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

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

August 25, 2015

Exemption No. 12587
Regulatory Docket No. FAA−2015−2302

Dr. Daanen Strachan
Alternatives Renewable Solutions, LLC
1725 I Street, NW., Suite 300
Washington DC 20006

Dear Dr. Strachan:

This letter is to inform you that we have granted your request for exemption. It transmits our decision, explains its basis, and gives you the conditions and limitations of the exemption, including the date it ends.

By letter dated May 23, 2015, you petitioned the Federal Aviation Administration (FAA) on behalf of Alternatives Renewable Solutions, LLC (hereinafter petitioner or operator) for an exemption. The petitioner requested to operate an unmanned aircraft system (UAS) to conduct aerial public safety inspections and photography of properties, bridges, and construction sites.

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

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

Airworthiness Certification

The UAS proposed by the petitioner are the DJI Phantom 2 Vision Plus and Walkera Tali H500.

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[1]. The FAA has issued grants of exemption in circumstances similar in all material respects to those presented in your petition. In Grants of Exemption Nos. 11062 to Astraeus Aerial (*see* Docket No. FAA−2014−0352), 11109 to Clayco, Inc. (*see* Docket No. FAA−2014−0507), 11112 to VDOS Global, LLC (*see* Docket No. FAA−2014−0382), and 11213 to Aeryon Labs, Inc. (*see* Docket No. FAA−2014−0642), the FAA found that the enhanced safety achieved using an unmanned aircraft (UA) with the specifications described by the petitioner and carrying no passengers or crew, rather than a manned aircraft of significantly greater proportions, carrying crew in addition to flammable fuel, gives the FAA good cause to find that the UAS operation enabled by this exemption is in the public interest.

Having reviewed your reasons for requesting an exemption, I find that—

- They are similar in all material respects to relief previously requested in Grant of Exemption Nos. 11062, 11109, 11112, and 11213;
- The reasons stated by the FAA for granting Exemption Nos. 11062, 11109, 11112, and 11213 also apply to the situation you present; and
- A grant of exemption is in the public interest.

Our Decision

In consideration of the foregoing, I find that a grant of exemption is in the public interest. Therefore, pursuant to the authority contained in 49 U.S.C. 106(f), 40113, and 44701, delegated to me by the Administrator, Alternatives Renewable Solutions, LLC is granted an exemption from 14 CFR §§ 61.23(a) and (c), 61.101(e)(4) and (5), 61.113(a), 61.315(a), 91.7(a), 91.119(c), 91.121, 91.151(a)(1), 91.405(a), 91.407(a)(1), 91.409(a)(1) and (2), and 91.417(a) and (b), to the extent necessary to allow the petitioner to operate a UAS to perform

[1] Aerial data collection includes any remote sensing and measuring by an instrument(s) aboard the UA. Examples include imagery (photography, video, infrared, etc.), electronic measurement (precision surveying, RF analysis, etc.), chemical measurement (particulate measurement, etc.), or any other gathering of data by instruments aboard the UA.

aerial data collection. This exemption is subject to the conditions and limitations listed below.

Conditions and Limitations

In this grant of exemption, Alternatives Renewable Solutions, LLC is hereafter referred to as the operator.

Failure to comply with any of the conditions and limitations of this grant of exemption will be grounds for the immediate suspension or rescission of this exemption.

1. Operations authorized by this grant of exemption are limited to the DJI Phantom 2 Vision Plus and Walkera Tali H500 when weighing less than 55 pounds including payload. Proposed operations of any other aircraft will require a new petition or a petition to amend this exemption.

2. Operations for the purpose of closed-set motion picture and television filming are not permitted.

3. The UA may not be operated at a speed exceeding 87 knots (100 miles per hour). The exemption holder may use either groundspeed or calibrated airspeed to determine compliance with the 87 knot speed restriction. In no case will the UA be operated at airspeeds greater than the maximum UA operating airspeed recommended by the aircraft manufacturer.

4. The UA must be operated at an altitude of no more than 400 feet above ground level (AGL). Altitude must be reported in feet AGL.

5. The UA must be operated within visual line of sight (VLOS) of the PIC at all times. This requires the PIC to be able to use human vision unaided by any device other than corrective lenses, as specified on the PIC's FAA-issued airman medical certificate or U.S. driver's license.

6. All operations must utilize a visual observer (VO). The UA must be operated within the visual line of sight (VLOS) of the PIC and VO at all times. The VO may be used to satisfy the VLOS requirement as long as the PIC always maintains VLOS capability. The VO and PIC must be able to communicate verbally at all times; electronic messaging or texting is not permitted during flight operations. The PIC must be designated before the flight and cannot transfer his or her designation for the duration of the flight. The PIC must ensure that the VO can perform the duties required of the VO.

7. This exemption and all documents needed to operate the UAS and conduct its operations in accordance with the conditions and limitations stated in this grant of

exemption, are hereinafter referred to as the operating documents. The operating documents must be accessible during UAS operations and made available to the Administrator upon request. If a discrepancy exists between the conditions and limitations in this exemption and the procedures outlined in the operating documents, the conditions and limitations herein take precedence and must be followed. Otherwise, the operator must follow the procedures as outlined in its operating documents. The operator may update or revise its operating documents. It is the operator's responsibility to track such revisions and present updated and revised documents to the Administrator or any law enforcement official upon request. The operator must also present updated and revised documents if it petitions for extension or amendment to this grant of exemption. If the operator determines that any update or revision would affect the basis upon which the FAA granted this exemption, then the operator must petition for an amendment to its grant of exemption. The FAA's UAS Integration Office (AFS−80) may be contacted if questions arise regarding updates or revisions to the operating documents.

8. Any UAS that has undergone maintenance or alterations that affect the UAS operation or flight characteristics, e.g., replacement of a flight critical component, must undergo a functional test flight prior to conducting further operations under this exemption. Functional test flights may only be conducted by a PIC with a VO and must remain at least 500 feet from other people. The functional test flight must be conducted in such a manner so as to not pose an undue hazard to persons and property.

9. The operator is responsible for maintaining and inspecting the UAS to ensure that it is in a condition for safe operation.

10. Prior to each flight, the PIC must conduct a pre-flight inspection and determine the UAS is in a condition for safe flight. The pre-flight inspection must account for all potential discrepancies, e.g., inoperable components, items, or equipment. If the inspection reveals a condition that affects the safe operation of the UAS, the aircraft is prohibited from operating until the necessary maintenance has been performed and the UAS is found to be in a condition for safe flight.

11. The operator must follow the UAS manufacturer's maintenance, overhaul, replacement, inspection, and life limit requirements for the aircraft and aircraft components.

12. Each UAS operated under this exemption must comply with all manufacturer safety bulletins.

13. Under this grant of exemption, a PIC must hold either an airline transport, commercial, private, recreational, or sport pilot certificate. The PIC must also hold a current FAA airman medical certificate or a valid U.S. driver's license issued by a state, the District of Columbia, Puerto Rico, a territory, a possession, or the Federal

government. The PIC must also meet the flight review requirements specified in 14 CFR § 61.56 in an aircraft in which the PIC is rated on his or her pilot certificate.

14. The operator may not permit any PIC to operate unless the PIC demonstrates the ability to safely operate the UAS in a manner consistent with how the UAS will be operated under this exemption, including evasive and emergency maneuvers and maintaining appropriate distances from persons, vessels, vehicles and structures. PIC qualification flight hours and currency must be logged in a manner consistent with 14 CFR § 61.51(b). Flights for the purposes of training the operator's PICs and VOs (training, proficiency, and experience-building) and determining the PIC's ability to safely operate the UAS in a manner consistent with how the UAS will be operated under this exemption are permitted under the terms of this exemption. However, training operations may only be conducted during dedicated training sessions. During training, proficiency, and experience-building flights, all persons not essential for flight operations are considered nonparticipants, and the PIC must operate the UA with appropriate distance from nonparticipants in accordance with 14 CFR § 91.119.

15. UAS operations may not be conducted during night, as defined in 14 CFR § 1.1. All operations must be conducted under visual meteorological conditions (VMC). Flights under special visual flight rules (SVFR) are not authorized.

16. The UA may not operate within 5 nautical miles of an airport reference point (ARP) as denoted in the current FAA Airport/Facility Directory (AFD) or for airports not denoted with an ARP, the center of the airport symbol as denoted on the current FAA-published aeronautical chart, unless a letter of agreement with that airport's management is obtained or otherwise permitted by a COA issued to the exemption holder. The letter of agreement with the airport management must be made available to the Administrator or any law enforcement official upon request.

17. The UA may not be operated less than 500 feet below or less than 2,000 feet horizontally from a cloud or when visibility is less than 3 statute miles from the PIC.

18. If the UAS loses communications or loses its GPS signal, the UA must return to a pre-determined location within the private or controlled-access property.

19. The PIC must abort the flight in the event of unpredicted obstacles or emergencies.

20. The PIC is prohibited from beginning a flight unless (considering wind and forecast weather conditions) there is enough available power for the UA to conduct the intended operation and to operate after that for at least five minutes or with the reserve power recommended by the manufacturer if greater.

21. Air Traffic Organization (ATO) Certificate of Waiver or Authorization (COA). All operations shall be conducted in accordance with an ATO-issued COA. The

exemption holder may apply for a new or amended COA if it intends to conduct operations that cannot be conducted under the terms of the attached COA.

22. All aircraft operated in accordance with this exemption must be identified by serial number, registered in accordance with 14 CFR part 47, and have identification (N−Number) markings in accordance with 14 CFR part 45, Subpart C. Markings must be as large as practicable.

23. Documents used by the operator to ensure the safe operation and flight of the UAS and any documents required under 14 CFR §§ 91.9 and 91.203 must be available to the PIC at the Ground Control Station of the UAS any time the aircraft is operating. These documents must be made available to the Administrator or any law enforcement official upon request.

24. The UA must remain clear and give way to all manned aviation operations and activities at all times.

25. The UAS may not be operated by the PIC from any moving device or vehicle.

26. All Flight operations must be conducted at least 500 feet from all nonparticipating persons, vessels, vehicles, and structures unless:
    a. Barriers or structures are present that sufficiently protect nonparticipating persons from the UA and/or debris in the event of an accident. The operator must ensure that nonparticipating persons remain under such protection. If a situation arises where nonparticipating persons leave such protection and are within 500 feet of the UA, flight operations must cease immediately in a manner ensuring the safety of nonparticipating persons; and
    b. The owner/controller of any vessels, vehicles or structures has granted permission for operating closer to those objects and the PIC has made a safety assessment of the risk of operating closer to those objects and determined that it does not present an undue hazard.

    The PIC, VO, operator trainees or essential persons are not considered nonparticipating persons under this exemption.

27. All operations shall be conducted over private or controlled-access property with permission from the property owner/controller or authorized representative. Permission from property owner/controller or authorized representative will be obtained for each flight to be conducted.

28. Any incident, accident, or flight operation that transgresses the lateral or vertical boundaries of the operational area as defined by the applicable COA must be reported to the FAA's UAS Integration Office (AFS−80) within 24 hours. Accidents must be

reported to the National Transportation Safety Board (NTSB) per instructions contained on the NTSB Web site: www.ntsb.gov.

If this exemption permits operations for the purpose of closed-set motion picture and television filming and production, the following additional conditions and limitations apply.

29. The operator must have a motion picture and television operations manual (MPTOM) as documented in this grant of exemption.

30. At least 3 days before aerial filming, the operator of the UAS affected by this exemption must submit a written Plan of Activities to the local Flight Standards District Office (FSDO) with jurisdiction over the area of proposed filming. The 3-day notification may be waived with the concurrence of the FSDO. The plan of activities must include at least the following:
    a. Dates and times for all flights;
    b. Name and phone number of the operator for the UAS aerial filming conducted under this grant of exemption;
    c. Name and phone number of the person responsible for the on-scene operation of the UAS;
    d. Make, model, and serial or N−Number of UAS to be used;
    e. Name and certificate number of UAS PICs involved in the aerial filming;
    f. A statement that the operator has obtained permission from property owners and/or local officials to conduct the filming production event; the list of those who gave permission must be made available to the inspector upon request;
    g. Signature of exemption holder or representative; and
    h. A description of the flight activity, including maps or diagrams of any area, city, town, county, and/or state over which filming will be conducted and the altitudes essential to accomplish the operation.

