.R. Part 21, Subpart H. Lastly, application of these same criteria demonstrates that there is no credible threat to national security posed by the UAS, due to its size, speed of operation, location of operation, lack of explosive materials or flammable liquid fuels, and inability to carry a substantial external load.

The FAA has issued the following exemptions to this regulation to Exemptions Nos. 11066, 11062, 11067 11065, 11138, 11136, and 11111.

**b. 14 CFR 45.23 (b) Display of marks; general and 45.29 Size of marks**

EFI, as the petitioner seeks relief from Part 45.23 (b) requiring markings on certain sections of the aircraft and markings of a certain size. Additionally, the aircraft must display the word "EXPERIMENTAL" in letters at least 2 inches high near the entrance to the cabin, cockpit, or pilot station.

The sUAV does not have an entrance in which the word "EXPERIMENTAL" can be placed. The size of the sUAV limits the size of the lettering that can be placed. The sUAV will have the words "Experimental" placed on the fuselage as large as possible in compliance with §45.29 (f) .

The equivalent level of safety will be provided by having the sUAV marked on its fuselage as required by §45.29 (f) where the pilot, observer and others working with the sUAV will see the identification of the UAS as "Experimental." The FAA has issued the following exemptions to this regulation to Exemptions Nos. 10700, 8738, 10167 and 10167A.

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

Part 61.113 (a) states that no person who holds a private pilot certificate may act as pilot in command of an aircraft that is carrying passengers or property for compensation or hire; nor may that person, for compensation or hire, act as pilot in command of an aircraft. Part 61.113 (b) states that a private pilot may, for compensation or hire, act as pilot in command of an aircraft in connection with any business or employment if: (1) The flight is only incidental to that business or employment; and (2) The aircraft does not carry passengers or property for compensation or hire. The FAA stated that it had to determine the level of pilot certificate appropriate for that proposed operation within the Grant of Exemption Regulatory Docket No. FAA-2014-0352. The FAA said within the Grant that it considers the overriding safety factor to be the airmanship skills acquired through UAS-specific flight cycles, flight time, and specific make and model experience and UAS testing.

EFI agrees with this determination and our proposed operations require that the PIC must either hold a Private Pilot Certificate issued by the FAA. Since there are currently no means available for the pilot of a UAS to gain the experience in an equivalent category and class in order to apply for a commercial pilot's license, EF proposes to generate an equivalent level of safety by requiring our pilots to complete, at a minimum, FAA private pilot ground instruction and pass the FAA Private Pilot written examination in addition to completing the private pilot requirements. Since the aircraft cannot carry passengers or property, we feel we meet the intent of 61.113 Subparagraph (b) even though the intent of this application is to conduct a business.

**d. 14 CFR Part 91.7 (Civil Aircraft Airworthiness).**

This regulation states that (a) No person may operate a civil aircraft unless it is in airworthy condition and (b) The pilot in command of a civil aircraft is responsible for determining whether that aircraft is in condition for safe flight. The pilot in command shall discontinue the flight when un-airworthy mechanical, electrical, or structural conditions occur. This exemption would not be necessary should the FAA approve the exemption for 14 CFR Part 21 Subpart H. If EFI UAS is not required to obtain an airworthiness certificate, then this would not apply; however EFI would maintain the UAS and the PIC would deem the UAS safe for flight operations and discontinue any flight if any mechanical, electrical, or structural problem arose.



**e. 14 CFR Part 91.9 (b) (Civil Aircraft Flight Manual, marking and placard requirements) and 14 CFR Part 91.203 (a) and (b) (Civil Aircraft; Certifications Required).**

This regulation states that no person may operate a U.S. registered civil aircraft-(1) For which an Airplane or Rotorcraft Flight Manual is required by Part 21.5 of 14 CFR unless there is available in the aircraft a current, approved Airplane or Rotorcraft Flight Manual or the manual provided for in 14 CFR Part 121.141 (b); and (2) For which an Airplane or Rotorcraft Flight Manual is not required by 14 CFR Part 21.5, 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 sUAS, given its size and configuration 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.