31. Flight operations may be conducted closer than 500 feet from participating persons consenting to be involved and necessary for the filming production, as specified in the exemption holder's MPTOM.

Unless otherwise specified in this grant of exemption, the UAS, the UAS PIC, and the UAS operations must comply with all applicable parts of 14 CFR including, but not limited to, parts 45, 47, 61, and 91.

This exemption terminates on August 31, 2017, unless sooner superseded or rescinded.

Sincerely,

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

Enclosures

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

Reg. Docket No._____

In the Matter of the Petition for Applicant

Alternatives Renewable Solutions, LLC

For an Exemption from the Requirements of the
Code of Federal Regulations Sections
Concerning Operations of Unmanned Aircraft Systems
Pursuant to Section 333 of the
FAA Modernization and Reform Act of 2012

Contact Information: Alternatives Renewable Solutions, LLC
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May 23, 2015

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

RE: Exemption Request from Section 333 of the FAA Modernization and Reform Act of 2012, Parts 21, 27, 45, 61, 91, and 93 of Federal Aviation Regulations

Dear Sir or Madam:

Pursuant to Section 333 of the FAA Modernization and Reform Act of 2012 and 14 C.F.R. Parts 21, 27, 45, 61, 91, and 93, Alternatives Renewable Solutions, LLC ("Petitioner"), a construction and engineering firm, hereby applies for an exemption from the listed Federal Aviation Regulations to allow commercial operations of both Micro Unmanned Aircraft Systems (mUAS) and Small Unmanned Aircraft Systems (sUAS) for conducting aerial public safety inspections and photography of vacant/and or occupied buildings, temporary tower crane assembly verification, construction activities for compliance determination, and substructure bridge inspections, so long as such operations are conducted within and under the conditions outlined here in or as may be established by the FAA as required by Section 333. We seek an exemption from the following regulations:

a) *14 C.F.R. Part 21, Subpart H- Airworthiness Certificates and 14 C.F.R. § 91.203(a)(1)*
b) *14 C.F.R. Part 27 Airworthiness Standards: Normal Category Rotorcraft*
c) *14 C.F.R. §§ 45.23(b), 45.27(a) and 91.9(c): Aircraft Marking and Identification Requirements*
d) *14 C.F.R. § 61.113: Private Pilot Privileges and Limitations*
e) *14 C.F.R. §91.7(a): Civil Aircraft Airworthiness*
f) *14 C.F.R. §91.9(b)(2): Civil Aircraft Flight Manual in the Aircraft*
g) *14 C.F.R. §91.103: Preflight Action*
h) *14 C.F.R. §91.109(a): Flight Instruction*
i) *14 C.F.R. §91.119: Minimum Safe Altitudes*
j) *14 C.F.R. §91.121: Altimeter Settings*
k) *14 C.F.R. §91.151(a): Fuel Requirements for Flight in VFR Conditions*
l) *14 C.F.R. §91.203(a) and (b): Carrying Civil Aircraft Certification and Registration*
m) *14 C.F.R. §§91.405(a); 407(a)(1); 409(a)(s); 417(a)(b): Maintenance Inspections*
n) *14 C.F.R. Subchapter F, Part 93-Special Air Traffic Rules, Subpart V-Washington, DC Metropolitan Area Special Flight Rules, §93.333: Failure to Comply with this Subpart*
o) *14 C.F.R. Subchapter F, Part 93-Special Air Traffic Rules, Subpart V-Washington, DC Metropolitan Area Special Flight Rules, §93.339 (a) through (e): Requirements for Operating in the DC SFRA, including the DC FRZ*
p) *14 C.F.R. Subchapter F, Part 93-Special Air Traffic Rules, Subpart V-Washington, DC Metropolitan Area Special Flight Rules, §93.341 (a);(c1) through (c5);(d): Aircraft Operations in the DC FRZ*

As shown in this petition and attached supporting documents, we request an exemption that would permit the operations of both mUAS and sUAS under controlled conditions in the Class G airspace that is 1)

limited; 2) predetermined; 3) controlled as to access; 4) identified and monitored; and 5) we will provide the necessary safety improvements and enhancements using industry practices for all operations. Approving our petition would thereby enhance safety while fulfilling the Secretary of Transportation's responsibilities to "establish requirements for the safe operation of such aircraft systems in the national airspace system" of Section 333(c) of the FAA Modernization and Reform Act of 2012.

If you have any questions, please feel free to contact me.

Sincerely,

William Jones

William Jones
General Counsel

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1 Description of Petitioner

Alternatives Renewable Solutions, LLC, a Disadvantage Business Enterprise (DBE) and Certified Business Enterprise (CBE) formed in 2009, is a Washington-DC based consulting company solving problems through innovative applications and solutions. We are addressing customers' needs in construction, engineering, and architecture using industry best practices. We are involved in the planning, coordination of various projects including government, residential, and commercial projects.

The Petitioner has launched its drone mapping and inspection service. Our quadcopter and hexacopter assets are suitable for various private, industrial, and commercial applications. We seek to provide aerial image-thermography, inspections of sites using high resolution video and photo cameras, surveys, and 3D image mapping from a point cloud. Aerial technology using unmanned aircraft systems (UAS) has been shown to significantly increase productivity and reduce the inherent safety risks to property and personnel. The Petitioner has adopted UAS technology to increase safety, accuracy, value, construction management, rapid turnaround of data, versatility, and its speed as opposed to traditional survey methods.

Additionally, the Petitioner is staffed with personnel who have UAS operational and maintenance experience. This natural transition to the infrastructure and public safety inspection market, along with our engineering inspection experience, reduces the overall risk to the public, while conducting inspection operations. Therefore, the Petitioner seeks the requested exemptions and a Certificate of Authorization to permit it to offer consulting services for the public and private sectors to conduct UAS operations for a host of industries and applications. These include:

- Aerial building photography and inspections;
- Aerial surveying and inspections;
- Substructure bridge inspections;
- Temporary tower crane assembly verification inspections;
- Construction activities for compliance determination; and
- Aerial inspections in the DC Metropolitan Area

2 Relevant Statutory Authority to Petitioner's Exemption Request

The Federal Aviation Administration (FAA)'s mission is to provide the safest airspace system globally. Since the National Airspace System (NAS) isn't static and will constantly be changing, it must adapt to new technologies and applications, as evidence by the proliferation of unmanned aircraft systems (UAS). Because UAS are inherently different from manned aircraft, introducing UAS into the NAS will be challenging. Under Section 333 of the FAA Modernization and Reform Act of 2012 (FMRA), the Secretary of Transportation has the authority to grant case-by-case authorization for certain unmanned aircraft to perform commercial operations prior to the

finalization of the small UAS Rule, which will be the primary method for authorizing small UAS operations once it is complete (Section 333, 2015).

The Section 333 Exemption process provides operators who wish to pursue safe and legal entry into the NAS a competitive advantage in the UAS marketplace, thus discouraging operations which are noncompliant with the implementing regulations and which improves safety. Therefore, this Petition is being submitted in accordance with Sections 333 (a) to (c) of the FMRA. In this Act, Congress directed the FAA "to safely accelerate the integration of civil UASs in the national airspace system", and under Section 333, the FAA Administrator is to permit UASs to operate in the NAS where it is safe and does not create a hazard or pose a threat to national security to do so based on the following:

- The UAS size, weight, speed, and operational capability;
- Operation of the UAS in close proximity to airports and populated areas; and
- Operation of the UAS within visual line-of-sight of the operator.[1]

In addition, the FAA Administrator has the general authority to grant exemptions from FAA safety regulations and minimum standards when the Administrator decides a requested exemption is in the public interest.[2] A party requesting an exemption must explain the reasons why the exemption: (1) would benefit the public as a whole and; (2) would not adversely affect safety or how it would provide a level of safety at least equal to the existing rules.[3]

The Petitioner will use multirotor UAS vehicles, weighing 6 or fewer lbs. including payload and operate under normal conditions at a speed of no more than 8.23 meters/sec or 16 knots for aerial public safety inspections. Each UAS will have the capability to hover, and move in the vertical and horizontal plane simultaneously. In addition, the UASs will operate only in the pilot's visual line of sight at all times. As a result, the Petitioner will demonstrate how the proposed UAS aerial public safety inspections will benefit the public and that the proposed operations will not adversely affect safety of the public and to those operating in the National Airspace System.

~~3~~ Qualifications for Approval under Section 333 of the FMRA

The proposed operations in this petition for exemption, qualify for expedited approval under Section 333 of the FMRA. Each of the statutory criteria and other potential relevant factors are satisfied. The Petitioner's planned operations would permit the use of small and relatively inexpensive UAS under controlled conditions in the Class G airspace that is: (a) limited; (b) predetermined; (c) controlled as to access; and (d) would pose an increased level of safety beyond what exists when building inspectors, infrastructure inspectors, fixed or rotor wing aircraft are used to accomplish the same purpose for inspection of buildings, bridge substructures, compliance determinations at construction sites, and crane assembly verifications.

[1] §333(b)(1) of FAA Modernization and Reform ACT 2012.
[2] 49 U.S.C. §44701(f) (authorizing the grant of exemptions from a requirement of regulations prescribed pursuant to Section 44701(a)-(b) and Sections 44702-44716).
[3] 14 C.F.R. §11.81, Petition for Exemptions.

The Petitioner's sUASs will operate in visual line-of-sight (VLOS) and in specific safe zone areas described in Section 5, Proposed Operations outlined in this Petition. Also, the Petitioner's fleet includes both a micro UAS (mUAS, weighing 2.75 lbs.) quadcopter and a small UAS (sUAS) hexacopter, weighing less than 6 pounds, including payload. They will operate under normal weather conditions, at speeds not to exceed 16 knots and have the capability to hover, and move in both vertical and horizontal positions. The proposed operations will be conducted with sUAS and or mUAS of a size and weight that will ensure a superior level of safety over conducting the same operations with conventional fixed wing, manned aircraft, and reduce the inherent safety risks to property and personnel.

Given the size of the mUAS and sUAS involved and the restricted safety zones in which they will operate, this Petition for exemption falls within the zone of safety, in which Congress[4] intended for the FAA to permit commercial UAS operations by exemption, pending completion of their formal ruling. Moreover, the authority granted to the FAA by Congress via Section 333 of the FMRA, provides the equivalent level of safety surrounding the proposed operations, and the significant benefit to the public, which the grant of the requested exemption is warranted and is in the public interest. Therefore, the Petitioner respectfully requests that the FAA grant the requested exemption without delay, because such operations will insure that both the mUAS and sUAS will not create a hazard to users of the NAS or the public.

3.1 DJI Phantom 2 Vision Plus, Version 3.0 mUAS Asset

The Petitioner will deploy the DJI Phantom 2 Vision + (**NT0050029**), version 3.0 for inspection of vacant or occupied buildings, compliance activities at construction sites, substructure bridge inspections, crane assembly verification inspection, and for general aerial surveys. The Petitioner shall use images captured from the DJI Phantom 2 Vision Plus. These images will be taken automatically and are geo-tagged by the Phantom 2 Vision Plus and then the rendering software will convert images to maps and 3D models.

A copy of the DJI Phantom 2 Vision Plus User Manual, Pilot Training Guide, Prop Guard Assembly Guide, Battery Safety Guide, and the ARS Flight Safety and Procedures Manual are submitted as supporting documents with this Petition.

The DJI Phantom 2 Vision+ represents the company's flagship consumer model, improving on the Phantom 2 Vision by adding a Zenmuse H3-3D gimbal camera system. The Phantom 2 Vision is only outfitted with a jello-slaying rubber platform to ward off minimal gyration shake, while the new Phantom 2 Vision+ corrects for vertical, horizontal, and angular shake. With this new system, the onboard camera can be tilted up or down, greatly maximizing the range of the lens. DJI also offers the Phantom 2, which comes without a camera or gimbal. The Vision+ can transmit video and flight data to a smart phone thru Wi-Fi with almost no latency, the operator can actually "Fly" the UAS base on the video screen with First Person View (FPV) experience, Wi-Fi range is about 500-700m (Perlman, 2014).

The Phantom 2 Vision Plus 3.0 or mUAS weighs 2.75 pounds including battery and camera. Incorporated into the programming of the mUAS is an automatic return home feature that

[4] *Id* at § 333(b)(1)

automatically directs the Phantom back to the point of take-off (Home location) should the unit lose communications with the transmitter. Also, the mUAS has a crusing speed of 15 knots and a maximum speed of 29 knots. Maximum flight time is 25 minutes and has a gross weight of 2.75 pounds.

As for the remote controller, it features a sliding power button, left and right joysticks, S2 and S1 switches, and a chrome eyelet to mount a neck strap to. There is a movable antenna at the top of the controller that can be angled upward, which is recommended by DJI for attaining the best signal. The WiFi extender has two LED lights that indicate connection status, as well as the power level health. In terms of actually piloting the drone, both the S2 and S1 switches need to be flipped up and the WiFi extender needs to be powered on. The S1 switch places the drone in calibration mode by flipping it back and forth several times, and the S2 switch will change the drone's Home location. The left joystick powers the drone up, down, and turns it left and right. The right joystick moves the drone forward, backward, sideways to the left, and sideways to the right (Perlman, 2014). In addition, the Phantom has an additional communication link between the camera and the mUAS's on a different radio frequency 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 PIC can use the mUAS's internal software to set maximum altitude AGL for each flight, allowing for customization of flights to no higher than 100 feet, 200 feet, 300 feet are some examples. The 400 feet maximum AGL can be programmed into the UAVs software pre-flight to insure compliance with FAA standards. Also, DJI has internal software that regulates the height of the mUAS with No-Fly-Zones. These zones include airports worldwide and have been divided into two types, A and B. Also, DJI has a flight limitation system that will prevent the mUAS from flying in restricted airspace. For example, if the mUAS is within 1.5 miles of an airport's restricted zone, the vehicle will not fly.

Finally, the mUAS has an altitude and radar monitoring function that allows the PIC better determination of height, direction of flight and distance from the PIC. Also, the PIC can monitor GPS lock status while in flight with green lights on mUAS and has the ability to anticipate loss of GPS locking so the PIC can land the UAS as a precaution.

Phantom Vision +	**Supported Battery**	5200mAh LiPo Battery
	Weight (battery & Propellers)	1242g or 2.75 pounds
	Hover Accuracy	Vertical: 0.8m; Horizontal: 2.5m
	Max Yaw Angular velocity	200 Degrees/second
	Max Tiltable Angle	35 Degrees
	Max. Ascent/Descent Speed	Ascent: 6 m/s; Descent 2 m/s
	Max. Flight Speed	15 m/s
	Diagonal Motor-Motor Distance	350mm

3.2 Tali Carbon H500 sUAS Asset

Also, the Petitioner will deploy the Tali Carbon H500 Devo F12 E (**N554QW**) for inspecting the substructure of bridges and for general aerial surveys. A copy of the Tali H500 DEVO Quick Start Guide, Settings Guide, Bluetooth Datalink Manual, GoPro Manual, and the ARS Flight Safety and Procedures Manual are submitted as supporting documents with the Petition.

The Tali H500 is considered by many to be the best drone in its class in the world. With its cutting edge technology combined with reliability and ease of use, the Tali H500 delivers excellent performance. It comes with the HD i-Look Plus camera and the mount accepts all GoPro cameras. It has first person view meaning that whatever the camera sees will be transmitted live to the controller. With a 25-minute flight time and the 10 waypoint GPS function, the PIC can tackle substructure bridge inspections. The retractable landing gear and 3D gimbal ensure that the camera shots are 100% unobstructed.

The Tali H500 weighs 4.45 pounds including battery and iLook camera. Incorporated into the programming of the sUAS is a "One Key Go Home" feature that returns the sUAS to the home location automatically. The Tali's failsafe return to home mode, an advanced return-to-home (RTH) protects the aircraft, in case of loss of control signal; whereby the H500 will automatically attempt to return to its starting position for a safe landing. With its' new Hyper I Intelligent Orientation Control (IOC) function that includes new advanced IOC systems, the H500 can start and fly in any orientation completely solving pilot loss of orientation problems. Also, the sUAS has a crusing speed of 25 knots and a maximum speed of 47.7 knots. Maximum flight time is 25 minutes and has a gross weight of 4.6 pounds.

As for the Devo F12e transmitter, manufactured by Walkera, the unit has 4 slider controls for controlling gains, gimbal, pitch, yaw and roll. Also, it has a built-in 5-in-1 video monitor, capable of displaying both video and telemetry data from the Tali H500. The F12e controller has 5.8 Ghz antenna and can display live data from the built-in screen. Data options include temperature, battery power, GPS position, speed, altitude, and distance from starting point. One great feature is the low power warning; the radio starts buzzing and vibrating when there is 2 minutes or less of flight time left on the H500 battery. The battery is a 6S 5400mah Li-Po 22.2V battery with built-in charge status monitoring and promoting safe and convenient flight operations.

Tali H500	**Supported Battery**	22V, 5200mAh LiPo Battery
	Weight (battery & Propellers)	2020g or 4.45 pounds
	Hover Accuracy	Vertical: 0.8m; Horizontal: 2.5m
	Main Rotor Diameter	233mm
	Brushless ESC	WST-15AH (R/G)
	Max. Flight Speed	24.58 m/s
	Stabilized 6 axis FLCS	DEVO-H

4 Description of Proposed Operations

To assist the FAA in its safety assessment of the Petitioner's proposed mUAS and sUAS operations, standard and industry specific procedures have been created. Below is a summary of operational limitations and conditions, which ensure an equivalent, or higher level of safety to operations conducted under regulatory guidelines.

4.1 Standard Operational Procedures for mUAS and sUAS Assets

1. For all flight operations, no person shall act as an operator or visual camera observer for more than one UAS operation at a time.
2. The Petitioner will operate both the Phantom 2 Vision Plus (mUAS) and the TALI H500 (sUAS).
3. All pilots of the mUAS and sUAS will conduct a preflight inspection prior to flight mission.
4. Prior to any flight mission, the operator and visual camera observer will conduct a preflight inspection, to include specific aircraft and control station systems checks to ensure both the mUAS and sUAS are safe for operations.

5. The mUAS weigh less than 2.75 pounds, including payload.
6. The sUAS weigh less than 6 pounds, including payload.
7. Flights will be operated within visual line-of-sight (VLOS) of a pilot and visual camera observer.
8. Maximum total flight time of each operational flight will be 25 minutes. Both the mUAS and sUAS calculates battery reserve in real time, and will return to its ground station with at least 20% battery power reserve should that occur prior to 25 minutes limit.
9. At all times, both the mUAS and sUAS will remain close enough to operator for the operator to be capable of seeing the aircraft with vision unaided by any device other than corrective lenses.
10. Both the mUAS and sUAS will not operate over any persons not directly involved in the operation.
11. Flights for both the mUAS and sUAS will occur during daylight-only operations.
12. During flight operations, both the mUAS and sUAS will yield right-of-way to other aircraft, manned or unmanned.
13. All flight operations will be in Class G Airspace.
14. mUAS flights will be operated at an altitude of no more than 400 feet above ground level (AGL) or no more than 100 feet above a structure being inspected, if that structure exceeds 400 feet.
15. sUAS flights will be operated at an altitude of no more than 500 feet above ground level (AGL) or no more than 100 feet above a structure being inspected, if that structure exceeds 500 feet.
16. Flights will be operated at a lateral distance of at least 500 feet from any structure or structure or vehicle unless permission has been granted by the owner or controller of the property in advance of the flight. Flights will not be conducted within 500 feet of any person who is not essential for the conduct of the flight unless that person is in a position where they are shielded from the aircraft and any possible debris resulting from an aircraft failure. Flight will be terminated if <u>a</u> person~~/s~~ breaches safety zone.
17. At a minimum, the crew for each operation will consist of the Pilot, Visual Camera Observer, Engineer Inspector, and one or more State or local government inspector.
18. The mUAS pilot will be an FAA licensed airman with a private pilot's certificate with rotorcraft experience, along with 100 hours of training.
19. The sUAS pilot will be an FAA licensed airman with a private pilot's certificate with rotorcraft experience along with 100 hours of training.
20. All Pilots will be vetted by the Transportation Security Administration.
21. The mUAS Pilot will be trained in flight, operations, and safety procedures in accordance with the ARS Flight Safety and Procedures Manual.
22. Both the mUAS and sUAS Pilots will be Pilot in Command (PIC). If a pilot certificate holder other than the UAS Pilot, who possesses the necessary PIC qualifications, is also present, that person can be designated as PIC.
23. The mUAS shall not operate in wind gusts greater than 10 mph.
24. The sUAS shall not operate in wind gusts greater than 18 mph.

25. Both the mUAS and sUAS will only operate within a confined "Sterile Area". A sterile area is defined as a safety zone surrounding the subject property that has been cleared of all individuals or animals that aren't part of the inspection. In addition, the Petitioner shall establish a security perimeter for the flight operations area.
26. A briefing will be conducted in regard to the planned mUAS and sUAS operations prior to each day's missions. It will be mandatory that all personnel who will be performing duties within the boundaries of the safety perimeter be present for this briefing.
27. The Pilot, Visual Camera Observer, and Inspection Engineer will have been trained in operations of UAS generally and will have experience in flying the particular UAS used for any operations.
28. The Pilot, Visual Camera Observer, Inspection Engineer and State or local inspector will at all times be able to communicate by voice or text via cellular or similar device.
29. 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.
30. The Petitioner will make available to the FAA, upon request, both the mUAS and/or sUAS for inspection or testing, and any associated documents/records required to be kept under the proposed rule.
31. Report an accident to the FAA within 10 days of any operation that results injury or property damage.
32. If both the mUAS or sUAS loses communications or loses its GPS signal, both assets will have the capability to return to a pre-determined location within the operational area and land.
33. All flight operations will only operate in optimal weather conditions with visibility of at least 3 miles from control station.
34. Both the mUAS and sUAS will have the capability to abort a flight in case of unpredicted obstacles or emergencies. The Pilot will then safely terminate mission and gain control of UAS and return to a pre-determine location.
35. The Petitioner will use a blanket 200-foot Certificate of Waiver or Authorization (COA) for all flights anywhere in the country except in restricted airspace and other areas such as major cities, where the FAA prohibits UAS operations. Moreover, the Petitioner will obtain an Air Traffic Organization (ATO) issued COA for flights above 200 feet prior to conducting any operation under this petition of exemption.

4.2 Specific Operational Procedures for Aerial Building Photography & Inspections

1. Ten days before flight operations, the operator will contact the State & local government inspection agency that aerial inspection of vacant or occupied buildings will be occurring.
2. The operator will enforce a safety zone covering 500 feet outside the perimeter of the subject building during flight operations. The safety zone will be established by the operator by using yellow safety tape and the posting of aerial inspection signs (see Supporting Documents).
3. mUAS flights will be operated at an altitude of no more than 200 feet above ground level (AGL).

4. Report an accident to the OSHA and the State & local government agency requesting the inspection within 10 days of any operation that results injury or property damage.

4.3 Specific Operational Procedures for Illegal and Legal Construction Inspections

1. Ten days before flight operations, the operator will contact the State & local government inspection agency that aerial inspection of the construction site will be occurring.
2. The operator will enforce a safety zone covering 500 feet outside the perimeter of the construction site during flight operations. The safety zone will be controlled by the general contractor with flaggers and other staff and the posting of aerial inspection flight signs (see Supporting Documents).
3. sUAS flights will be operated at an altitude of no more than 300 feet above ground level (AGL).
4. Report an accident to the OSHA and the State & local government agency requesting the inspection within 10 days of any operation that results injury or property damage.

4.4 Specific Operational Procedures for Temporary Tower Crane Assembly Verification Inspections

Cranes are carefully designed, tested, and manufactured for safe operation. When used properly they can provide safe reliable service to lift or move loads. Because cranes have the ability to lift heavy loads to great heights, they also have an increased potential for catastrophic accidents, if safe operating practices are not followed (Culver, 1994). Due to significant advances, safety professionals, and OSHA compliance officers need to keep abreast of modern crane technology and changes in operating procedures to help them recognize problems before potentially unsafe conditions lead to accidents that result in injuries and/or fatalities, as well as damage to equipment.