EFI feels that requesting relief from these regulations may not be necessary. EFI will have in its possession, on-site, the UAS manufacturer's flight/operations manual and registration paperwork.

The equivalent level of safety will be maintained by keeping the flight manual at the ground control point where the pilot flying the sUAV will have immediate access to it. The FAA has issued the following exemptions to this regulation: Exemption Nos. 8607, 8737, 8738, 9299, 9299A, 9565, 9565B, 10167, 10167A, 10602, 32827, and 10700.

**f. 14 CFR 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 attachment provided (EFI pre-flight check list). The PIC will take all actions including reviewing weather, flight battery requirements, landing and takeoff distances and aircraft performance data before initiation of flight.

**g. 14 CFR 91.109 Flight Instruction; Simulated instrument flight and certain flight tests**

The regulation states, "No person may operate a civil aircraft that is being used for flight instruction unless that aircraft has fully functioning dual controls."

sUASs and remotely piloted aircraft, by their design do 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 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 provided by the fact that neither a pilot nor passengers will be carried in the aircraft and by the size and speed of the aircraft.

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

The regulation states that over sparsely populated areas the aircraft cannot be operated closer than 500 feet to any person, vessel, vehicle, or structure.

Since our sUAS is restraint to 400 feet AGL, EFI would not be able to comply with this requirement. In order to provide an equivalent level of safety we will only fly over private property within the size of the property and with the permission of the owner of the property. The aircraft will not be operated over congested areas or over any open-air assembly of persons. The property owner will be briefed on the expected route of flight and the associated risks to persons and property on the ground. The aircraft will be operated at a low altitude allowing, if a power unit fails, an emergency landing without undue hazard to

persons or property on the surface. Therefore we maintain that due to the small size of the sUAS, the hazard to persons, vehicles and structures is minimal compared to manned aircraft, which should be considered in granting the exemption.

**i. 14 CFR Part 91.121 (Altimeter Settings)**

This regulation requires each person operating an aircraft to maintain cruising altitude by reference to an altimeter that is set "...to the elevation of the departure airport or an appropriate altimeter setting available before departure."

As the sUAS may not have a barometric altimeter, but instead a GPS altitude read out, an exemption may be needed. An equivalent level of safety will be achieved by the operator, pursuant to the Manual and Safety Check list, confirming the altitude of the launch site shown on the GPS altitude indicator before flight.

**j. 14 CFR 91.151(a) Fuel requirements for flight in VFR conditions**

The regulation provides that no person may begin a flight in an airplane under day-VFR conditions unless there is enough fuel to fly to the first point of intended landing and to fly after that for at least 30 minutes.

We feel the intention of this paragraph is to provide an energy reserve as a safety buffer for delays to landing. The sUAS is battery operated and the maximum duration of flight from a single battery charge is a max flight time of 21-25 minutes but all EFI operations are limited to 15 minutes (60-71% battery consumption) with a reserve of 6-10 minutes (29-40% battery reserve) for return to base procedures. A "dynamic home" button on the remote control gives the PIC a one-touch button return home/base action. The PHANTOM is controlled by a remote control base station and an Apple iPad which runs an application (APP) that provides airspeed, waypoints, compass, battery life, flight time and airspace information. Even though EFI does not expect to operate in conditions where the battery levels will be below 20%, the APP will begin to warn PIC and will ask to bring home UAV. This will ensure that we meet the reserve energy requirement of this paragraph. We request an exemption to the word "fuel" and ask for an equivalent interpretation with the word "energy".