Keeping these factors in mind, the need for a better understanding of crane operations and the implementation of appropriate maintenance schedules is evident in preventing accidents. A recent study by Don Dickie, a recognized crane authority with the Construction Safety Association of Ontario, indicated that although mechanical failures represents only 11 percent of the causes of crane accidents, they usually result in major accidents. Studies and analyses of crane accidents involving mechanical failure show they are frequently due to a lack of preventive maintenance or adequate training and/or experience on the part of the personnel involved. Finally, cranes and associated rigging equipment must be inspected regularly to identify and existing or potentially unsafe conditions. This preventive maintenance must be performed as required by the crane manufacturer and/or the supplier to ensure safe crane operation. Below is a detailed summary of operational limitations and conditions, which ensure an equivalent or higher level of safety to operations conducted under regulatory guidelines for proposed tower crane assembly verification inspections (see Figure 1).

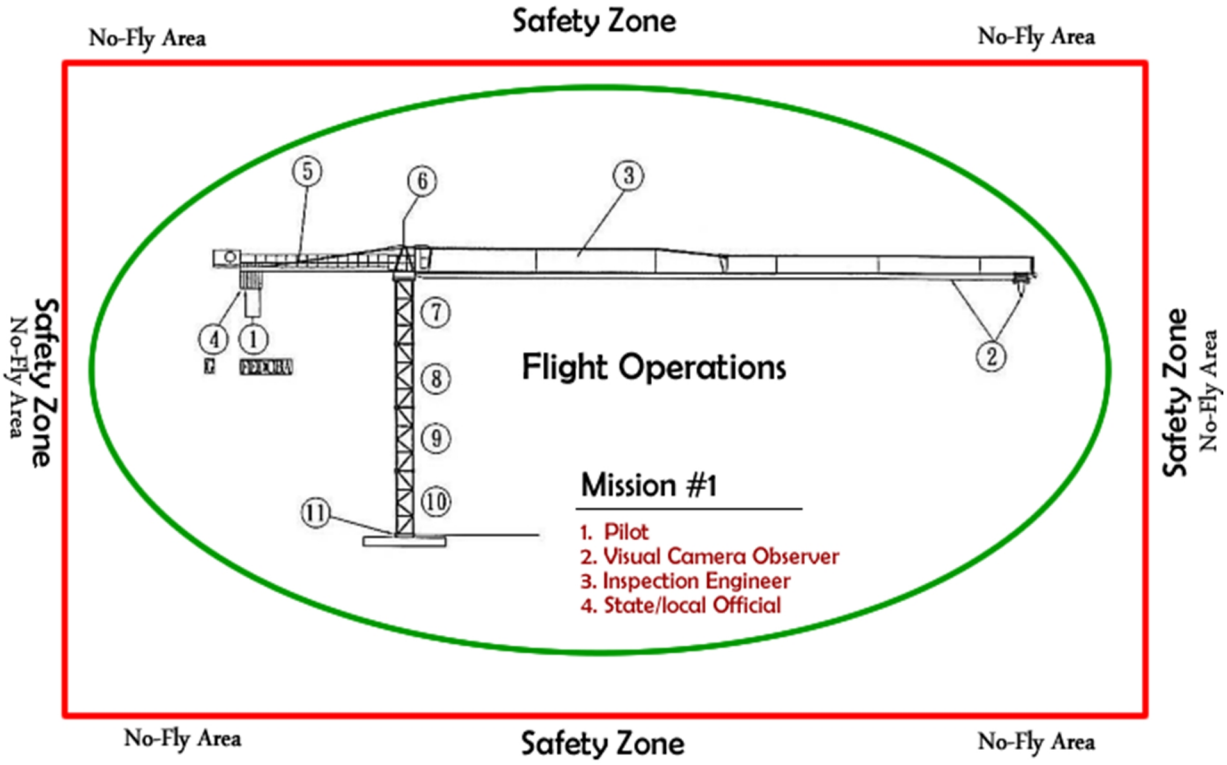

Figure 1: Temporary Tower Crane Inspection Map

1. The operator will file a FAA form 7711-1, or its equivalent with the local Flight Standards District Office (FSDO).
2. At least five days before schedule inspections, the operator of both the mUAS and sUAS affected by this exemption must submit a written Scope of Work Activities to the local FSDO with jurisdiction over the area of proposed infrastructure inspection. The 5-day notification may be waived with the concurrence of the FSDO. The Scope of Work includes the following, but not limited to:
    a. Dates and times of flights.
    b. Name and phone number of the operator for the UAS inspections conducted under this petition of exemption.
    c. Name, phone number, and certificate number of the PIC.
    d. Make, model, and N-number of UAS asset used in operation.
    e. A statement that the operator has obtained permission from property owners and/or local officials to conduct the infrastructure inspection event; the list of those who gave permission must be made available to the inspector upon request.
    f. A description of the flight mission, including maps or diagrams of any area, city, town, county, and/or state over which infrastructure inspection will be conducted and the altitudes essential to accomplish the operation.

3. Ten days before flight operations, the operator will contact the State & local government inspection agency that aerial inspection of the tower crane will be occurring on a construction site.
5. The operator will enforce a safety zone covering 500 feet outside the perimeter of the construction site during flight operations. The safety zone will be controlled by the general contractor with flaggers and the operator will impose a non-fly zone and post aerial inspection in progress signs (see Supporting Documents).
4. Both mUAS and sUAS flights will be operated at an altitude of no more than 400 feet above ground level (AGL).
5. Prior to inspection, the general contractor will be required to move the hook (#2) and jib/trolley (#3) in a lock position that provides the best and safe flight path without any obstruction of buildings, people or roadways.
6. The flight operations will be restricted to a spherical flight path surrounding the tower crane starting with the concrete footing (#11), continuing up the mast (#10 -#7), then moving then horizontally to the counter-jib ballast (#1), the counter-jib block (#4), the hoisting drum (#5), continuing past the cabin (#6) and jib-trolley (#3) and finally to the hook (#2). Then the operator will repeat the flight path backwards in the following order: #2, #3, #6, #5, #4, #1, #7-#10, #11, and then land the UAS (see Figure 1).
7. Report an accident to the OSHA and the State & local government agency requesting the inspection within 10 days of any operation that results injury or property damage.

4.5 Specific Operational Procedures for Substructure Bridge Inspections

The operator will conduct a systematic method to inspect the substructure of the bridge. The proposed operations includes inspection of bridge substructures over waterways. The substructure supports the superstructure and transmits loads from the superstructure to the ground. The substructure generally consists of pier caps, columns and piles. The substructure may be constructed of timber, concrete or steel. Timber members are inspected for wood rot, crushing, splitting and cracking. Concrete members are inspected for cracking, spalling, and hollow areas. Steel members are inspected for paint peeling, corrosion and cracking. In addition, the substructure is inspected for evidence of settlement or scour. Settlement is elements of the substructure moving downward due to soil conditions. Scour is the undermining of a structure due to water flow removing soil, which supports the structure (see Figure 2). Below is a detailed summary of operational limitations and conditions, which ensure an equivalent or higher level of safety to operations conducted under regulatory guidelines.

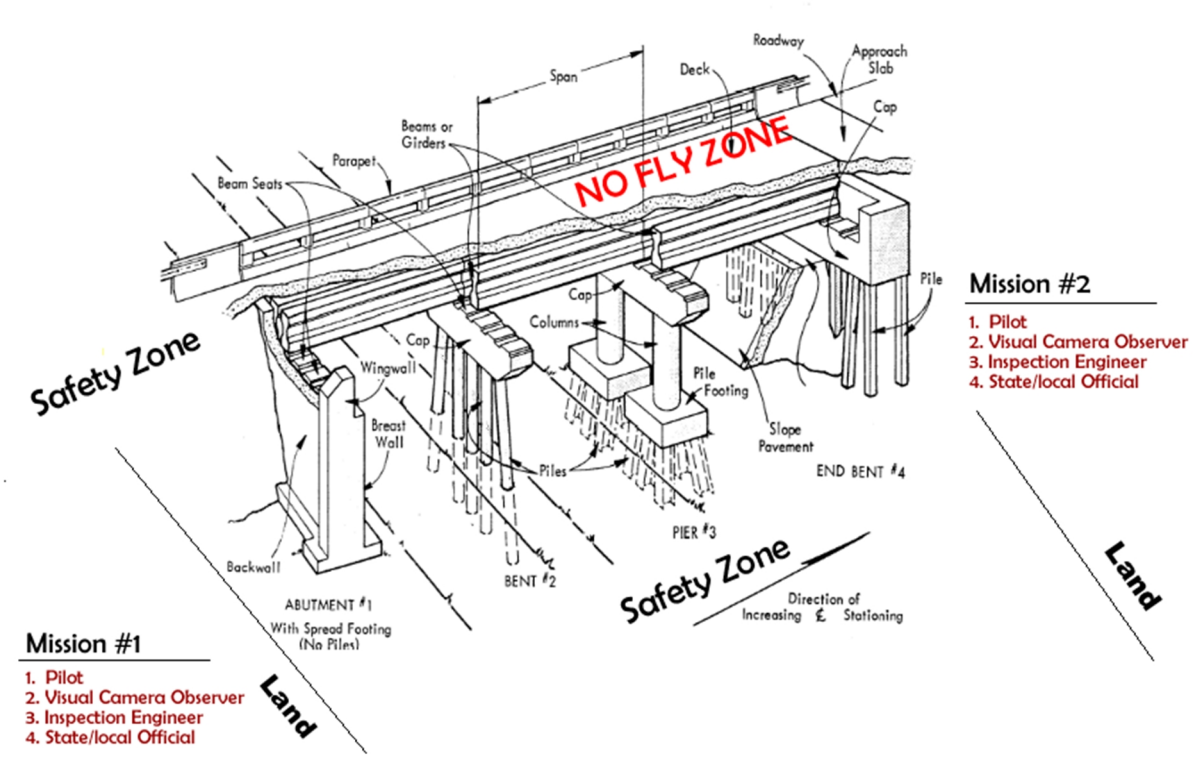

Figure 2: Bridge Inspection Map

1. The operator will file a FAA form 7711-1, or its equivalent with the local Flight Standards District Office.
2. Ten days before flight operations, the operator will contact the United States Coast Guard to notify all boaters, military and commercial ship operators that UAS operations are being conducted and to request a Coast Guard Patrol or State/Local Environmental Fishery Unit with boat(s) in the water to monitor the safety zone.
3. The operator will conduct only bridge over waterway substructure inspections.
4. A no-fly zone will be established over bridge.
5. UAS flights will be operated underneath the bridge.
6. The operator will conduct a minimum of two missions, all over water, to inspect the bridge substructures using both the mUAS and sUAS assets.
7. Report an accident to the United States Coast Guard within 10 days of any operation that results injury or property damage.
8. At least five days before scheduled inspections, the operator of both the mUAS and sUAS affected by this exemption must submit a written Scope of Work Activities to the local FSDO with jurisdiction over the area of proposed infrastructure inspection. The 5-day notification may be waived with the concurrence of the FSDO. The Scope of Work includes the following, but not limited to:
    a. Dates and times of flights.

b. Name and phone number of the operator for the UAS inspections conducted under this petition of exemption.
c. Name, phone number, and certificate number of the PIC.
d. Make, model, and N-number of UAS asset used in operation.
e. A statement that the operator has obtained permission from property owners and/or local officials to conduct the infrastructure inspection event; the list of those who gave permission must be made available to the inspector upon request.
f. A description of the flight mission, including maps or diagrams of any area, city, town, county, and/or state over which infrastructure inspection will be conducted and the altitudes essential to accomplish the operation.

4.6 Specific Operational Procedures for the DC Special Flight Rules Area (DC SFRA), including the DC Metropolitan Area Flight Restricted Zone (DC FRZ)

1. Airspace surrounding the Whitehouse, the U.S. Treasury Building, the Mall, and the U.S. Capitol building and grounds are prohibited from flight operations.
2. The operator will notify the U.S. Capitol Police of all flight operations.
3. The operator shall review all Notice-To-Airmen (NOTAMs) and file a DC SFRA Flight Plan with the Washington Flight Standards Office.
4. The PIC shall communicate with the Washington Flight Standards Office by cell phone stating the current flight operation, location, altitude, and operational timeframe when conducting operations within the DC SFRA, including the DC FRZ.
5. The PIC shall provide battery level, altitude, and distance from PIC and location for all flight operations to the Washington Flight Standards Office.
6. All flight operations in the District of Columbia will be 350 feet or below.
7. During flight operations, both the mUAS and sUAS will yield right-of-way to all military, manned or unmanned aircraft.
8. At least five days before schedule inspections, the operator of both the mUAS and sUAS affected by this exemption must submit a written Scope of Work Activities to the Washington FSDO with jurisdiction over the area of proposed infrastructure inspection. The 5-day notification may be waived with the concurrence of the FSDO. The Scope of Work includes the following, but not limited to:
    a. Dates and times of flights.
    b. Name and phone number of the operator for the UAS inspections conducted under this petition of exemption.
    c. Name, phone number, and certificate number of the PIC.
    d. Make, model, and N-number of UAS asset used in operation.
    e. A statement that the operator has obtained permission from property owners and/or local officials to conduct the infrastructure inspection event; the list of those who gave permission must be made available to the inspector upon request.
    f. A description of the flight mission, including maps or diagrams of any area, city, town, county, and/or state over which infrastructure inspection will be conducted and the altitudes essential to accomplish the operation.

5 Regulations from Which Exemption Relief is Requested

The Petitioner requests an exemption from several interrelated provisions of 14 C.F.R. Parts 21, 27, 45, 61, 91, and 93 for purposes of conducting the requested operations using both a mUAS and sUAS. Listed below are: (1) the specific sections of 14 C.F.R. for which an exemption is sought: and (2) the operating procedures and safeguards that the Petitioner has established, which will ensure a level of safety equal to or better than the rules from which exemption is sought.[5]

5.1 14 C.F.R. Part 21, Subpart H- Airworthiness Certificates and 14 C.F.R. § 91.203(a)(1)

The Petitioner seeks an exemption from this provision, which establishes the procedural requirements for the issuance of airworthiness certificates as required by §91.203(a)(1). Under both the Federal Aviation Act (49 U.S.C. §44701 (f)) and Section 333 of the FMRA, both authorizes 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. Moreover, given the size and limited operating area associated with both the mUAS (4.4 pounds, including payload) and sUAS (6 pounds, including payload) to be utilized by the Petitioner, an exemption from Part 2, Subpart H meets the requirements of an equivalent level of safety under Part 11 and Section 333 of the FMRA.

Finally, in all cases, an analysis of these criteria demonstrates that both the mUAS and sUAS operated without an airworthiness certificate, in the restricted environment and under the conditions proposed, will be at least as safe as, or safer than, a conventional craft operating with an airworthiness certificate without the restrictions and conditions of the proposed UAS operations.

The mUAS, weighing 2.75 pounds and the sUAS weighing less than 6 pounds including payload, carry neither a pilot nor passenger and carry no explosive materials or flammable liquid fuels, and operate exclusively within a secured and sterile area. Unlike other civil aircraft, the proposed operations will be controlled and monitored by the pilot, visual camera observer, and inspection engineer, pursuant to procedures in Section 4. Moreover, the FAA will have advance notice of all operations conducted under this exemption.

These safety enhancements, which already apply to civil aircraft operated in connection with existing inspection operations, provide a greater degree of safety to the Petitioner's staff and contractors, the public, and property owners than conventional operations conducted with airworthiness certificates issued under 14 C.F.R. Part 21, Subpart H. Moreover, application of these same criteria demonstrates that there is no credible threat to national security posed by both the mUAS and sUAS, due to its size, speed of operation, lack of explosive materials or flammable liquid fuels, and inability to carry a substantial external load.

[5] See 14 C.F.R. § 11.81(c) which requires a petition for exemption to include: "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 you seek exemption."

5.2 14 C.F.R. Part 27 Airworthiness Standards: Normal Category Rotorcraft

The procedural requirements for airworthiness certification of normal category rotorcraft is set forth in 14 C.F.R. Part 27. To the extent that both the Petitioner's mUAS and sUAS would otherwise require certification under Part 27, Petitioner seeks an exemption from Part 27's airworthiness standards for the same reasons identified in the exemption request from 14 C.F.R. Part 21, Subpart H.

5.3 14 C.F.R. §§ 45.23(b), 45.27(a) and 91.9(c): Aircraft Marking and Identification Requirements

This Petitioner seeks an exemption from the aircraft marking and identification requirements of 14 C.F.R. §§45.23(b), 45.27(a), and 91.9(c):

> *Section 45.23(b), Markings of the Aircraft, states that 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 the aircraft near each entrance to the cabin, cockpit, or pilot station, letters not less than 2 inches nor more than 6 inches high, the worlds "limited," "restricted," "light-sport," "experimental," or "provisional," as applicable.*
>
> *Section 45.27(a), Rotorcraft, states each operator of a rotorcraft must display on that rotorcraft horizontally on both surfaces of the cabin, fuselage, boom, or tail the marks required by* §45.23.
>
> *Section 91.9(c), Civil Aircraft Flight Manual, Marking, and Placard Requirements, states that no person may operate a U.S. registered civil aircraft unless the aircraft is identified in accordance with Part 45 of this Chapter.*

The request of an exemption from §45.23(b) is warranted because both the mUAS and sUAS have no entrance to the cabin, cockpit, or pilot station on which the registration number can be placed. Moreover, given the size of the UASs, two-inch lettering would be impossible. However, the aircraft registration, or "N Number" will be placed on the fuselage in compliance with §45.29(f). Moreover, given the nature of the specific relief sought by this exemption request, the Petitioner requires relief from the associated marking and identification requirements of §45.27(a) and §91.9(c), which would require compliance with §45.23(b).

The level of safety for exemptions to the aircraft marking and identification requirements of 14 C.F.R. §§45.23(b), 45.27(a), and 91.9(c) will be provided by having both mUAS and sUAS marked on its fuselage as required by §45.29(f) where the Pilot, Visual Camera Observer, and Inspection Engineer and others working with the UASs will see the "N Number" identification on the aircraft. Additionally, the Petitioner will ensure compliance with any requests of UASs' marking by the FAA. The FAA has issued the following exemptions to the aircraft marking requirements of §45.23(b): Exemption Nos. 0692, 0816, 8738, 10700, 10167 and 10167A.

5.4 14 C.F.R. § 61.113: Private Pilot Privileges and Limitations

The Petitioner seeks an exemption from the private pilot privileges and limitations of 14 C.F.R. §61.113 (a) and (b), which states that:

> *(a) Except as provided in paragraphs (b) through (h) of this section, 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.*
>
> *(b) 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 purpose of Part 61 is to ensure that the skill and competency of any pilot matches the airspace in which he or she will be operating, as well as requiring certifications if the private pilot is carrying passengers or cargo for hire. In this case, while both the mUAS and sUAS will be operated as part of a commercial operation, they carry neither passengers nor cargo. Accordingly, the Petitioner seeks an exemption from 14 C.F.R. §61.113 (a) and (b), commercial limitation requirement that the flight be incidental to the business to benefit from the exception.

As set forth in the ARS Flight Safety and Procedures Manual, to ensure an equivalent level of safety, any person acting as a pilot in command, must be knowledgeable in the airspace and communication issues pertaining to all aircraft operations, but also in the unique aspects of both mUAS and sUAS flights. Unlike a conventional aircraft that carries the pilot and passengers, both mUAS and sUAS, are remotely controlled with no living thing or cargo on board.

The area of operation is controlled and restricted, and all flights are planned and coordinated in advance as set forth in Section 4 of this Petition. Furthermore, while helpful, a pilot license will not ensure remote control piloting skills, though the Petitioner's pilot vetting and training program will ensure the PIC has substantial experience on either the mUAS and/or the sUAS. Moreover, private pilot certificate holders will operate either the mUAS or sUAS with the same skill level. The risk to the operations of both the mUAS and sUAS are far less than the risks levels inherent in the commercial activities within Part 61. As a result, allowing the Petitioner to operate its UASs with a private pilot certificates as the PIC will exceed current safety levels in relations to 14 C.F.R. §61.113 (a) and (b). The Petitioner believes that this system will provide a high-level of competency and proficiency for its pilots that ensures a level of safety equal to or greater than the rules from which this exemption is requested.

5.5 14 C.F.R. §91.7(a): Civil Aircraft Airworthiness

The Petitioner seeks an exemption from 14 C.F.R. §91.7(a), which requires that a civil aircraft be in airworthy condition to be operated. As there will be no airworthiness certificate issued for the both the mUAS and sUAS, should this exemption be granted, no FAA regulatory standard will exist for determining airworthiness.

The level of safety is maintained and operated in accordance with all specifications and requirements identified by the manufacturer. The Petitioner will only operate UASs that have a proven track record of reliability and safety. In addition, given that both mUAS and sUAS will be operated by the Petitioner under 6 pounds, and no UAS will be flown unless it has been

maintained and prepared for flight in accordance with the manufacturer's requirements, and equivalent level of safety will be provided.

5.6 14 C.F.R. §91.9(b)(2): Civil Aircraft Flight Manual in the Aircraft

The Petitioner seeks an exemption from 14 C.F.R. §91.9(b)(2), which requires that:

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

The UASs, given their 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 also because there is no room or capacity to carry such an item on the aircraft.

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

5.7 14 C.F.R. §91.103: Preflight Action

The Petitioner seeks an exemption from 14 C.F.R. §91.103, which requires a PIC to become familiar with specific information before each flight, including information contained in the FAA-approved Flight Manual on board the aircraft. In as such, as the FAA approved flight manual will not be provided for both the mUAS and sUAS, an exemption is requested.

An equivalent level of safety will be provided by following the ARS Safety & Procedures Manual and flight manual provided by the manufacturer. The PIC will take all required preflight actions-including reviewing weather, flight battery requirements, landing and takeoff distance, and aircraft performance data, prior to flight. Both the Manufacturer Flight Manual and ARS Flight Safety & Procedures Manual will be located at the ground station with the pilot at all times.

5.8 14 C.F.R. §91.109(a): Flight Instruction

The Petitioner seeks an exemption from 14 C.F.R. §91.109(a), which provides that:

> *"No person may operate a civil aircraft (except a manned free balloon) that is being used from flight instruction unless that aircraft has fully functioning dual controls." Both the mUAS and sUAS piloted aircraft, by their design, do not have functional dual controls. Instead, flight control is accomplished through the use of a box that communicates with the aircraft via radio communications.*

As a result of the size and speed of both the mUAS and sUAS, an equivalent level of safe training can still be performed without dual controls because no pilot or passengers are aboard the UASs,

and all persons will be a safe distance away in the event that the UASs experiences an difficulties during flight instruction. The FAA has approved exemptions from flight training without fully functional dual controls for a number of aircraft and for flight instruction for exemptions numbers 5778K and 9862A.

5.9 14 C.F.R. §91.119: Minimum Safe Altitudes

The Petitioner requests an exemption from the minimum safe altitude requirements of 14 C.F.R. §91.119, which prescribes that:

> *The minimum safe altitudes under which aircraft may not operate, including 500 feet above the surface and away from any person, vessel, vehicle, or structure in non-congested areas*[6].

Section 91.119(d) allows for a:

> *Helicopter to operate at less than those minimum altitudes when it can be operated "without hazard to persons or property on the surface," provided that "each person operating the helicopter complies with any routes or altitudes specifically prescribed for helicopters by the FAA."*

As previously stated in-Section 5.1, the mUAS flights will be operated at an altitude of no more than 400 feet above ground level (AGL) or no more than 100 feet above a structure being inspected, if that structure exceeds 400 feet. Also, the sUAS flights will be operated at an altitude of no more than 500 feet above ground level (AGL) or no more than 100 feet above a structure being inspected, if that structure exceeds 500 feet. Flights will operated at a lateral distance of at least 500 feet from any structure or structure or vehicle unless permission has been granted by the owner or controller of the property in advance of the flight. Flights will not be conducted within 500 feet of any person who is not essential for the conduct of the flight unless that person is in a position where they are shielded from the aircraft and any possible debris resulting from an aircraft failure. Flight will be terminated if a person breaches the safety zone.