**k. 14 CFR Part 91.203 (a) and (b) – Civil Aircraft; Certifications Required.**

These regulations state that

(a) Except as provided in §91.715, no person may operate a civil aircraft unless it has within it the following: (1) An appropriate and current airworthiness certificate. Each U.S. airworthiness certificate used to comply with this subparagraph (except a special flight permit, a copy of the applicable operations specifications issued under §21.197(c) of this chapter, appropriate sections of the air carrier manual required by parts 121 and 135 of this chapter containing that portion of the operations specifications issued under §21.197(c), or an authorization under §91.611) must have on it the registration number assigned to the aircraft under part 47 of this chapter. However, the airworthiness certificate need not have on it an assigned special identification number before 10 days after that number is first affixed to the aircraft. A revised airworthiness certificate having on it an assigned special identification number that has been affixed to an aircraft may only be obtained upon application to an FAA Flight Standards district office. (2) An effective U.S. registration certificate issued to its owner or, for operation within the United States, the second copy of the Aircraft registration Application as provided for in §47.31(c), or a registration certification issued under the laws of a foreign country.

(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 sUAS fully loaded weighs no more than 55 lbs and is operated without an onboard pilot. As such, there is no ability or place to carry certification and registration documents or to display them on the sUAS.

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, to the extent they are applicable to the sUAS. 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.

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

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

It is our intention that the PIC perform maintenance and inspection of the aircraft and "be authorized to approve the aircraft for return to service." The PIC will ensure that the aircraft is in an airworthy condition prior to every flight and in addition conduct detailed inspections after every two hours of flight. Maintenance performed by the PIC is limited to repairing small cracks, replacing a propeller, checking electrical connections and updating software and firmware for the on-board computer. The manufacturer or their designated repair facility will perform all other maintenance. The PIC will document work performed in accordance with 91.417. We feel that due to the size, construction, and simplicity of the aircraft, the PIC can ensure an equivalent level of safety.

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

This policy provides that both the PIC and VO must have a valid FAA second-class medical certificate issued under part 67 in order to perform as a pilot or observer.

The sUAS maximum gross weight is under 3 pounds, it is constructed of carbon fiber and plastic and the PIC is not on board. Both the PIC and the VO are required to be in visual line of sight. Given the unlikely event that both the PIC and VO become medically incapacitated while the aircraft is in flight, the UAS will return autonomously to the site of launching and land without crew intervention. Therefore, requiring the PIC and VO to meet the same medical requirements as a commercial pilot carrying passengers in a large aircraft is an unnecessary burden. We propose that the minimum medical requirements for the PIC and VO be a FAA third class medical certificate.

**4. 14 CFR Part 11.81 (d)-The reasons why granting EFI request would be in the public interest; that is, how it would benefit the public as a whole**

The reasons why granting EFI request would be in the public interest; that is, how it would benefit the public as a whole:

Granting an exemption for EFI would allow the organization to safely and efficiently conduct small UAS flight operations to assist in the quick response and assessment of potentially hazardous conditions, specifically landslide and flooding that may pose a detriment to the public safety. Other potential natural hazards that the UAS may be used to provide a tool for the quick response and assessment of potentially dangerous situation to public safety are Tsunami, Earthquake, and Hurricanes, and Tornado damage.

Without this exemption, EFI would be restricted to the use of its aerial blimp which is not as time efficient as the sUAS and is relatively limited to airspace above the PIC which may at times be dangerous for employees to navigate, especially given the potentially dangerous conditions near and around moving landslides and/or flooding events.



EFI, with the integration of unmanned aircraft technology into EFI's services, will have an immediate and positive impact by providing enhanced services and experience while providing safer and environmentally efficient service by dismissing the use of manned helicopters or planes and their emissions. This new avenue of intelligence will, in a positive way, impact the public's interest with a complete evaluation of their security and less of an environmental impact from manned aircraft, emissions and the fatal injuries they represent.

**5. 14 CFR Part 11.81 (e) – The reasons why granting the exemption would not adversely affect safety, or how the exemption would provide a level of safety at least equal to that provided by the rule from which EFI seeks the exemption**

The operation of small UASs, weighting less than 55 lbs., conducted in the strict conditions outlined above, will provide an equivalent level of safety supporting the grant of the exemptions requested herein, including exempting the applicant from the requirements of Part 21 and allowing commercial operations. These lightweight aircraft operate at slow speeds, close to the ground, and in a sterile environment and, as a result, are far safer than conventional operations conducted with turbine helicopters operating in close proximity to the ground and people