Moreover, as compared to flight operations with aircraft or rotorcraft, weighing far more than 6 pounds proposed herein and carrying flammable fuel, any risk associated with our operations is far less than those presently presented with helicopters and other conventional aircraft operating at or below 500 feet AGL. An equivalent level of safety will be achieved given the size, weight, and speed of both the mUAS and sUAS, as well as the location where it is operated. Furthermore, by operating at such low~~er~~ altitudes; both the mUAS and sUAS will not interfere with other aircraft that are subject to the minimum safe altitude regulations.

5.10 14 C.F.R. §91.121: Altimeter Settings

The Petitioner seeks an exemption from 14 C.F.R. §91.121, which requires that:

A person operating an aircraft to maintain crusing altitude or flight level by reference to an altimeter that is set to the elevation of the departure airport or barometric pressure. An

[6] See 14 C.F.R. *§91.119(c)*

exemption is required to the extent that both the mUAS and sUAS do not have a barometric altimeter, but rather a GPS altitude read out.

An equivalent level of safety will be achieved by following the procedures set forth in the ARS Flight Safety & Procedure Manual. Moreover, as stated in the manual, the operator will confirm the altitude of the launch site shown on the GPS altitude indicator before flight. Finally, the PIC will use the GPS altitude indicator to constantly monitor either the mUAS or the sUAS height, thus ensuring operation at safe altitudes.

5.11 14 C.F.R. §91.151(a): Fuel Requirements for Flight in VFR Conditions

The Petitioner seeks an exemption from 14 C.F.R. §91.151(a), which requires that:

> *(a) No person may begin 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 crusing 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 battery powering both the mUAS and sUAS provides approximately 25 minutes of powered flight. An exemption from the 30 minute reserve requirement in 14 C.F.R. §91.151 is therefore required.

An equivalent level of safety can be achieved by limiting flights to 18 minutes, or enough battery reserve to ensure that the both the mUAS and sUAS land at the ground station with at least 25% of battery power (as determined by the onboard monitoring system and pilot), whichever happens first. This restriction would be more than adequate to return both the mUAS and sUAS to its planned landing zone from anywhere within its limited operating area.

5.12 14 C.F.R. §91.203(a) and (b): Carrying Civil Aircraft Certification and Registration

The Petitioner seeks an exemption from 14 C.F.R. §91.203 (a) and (b) which requires that:

> *(b) 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.*
>
> *(c) 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 Petitioner's UASs, fully loaded weigh no more than 6 pounds and are operated without an onboard pilot. Therefore, there is no ability or place to carry certification and registration documents or to display them on both the mUAS and sUAS.

The equivalent level of safety will be achieved and sustained by keeping these documents at the ground station or flight control point where the pilot flying the UAS will have immediate access

to them at the ground station or control point. The FAA has issued the following exemptions to this regulation: Exemption Nos. 9565, 9665, 9789A, 9797, 9797A, 9816A, and 10700.

5.13 14 C.F.R. §§91.405(a); 407(a)(1); 409(a)(s); 417(a)(b): Maintenance Inspections

The Petitioner seeks an exemption from the maintenance inspection requirements of 14 C.F.R. §§91.405(a); 407(a)(1); 409(a)(s); 417(a) and (b). These regulations specify that the:

> *Maintenance and inspection standards in reference to 14 C.F.R. Part 43. As a result, an exemption to these regulations is needed because Part 43 and the stated sections apply only to aircraft with an airworthiness certificate, which both the mUAS and sUAS will not have.*

An equivalent level of safety will be achieved because maintenance and inspections will be performed in accordance with the UAS Manufacturer Manuals, shown in the Supporting Documents Section. Also, the Pilot will ensure that the mUAS or sUAS are in working order prior to initiating flight, perform the required maintenance, and keep a log of any maintenance performed. The Pilot is the person most familiar with the aircraft and best suited to maintain the aircraft in an airworthy condition to provide the equivalent level of safety.

Also, given that both the mUAS and sUAS are very limited in size and will carry a small payload and operate only in restricted or sterile areas for limited periods of time during daylight hours, creates less risk than that associated with conventional rotorcraft performing the same operation.

5.14 14 C.F.R. Subchapter F, Part 93-Special Air Traffic Rules, Subpart V-Washington, DC Metropolitan Area Special Flight Rules, §93.333: Failure to Comply with this Subpart

The Petitioner seeks an exemption from knowingly violating 14 C.F.R. §93.333(b). This regulation states that:

> *The DC FRZ and DC SFRA were established for reasons of national security under the provisions of 49 U.S.C. 40103(b)(3). Areas established by the FAA under that authority constitute "national defense airspace" as that term is used in 49 U.S.C. 46307. In addition to being subject to the provisions of paragraph (a) of this section, persons who knowingly or willfully violate national defense airspace established pursuant to 49 U.S.C. 40103(b)(3) may be subject to criminal prosecution.*

The Petitioner's PIC will operate its UASs with a private pilot certificate only in the Class G airspace. The Petitioner believes that operating in the Class G airspace and providing the Washington Flight Standards District Office with an equivalent level of means to identify, track (locate), and communicate with the operator during flight operations provides the necessary approval to knowingly operating in the DC FRZ and DC SFRA. Moreover, given the nature of the specific relief sought by this exemption request, the Petitioner requires relief from 14 C.F.R. §93.333(b).

5.15 14 C.F.R. Subchapter F, Part 93-Special Air Traffic Rules, Subpart V-Washington, DC Metropolitan Area Special Flight Rules, §93.339 (a) through (e): Requirements for Operating in the DC SFRA, including the DC FRZ

The Petitioner seeks an exemption from 14 C.F.R. §93.339 (a) through (e) which states that:

(a) Except as provided in paragraphs (b) and (c) of this section and in §93.345, or unless authorized by Air Traffic Control, no pilot may operate an aircraft, including an ultralight vehicle or any civil aircraft or public aircraft, in the DC SFRA, including the DC FRZ, unless—

1) The aircraft is equipped with an operable two-way radio capable of communicating with Air Traffic Control on appropriate radio frequencies;

2) Before operating an aircraft in the DC SFRA, including the DC FRZ, the pilot establishes two-way radio communications with the appropriate Air Traffic Control facility and maintains such communications while operating the aircraft in the DC SFRA, including the DC FRZ;

3) The aircraft is equipped with an operating automatic altitude reporting transponder;

4) Before operating an aircraft in the DC SFRA, including the DC FRZ, the pilot obtains and transmits a discrete transponder code from Air Traffic Control, and the aircraft's transponder continues to transmit the assigned code while operating within the DC SFRA;

5) For VFR operations, the pilot must file and activate a DC FRZ or DC SFRA flight plan by obtaining a discrete transponder code. The flight plan is closed upon landing at an airport within the DC SFRA or when the aircraft exits the DC SFRA;

(b) Paragraph (a)(5) of this section does not apply to operators of Department of Defense aircraft, law enforcement operations, or lifeguard or air ambulance operations under an FAA/TSA airspace authorization, if the flight crew is in contract with Air Traffic Control and is transmitting an Air Traffic Control-assigned discrete transponder code.

(c) When operating an aircraft in the VFR traffic pattern at an airport within the DC SFRA (but not within the DC FRZ) that does not have an airport traffic control tower, a pilot must—

1) File a DC SFRA flight plan for traffic pattern work;

2) Communicate traffic pattern position via the published Common Traffic Advisory Frequency (CRAF);

3) Monitor VHF frequency 121.5 or UFH frequency 243.0, if the aircraft is suitably equipped;

4) Obtain and transmit the Air Traffic Control-assigned discrete transponder code; and

5) When exiting the VFR traffic pattern, comply with paragraphs (a)(1) through (a)(7) of this section.

(d) When operating an aircraft in the VFR traffic pattern at an airport within the DC SFRA (but not within the DC FRZ) that has an operating airport traffic control tower, a pilot must:

1) *Before departure or before entering the traffic pattern, request to remain in the traffic pattern;*
2) *Remain in two-way radio communications with the tower. If the aircraft is suitably equipped, the pilot must also monitor VHF frequency 121.5 or UHF frequency 243.0;*
3) *Continuously operate the aircraft transponder on code 1234 unless Air Traffic Control assigns a different code; and*
4) *Before exiting the traffic pattern, comply with paragraphs (a)(1) through (a)(7) of this section*

(e) Pilots must transit the assigned transponder code. No pilot may use transponder code 1200 while in the DC SFRA.

As a result of the size of both the mUAS and sUAS, neither asset has the ability to carry two-way communications and a transponder on-board to track and communicate with the ATC. However, the Petitioner shall engage and maintain communications with the Washington Flight Standards Office by cell phone stating its current flight operation, location, altitude, and operational timeframe when conducting operations within the DC SFRA, including the DC FRZ. The PIC shall obtain readings from the communication link between the controller and UAS to include battery level, altitude, distance from PIC, and location for all flight operations.

As part of preflight plans, the operator shall review all NOTAMs and file a DC SFRA Flight Plan with the Washington Flight Standards Office. The operator shall state that "we would like to file a DC SFRA flight plan for a VFR flight at subject property located at _____ being inspected." Next, the operator shall remain only in Class G airspace and request approval to conduct flight operations. During flight operations, the operator shall maintain communications with the Washington Flight Standards Office stating current flight operations, location, and altitude. Once flight operations ends, the operator shall notify the Washington Flight Standards Offices by cell phone that flight operations are closed. Given these operational procedures, an equivalent level of means to identify, track (locate), and communicate with the operator during flight operations provides the necessary rationale to operate in the DC FRZ and DC SFRA.

5.16 14 C.F.R. Subchapter F, Part 93-Special Air Traffic Rules, Subpart V-Washington, DC Metropolitan Area Special Flight Rules, §93.341 (a);(c1) through (c5);(d): Aircraft Operations in the DC FRZ

The Petitioner seeks an exemption from 14 C.F.R. §93.341 (a); (c1) through (c5) and (d) which states that:

(a) Except as provided in paragraph (b) of this section, no pilot may conduct any flight operation under part 91, 101, 103, 105, 125, 133, 135, or 137 of this chapter in the DC FRZ, unless the specific flight is operating under an FAA/TSA authorization.

(b) (b) Department of Defense (DOD) operations, law enforcement operations, and lifeguard or air ambulance operations under an FAA/TSA airspace authorization are exempted from the prohibition in paragraph (a) of this section if the pilot is in contact with Air Traffic Control and operates the aircraft transponder on an Air Traffic Control-assigned beacon code.

(c) The following aircraft operations are permitted in the DC FRZ:

1) Aircraft operations under the DCA Access Standard Security Program (DASSP) (49 CFR part 1562) with a Transportation Security Administration (TSA) flight authorization.
2) Law enforcement and other U.S. Federal aircraft operations with prior FAA approval.
3) Foreign-operated military and state aircraft operations with a State Department-authorized diplomatic clearance, with State Department notification to the FAA and TSA.
4) Federal, State, Federal DOD contract, local government agency aircraft operations and part 121, 129 or 135 air carrier flights with TSA-approved full aircraft operator standard security programs/procedures, if operating with DOD permission and notification to the FAA and the National Capital Regional Coordination Center (NCRCC). These flights may land and depart Andrews Air Force Base, MD, with prior permission, if required.
5) Aircraft operations maintaining radio contact with Air Traffic Control and continuously transmitting an Air Traffic Control-assigned discrete transponder code. The pilot must monitor VHF frequency 121.5 or UHF frequency 243.0.

(d) Before departing from an airport within the DC FRZ, or before entering the DC FRZ, all aircraft, except DOD, law enforcement, and lifeguard or air ambulance aircraft operating under an FAA/TSA airspace authorization must file and activate an IFR or a DC FRZ or a DC SFRA flight plan and transmit a discrete transponder code assigned by an Air Traffic Control facility. Aircraft must transmit the discrete transponder code at all times while in the DC FRZ or DC SFRA.

Given that an equivalent level of means to identify, track (locate), and communicate with the operator during flight operations provides the necessary rationale to operate in the DC FRZ and DC SFRA, the Petitioner requests authorization from the FAA/TSA to conduct flight operations in the Class G airspace. All PICs and visual camera operators shall have background checks conducted by the TSA. Additionally, the Petitioner shall engage and maintain contact with the Washington Flight Standards Office by cell phone, without the need for the pilot to monitor VHF frequency 121.5 or UHF frequency 243.0. Also, there will not be a need to transmit a discrete transponder code assigned by the ATC, since the UAS doesn't have an onboard transponder and that the operator will be notifying the Washington Flight Standards Offices by cell phone of the start and end of flight operations in the DC FRZ and DC SFRA. The Petitioner believes that this system will provide a high-level of notification, tracking and communicating with the FAA, which ensures a level of safety equal to or greater than the rules from which this exemption is requested.

6 Public Interest

Across the United States, State & local municipalities are responsible for protecting the health, safety, economic interests and the quality of life of local residents, businesses and visitors to their specific jurisdictions. These municipalities' charge an agency to regulate construction activities for compliance determination and inspections of vacant or occupied buildings, crane

assembly and bridges. However, as a result of budget cuts, many jurisdictions had to reduce resources and the number of government employees to monitor, assess, and inspect these activities. These agencies are faced with a public health and safety crisis that requires the use of aerial technology using UASs. The Petitioner's UASs will significantly increase productivity and reduce the inherent safety risks to property and personnel. The UASs will capture critical images that can then be uploaded to cloud software for rendering and can be processed into orthomosaic and 3D images that will serve as evidence to fine and prosecute individuals breaking local rules.

In order for the FAA to consider a petition for exemption, the petition must meet the requirements of 14 CFR §11.81(d), which requires the Petitioner to state the reasons why granting a request would be in the public interest and how it would benefit the public as a whole. Granting the approval of exemption of UAS commercial operations for conducting aerial public safety inspections and photography of vacant/and or occupied buildings, temporary tower crane assembly verification inspection, determine compliance with respect to construction activities, and substructure bridge inspections will benefit the public as a whole in many aspects.

6.1 The Need for Aerial Building Photography & Inspections

In general, a vacant property becomes a problem when the property owner abandons the basic responsibilities of ownership, such as routine maintenance or mortgage and property tax payments. Multiple variables can lead authorities to designate a property as either vacant or abandoned, including the physical condition of a structure, the amount of time that a property has been in that particular condition, and the relationship of the owner to the property. For example, in Baltimore, the city building code defines residences as vacant only if they are uninhabitable, not if they are merely unoccupied. Also, in the District of Columbia, the Vacant Building Enforcement Unit reaches out to owners of vacant buildings, and maintains a list of all vacant and blighted buildings. This list is used by the District of Columbia's Office of Tax and Revenue in reclassifying vacant buildings to the higher property tax rate, as mandated by DC Official Code.

The absence of universal definitions of vacancy and abandonment complicates efforts to assess the number of vacant and abandoned properties nationally. The best aggregate sources include the U.S. Census Bureau and the U.S. Postal Service, although these are not without limitations. Using these sources, the U.S. Government Accountability Office (GAO) reported in 2011 that vacant residential units, not including those used seasonally or by migrant workers, increased from 7 million in 2000 to 10 million in 2010. The Joint Center for Housing Studies of Harvard University reported that a subset of this category, homes vacant and not being marketed for sale or rent, reached a record high of 7.4 million in 2012, with increases concentrated in the high-foreclosure areas of the South and West. Although vacant homes can be found throughout the country, they tend to be concentrated; nearly 40 percent of the nation's vacant homes are located in just 10 percent of all census tracts. More than half of the census tracts with vacancy rates of 20 percent or higher were in just 50 counties, most of them in metropolitan areas. Wayne County in Michigan and Cook County in Illinois, for example, each have more than 200 high-vacancy neighborhoods. Another example is in the District of Columbia, where this 10 square mile city has over 3,000 vacant and abandon buildings. In addition to the many vacant and abandoned

residential properties across the nation, estimates place the number of brownfields — idle former industrial properties with real or perceived environmental contamination — at approximately a half-million (HUD, 2014).

The use of UASs for inspecting vacant and abandon buildings is warranted and can considerably reduce the risk of building collapse and identify dangerous building conditions for citizens. An inspector may not have the most effective access to monitor, collect, and assess potential building code violations. Also, he or she may not have access to the rear of the building, which could be land locked by other buildings or by other obstacles. Moreover, a mUAS can gather more information safely, survey the alleged violation, and save lives from buildings that may collapse. For example, the DJI Phantom 2 Vision Plus has the capability to inspect, photograph, capture, collect images, and upload data to cloud software that is rendered into 3D images. The inspector can now have the ability to gather 2D volumetric data points and view a 3D image of the entire building through the use of the mUAS's ability to hoover and circle the site.

6.2 The Need for Substructure Bridge Inspections

In a recent analysis of the U.S. Department of Transportation's bridge inventory database, the 2015 American Road & Transportation Builders Association (ARTBA) Report found that over 61,000 bridges in the U.S. need structural repair. The analysis of the federal government data, conducted by ARTBA's Chief Economist Dr. Alison Premo Black, shows cars, trucks and school buses cross the nation's 61,064 structurally compromised bridges 215 million times every day. Not surprisingly, the most heavily traveled are on the Interstate Highway System, which carries the bulk of truck traffic and passenger vehicles (Houlihan, 2015).

Dr. Black suggests that the bridge problem could get worse. For instance, the Federal Highway Trust Fund (HTF) is the source of 52 percent of highway and bridge capital investments made annually by state governments. The HTF has suffered five revenue shortfalls between 2008 and 2014, and has been bailed out with nearly $65 billion in revenues from the General Fund just to preserve existing investment levels. Nearly a dozen states so far have canceled or delayed road and bridge projects because of the continued uncertainty over the trust fund situation. "State and local governments are doing the best they can to address these significant challenges, given limited resources," Black says. ARTBA expects that number to increase as the deadline nears. "Many of the most heavily traveled bridges are nearly 50 years old. Elected officials can't just sprinkle fairy dust on America's bridge problem and wish it away," Dr. Black said. "Bridge decks and support structures are regularly inspected by the state transportation departments for deterioration and are rated on a scale of zero to nine—nine being "excellent" condition. A bridge is classified as structurally deficient and in need of repair if its overall rating is four or below. The ARTBA analysis of the bridge data supplied by the states to the U.S. DOT also found (Houlihan, 2015):

- Pennsylvania (5,050), Iowa (5,022), Oklahoma (4,216), Missouri (3,310), Nebraska (2,654), California (2,501), Kansas (2,416), Mississippi (2,275), Illinois (2,216) and North Carolina (2,199) have the highest numbers of structurally deficient bridges. The District of Columbia (14), Nevada (34), Delaware (48), Hawaii (61), and Utah (102) have the least.

Figure 3: A bridge inspection using truck & boom.

- At least 15 percent of the bridges in eight states—Rhode Island (23 percent), Pennsylvania (22 percent), Iowa (21 percent), South Dakota (20 percent), Oklahoma (18 percent), Nebraska (17 percent), North Dakota (16 percent) and Maine (15 percent)—fall in the structurally deficient category.

These State Bridge Inspection Units are responsible for managing their local transportation structures. This includes performing bridge inspections in accordance with Federal regulations on all bridges owned by local government agencies, making structure work repair recommendations, determining the safe load capacity of all bridges, reviewing and approving encroachment permits. These agencies hire engineering contractors or use internal staff to inspect bridges. Various methods are used to inspect bridges. They include the use of helicopters, truck & boom, underwater diving, trailer mounted units, and water taxi inspections (see Figure 3). However, these agencies are faced with many challenges using these current methods. One such method, as shown in Figure 3, include utilizing a mobile inspection vehicle to lower inspectors over the side of the bridge. This method causes traffic congestion, accidents, and has the risk of the inspector falling out of the boom carry box. Challenges that agencies must mitigate include:

- Reduced work windows because of high traffic demands thus limiting inspectors' access to key sections of bridges.
- More stringent regulatory obligations also require adjustments to inspection schedules to accommodate nesting periods of protected migratory bird species.
- Inspection schedules have flexibility built to accommodate unplanned inspections in the case of a bridge suffering unexpected damage.
- New FHWA inspection performance measures require a bridge to be inspected as close as possible to the date plus the inspection cycle (typically 2 years).

The use of UASs for inspecting bridge substructures is warranted and the Petitioner's planned operations dramatically improves safety and reduces risk concerning bridge inspections by alleviating human exposure to dangers associated with current methods such as helicopters, truck & boom, underwater diving, trailer mounted units, and water taxi inspections. The most used method, mobile truck and boom, is dangerous to ongoing motor vehicles and has caused serious accidents over the years. In addition, these standard procedures are extremely labor-intensive and time consuming. sUASs serves as a feasible solution for State Bridge Inspection Units seeking an alternative method that is safer, less expensive, and efficient. For example, using the

Tali H500, we have the capability to inspect, capture, collect infrared data for analysis and upload data to cloud software that allows engineers to conduct detail assessment of the bridge substructure.

6.3 The Need for Construction Inspections

Construction is a high hazard industry that comprises a wide range of activities involving construction, alteration, and/or repair. Examples include residential construction, commercial building erection, excavations, demolitions, and large scale jobs. Construction workers engage in many activities that may expose them to serious hazards, such as falling from rooftops, unguarded machinery, being struck by heavy construction equipment, electrocutions, silica dust, and asbestos (U.S. Department of Labor, 2015).

In general, construction activities falls into two categories, those activities which are conducted in compliance with applicable authorities and those which are not. The vast number of compliant activities are accounted for with permits. Construction activities which are conducted in compliance with permits or regulations are inherently conducted in a safer manner. City inspectors are not onsite full-time to assess potential dangers from deficiencies in excavation, grading, building footings, foundations, and framing. Some general contractors and home owners bypass the permitting process and begin and complete construction activities which are not in compliance with the applicable regulatory or statutory authority. These noncompliant activities are frequently missed by city inspectors, but are often discovered after an accident or the death of workers or citizens.

Construction which is conducted in violation of permitting or regulatory requirements is difficult to uncover due to some privacy and trespassing rules. Many times, neighbors or concerned citizens call city inspectors to notify them of suspicious construction activities or projects. City inspectors are often thwarted from pursuing an enforcement or compliance action by the simple fact that the homeowner may not be home or the property owner may not be on site at the time of the attempted inspection. The city inspector cannot gather evidence to support a case for noncompliance without violating city regulations with respect to access to private property.

The use of UASs for determining whether construction sites are in compliance with applicable permits and regulations is justified and can considerably reduce the risk to inspectors, workers, residents, and survey teams. To monitor, gather, and collect data would often require an inspector to get this information from difficult or dangerous areas onsite or be at risk of possibly falling at the jobsite. Falls are the leading source of workplace fatalities and injuries on construction sites (OSHA, 2015). However, a UAS can gather more information safely, reduce falls, and save lives on these types of construction sites. For example, the DJI Phantom 2 Vision Plus has the capability to inspect, photograph, capture, collect images, and upload data to cloud software that is rendered into 3D images and maps. As a result of this technology, the building inspector, now has the ability to gather data and view building site progress without going to the site.

6.4 The Need for Temporary Tower Crane Assembly Verification Inspections

The Federal Occupational Safety & Health Administration (OSHA) is a small agency that has approximately 2,200 inspectors responsible for the health and safety of 130 million workers, employed at more than 8 million worksites around the nation — which translates to about one compliance officer for every 59,000 workers.

OSHA estimates that there are about 125,000 cranes in operation in the construction industry in the United States every day. There are an additional 80,000 to 100,000 involved in the maritime shipping industry. Because cranes are so large, and the weights they carry are so immense, even the slightest operator error or improperly maintained bolt can result in a catastrophic accident.

Early governmental regulation of the crane and rigging industries was light, mostly occurring at the state level. The most significant development in the regulatory landscape took place when the OSHA Act of 1970 was signed into law. OSHA regulations lagged behind industry standards until 2010, when a broad update of OSHA construction crane regulations went into effect. In developing the new regulations, OSHA consulted with a panel of industry experts and applied cost-benefit analyses in addition to unalloyed safety considerations. Though portions of the regulations remain controversial in the industry, the agency clearly based its work on a broad view without reacting "knee-jerk" to particular events of failures (Shapiro & Ratay, 2013).