**6. 14 CFR Part 11.81 (f)- A summary we can publish in the Federal Register, stating**

**(1) The rule from which you seek the exemption**

14 CFR Part 21 Subpart H – Airworthiness certification  
 14 CFR Part 45.23 & 45.29 – Display of marks; general & Size of Marks  
 14 CFR Part 61.113 (a) and (b) – Private pilot privileges and limitations: Pilot in command  
 14 CFR Part 91.7 – Civil Aircraft Airworthiness  
 14 CFR Part 91.9 (b) – Civil aircraft flight manual, marking and placard requirements  
 14 CFR Part 91.103 – Pre-flight action  
 14 CFR Part 91.109 – Flight Instruction  
 14 CFR Part 91.119 – Minimum safe altitudes  
 14 CFR Part 91.121 – Altimeter settings  
 14 CFR Part 91.151 – Fuel requirements for flight in VFR conditions  
 14 CFR Part 91.203 (a) and (b) – Civil Aircraft; Certifications Required  
 14 CFR Part 91.405 – Maintenance required  
 14 CFR Part 91.407 – Operation after maintenance, preventive maintenance, rebuilding or alteration  
 14 CFR Part 91.409 – Inspections  
 14 CFR Part 91.417 – Maintenance Records U.S. DOT-FAA-Air Traffic Organization Policy

**(2) A brief description of the nature of the exemption you seek**

EFI seeks relief from the applicable parts of 14 CFR 21, 45, 61, 91 and U.S. DOT-FAA-Air Traffic Organization Policy Notice N JO 7210.873 (6.d) as requested within this petition to allow EFI to safely and efficiently conduct civil sUAS flight operations. This will have an immediate and positive impact by providing enhanced services and experience while providing safer and environmentally efficient service by dismissing the use of manned helicopters and their emissions. This new avenue of intelligence will, in a positive way, impact the public's interest with a complete evaluation of their security and less of an environmental impact from manned aircraft, emissions and the fatal injuries they represent

Approval of exemptions allowing commercial operations of sUASs in natural hazard assessment will enhance public safety by incorporating a quick tool in the assessment of landslide, flooding, earthquake, tsunami, and tornado damage.

The operation of small UASs, weighting less than 55 lbs., conducted in the strict conditions outlined above, will provide an equivalent level of safety supporting the grant of the exemptions requested herein, including

exempting the applicant from the requirements of Part 21 and allowing commercial operations. These lightweight aircraft operate at slow speeds, close to the ground, and in a sterile environment and, as a result, are far safer than conventional operations conducted with turbine helicopters operating in close proximity to the ground and people.

**7. 14 CFR Part 11.81 (g) Any additional information, views or arguments available to support your request**

This exemption to EFI would allow for a quick responsible way for the assessment of natural hazards and environmental analysis thus benefitting public safety and emergency response. The use and utilization of aerial photographs acquired from the UAS are in no way different than those currently acquired by manned airplanes. Using UAS instead of an airplane would decrease the time to complete a hazard assessment which could lead to faster mitigation responses. Additional development and operations would benefit not only its communities and the public at large, but would allow EFI to serve as a partner with the FAA and others within the UAS community to advance this new and emerging technology in a safe and controlled environment. EFI has demonstrated the value of our request to utilize our UAS technology in a productive and safe manner within the FAA guidelines.

We are prepared to modify or amend any part of this request to satisfy the need for an equivalent level of safety. We look forward to working with your

**Respectfully submitted**

**EARTH FORENSICS, Inc.**



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President, Principal Consultant



**Rene Perez, MS, PG 8184, CHG 997**  
Senior Consultant

**Attachments:**

**EFI Phantom Pre-Flight Check List**

**Phantom\_2\_Vision\_Plus\_User\_Manual\_v1.6\_en**

**Phantom\_2\_Vision\_Plus\_Pilot\_Training\_Guide\_v1.1\_en**

**Phantom\_2\_Vision\_Plus\_Quick\_Start\_Guide\_en**

**Smart\_Flight\_Battery\_Safety\_Guidelines**