By its very nature, construction is a challenging and dangerous industry. In contrast to most industries, construction often requires travel to multiple sites, each with their own constantly changing hazards. Temporary tower cranes play an essential role on construction sites throughout the United States on a daily basis. Also, temporary tower cranes add many complex risks to the construction process. Recently, numerous fatal crane collapses have grabbed national news headlines, increasing attention and scrutiny of construction crane operations. The most highly publicized being massive tower crane failures in New York, Miami, and Seattle. Estimates indicate that up to 33% of construction casualties and between 8 to 16% of construction fatalities involve cranes (Parfitt, 2010).

Between 1992 and 2006, 610 construction worker deaths were attributed to crane accidents, about 42 per year. Nearly two-thirds of all crane-related accidents are caused by tower style cranes. Other styles responsible for injuries include mobile cranes, gantries and loader cranes. In the US, most medium-sized and large construction sites are serviced by mobile cranes. Their variety, purposes and duration of use vary greatly. A truck-mounted mobile crane may show up at a site to make a handful of picks before departing, while a crawler crane could be set up for a year-long assignment. Mobility confers its own set of hazards, inferring likelihood that an operating site has not been adequately surveyed beforehand and perhaps not prepared for the presence of a crane. Moreover, the operator and crew may be encountering unfamiliar conditions with unexplored hazards. Mobility also confers the possibility of last-minute changes or improvisations, defeating the benefit of a plan (Shapiro & Ratay, 2013). The Petitioner's work shall focus on the assembly/disassembly failures and among mobile cranes, the frequent types of serious accidents are:

- Electrocution – the victims is usually a rigger handling the load when the boom or load line contacts an overhead power line.
- Overturning – caused by overloading, ground support failure or improper operation of the crane (see Figure 4).
- Collision – a portion the crane or a suspended load strikes a building, person or object, or a suspended load is trapped.
- Over-travel – the load block strikes the boom tip or boom runs up against the backstops.
- Structural failure – from excessive side loading, overloading or an equipment deficiency.
- **Assembly/disassembly failure – the crew deviates from a qualified procedure.**
- Crushing – a worker is caught by a rotating or moving part such as a revolving deck or a spooling rope.

Similar types of accidents can occur with tower cranes, albeit less frequently because tower cranes tend to work under more controlled circumstances than mobile cranes. Tower cranes are used in the US primarily on major construction sites. By nature, they are fixed or semi-fixed in place and, therefore, less prone to problems caused by scanty planning, hasty preparation or last-minute improvisation. The greatest exposure of these machines to accidents occurs when they are being erected, dismantled or jumped (Shapiro & Ratay, 2013).

Figure 4: A crawler crane relies on firm level ground support to keep it from tipping.

A crane accident in the core of a large city can be a catastrophic event that splashes across television screens and tabloid covers (see Figure 5). Government officials are compelled by public outcry to react; their constituents must be made to feel safe while walking through streets stalked by the shadows of giant construction cranes. Under such circumstances, major accidents in dense urban zones have spurred the creation of crane regulations, particularly in California and New York. Officials in other localities have reacted similarly to singular dramatic accidents, sometimes creating laws that are closely crafted to the particularities of the accidents that spawned them (Shapiro & Ratay, 2013).

This jagged path to the making of crane rules is an aberration. The great bulk of crane standards and regulations in both the United States and the world at large are, instead, the product of a steady progression of deliberations, built upon collective knowledge and wisdom acquired over decades. Much of the knowledge, unfortunately, comes from the experience of accidents.

Figure 5: On the Upper East Side of Manhattan, a tower crane collapsed during a climbing operation, resulting in multiple deaths and massive property damage.

Most crane accidents do not occur in the center of major cities, nor do they make the front pages of tabloids. These lesser-publicized events add up to a much greater human and economic toll than the headline-grabbers. They do not, however, escape attention. Stakeholders, who suffer the losses and deal with the consequences, do not ordinarily forget them (see Figure 6). For those apt to learn from experience, the cruel lessons of a serious mishap will be internalized, analyzed and applied (Shapiro & Ratay, 2013).

Regardless of what laws are in the books -- if enforcement is lacking -- conditions are not apt to improve. The arrest of former inspector Edward J. Marquette for allegedly falsify a business record and filing it with the buildings department has reduced the number of crane inspectors in New York to four. With only four inspectors being left responsible for 250 cranes in use, of which 30 are tower cranes, the ability to fully enforce regulations is clearly questionable (Sawyer, et al., 2008). Moreover, some building inspection units don't have certified inspectors to climb and assess cranes. For example, in the District of Columbia, there are over 52 cranes in operations that are required to be inspected by law. However, the D.C. Building Inspection Unit does not have a certified inspector on staff to enforce the regulations.

Figure 6: A half-mile-long cableway across Black Canyon on the Colorado River collapsed during high winds. Its loss set back construction of a vital interstate bridge link by two years.

The use of UASs for inspecting cranes is justified and alleviates human exposure to danger associated with this high-risk job. The current crane inspection method consists of an inspector climbing the crane and visually inspecting the base, mast, jib, and counter-jib. Inspectors are at risk and are exposed to unsafe conditions when conducting these inspections. In some situations, building inspection units may rely on the general contractor to conduct self-inspection of the crane, since they lack the resources to provide a certified staff to verify the assembly. The Petitioner's planned operations addresses the safety issues and diminishes the risk to workers, inspectors, and citizens by ensuring that the assembly was constructed properly and reduces the chances of crane failure. To further enhance safety and the public interest, the inspector has the ability to review, inspect, and assess the entire crane from detailed images gathered from the UAS. The UAS has the capability to capture and upload data to cloud

software that renders the crane as a 3D image. The inspector, located onsite, now has the ability to view 3D images of the entire crane within 45 minutes.

The Petitioner's UASs remove the environmental impact by significantly decreasing the energy used for aerial imaging for crane, bridge and construction site inspections. The UAS uses a rechargeable lithium polymer battery, as opposed to Jet A or JP5 (kerosene based) fuel that burns in the operations of a helicopter, which weights thousands of pounds. Also, the public's interest is further minimized in the event of an accident, thus reducing the human exposure to harmful carbon emissions associated with helicopters and/or manned aircraft.

In addition, the Petitioner's UASs may well replace the need to use helicopters and manned aircraft to inspect cranes, bridges, and construction sites. For our planned operations, our proposed UASs are under 6 pounds and carry no combustible fuel on board, as opposed to the larger powered helicopters and manned aircraft. The paradigm shift to UASs from larger manned aircraft minimizes risks to the public and improves the overall health and safety of workers.

Finally, granting this Petitioner's exemption application will fulfill Congress's intent of allowing UASs to operate with significant safety precautions in low risk environments as stated in Section 333 (a) – (c) of the FMRA. The law directs the FAA Administrator to grant case-by-case authorization for certain unmanned aircraft to perform commercial operations prior to the finalization of the small UAS Rule under Section 332 of FMRA, which will be the primary method for authorizing small UAS operations once it is complete (Section 333, 2015). In addition, the Petitioner's goal is to aide and assist government agencies as a contractor to perform aerial public safety inspections and photography of vacant/and or occupied buildings, crane assembly verification, construction activities for compliance determination, and substructure bridge inspections using UASs. As a result, the public as a whole will benefit from the safer, efficient, and reliable aerial services that UASs operations will provide for state and local government agencies.

7 Drug Free Workplace

Alternatives Renewable Solutions, LLC intends to help provide a safe and drug-free work environment for our clients, employees, and contractors. All employees or contractors who perform safety inspection related activities and functions are prohibited from performing work if they have alcohol or prohibited drugs in their system. With this goal in mind and because of the serious drug abuse problem in today's workplace, we are establishing the following policy for existing and future employees, staff, and contractors of Alternatives Renewable Solutions, LLC.

The Company explicitly prohibits:

- The use, possession, solicitation for, or sale of narcotics or other illegal drugs, alcohol, or prescription medication without a prescription on Company, customer premises or while performing an assignment in public domain.
- Being impaired or under the influence of legal or illegal drugs or alcohol away from the Company customer premises, or public domain, if such impairment or influence

adversely affects his/her's work performance, the safety of the of others, or puts at risk the Company's reputation.

- Possession, use, solicitation for, or sale of legal or illegal drugs or alcohol away from the Company, public domain or customer premises, if such activity or involvement adversely affects the employees or contractors work performance, the safety of the employee or of others, or puts at risk the Company's reputation.
- The presence of any detectable amount of prohibited substances in the employees or contractors system while at work, while on the premises of the company, or its customers, or while on company business. "Prohibited substances" include illegal drugs, alcohol, or prescription drugs not taken in accordance with a prescription given to the employee or contractor.

The Company will conduct drug and/or alcohol testing under any of the following circumstances:

- RANDOM TESTING: Employees or contractors may be selected at random for drug and/or alcohol testing at any interval determined by the Company.
- FOR-CAUSE TESTING: The Company may ask an employee or contractor to submit to a drug and/or alcohol test at any time it feels that the employee or contractor may be under the influence of drugs or alcohol, including, but not limited to, the following circumstances: evidence of drugs or alcohol on or about the his/her person or in the his/her vicinity, unusual conduct on the his/her part that suggests impairment or influence of drugs or alcohol, negative performance patterns, or excessive and unexplained absenteeism or tardiness.
- POST-ACCIDENT TESTING: Any employee or contractor involved in an on-the-job accident or injury under circumstances that suggest possible use or influence of drugs or alcohol in the accident or injury event may be asked to submit to a drug and/or alcohol test. "Involved in an on-the-job accident or injury" means not only the one who was or could have been injured, but also any employee or contractor who potentially contributed to the accident or injury event in any way.

If an employee or contractor is tested for drugs or alcohol outside of the employment/contractor context and the results indicate a violation of this policy, or if an employee/contractor refuses a request to submit to testing under this policy, the he or she may be subject to appropriate disciplinary action, up to and possibly including discharge from contract or employment. In such a case, the employee/contractor will be given an opportunity to explain the circumstances prior to any final action becoming effective.

8 Privacy Policy

All flights will occur in accordance with state, county, or local laws regarding privacy.

9 Federal Registry Summary

Pursuant to Section 333 of the FAA Modernization and Reform Act of 2012 and 14 C.F.R. Parts 21, 27, 45, 61, 91, and 93, the following summary is provided for publication in the Federal Register, should it be determined that publication is needed:

The Petitioner seeks an exemption from the following rules:

a) *14 C.F.R. Part 21, Subpart H- Airworthiness Certificates and 14 C.F.R. § 91.203(a)(1)*
b) *14 C.F.R. Part 27 Airworthiness Standards: Normal Category Rotorcraft*
c) *14 C.F.R. §§ 45.23(b), 45.27(a) and 91.9(c): Aircraft Marking and Identification Requirements*
d) *14 C.F.R. § 61.113: Private Pilot Privileges and Limitations*
e) *14 C.F.R. §91.7(a): Civil Aircraft Airworthiness*
f) *14 C.F.R. §91.9(b)(2): Civil Aircraft Flight Manual in the Aircraft*
g) *14 C.F.R. §91.103: Preflight Action*
h) *14 C.F.R. §91.109(a): Flight Instruction*
i) *14 C.F.R. §91.119: Minimum Safe Altitudes*
j) *14 C.F.R. §91.121: Altimeter Settings*
k) *14 C.F.R. §91.151(a): Fuel Requirements for Flight in VFR Conditions*
l) *14 C.F.R. §91.203(a) and (b): Carrying Civil Aircraft Certification and Registration*
m) *14 C.F.R. §§91.405(a); 407(a)(1); 409(a)(s); 417(a)(b): Maintenance Inspections*
n) *14 C.F.R. Subchapter F, Part 93-Special Air Traffic Rules, Subpart V-Washington, DC Metropolitan Area Special Flight Rules, §93.333: Failure to Comply with this Subpart*
o) *14 C.F.R. Subchapter F, Part 93-Special Air Traffic Rules, Subpart V-Washington, DC Metropolitan Area Special Flight Rules, §93.339 (a) through (e): Requirements for Operating in the DC SFRA, including the DC FRZ*
p) *14 C.F.R. Subchapter F, Part 93-Special Air Traffic Rules, Subpart V-Washington, DC Metropolitan Area Special Flight Rules, §93.341 (a);(c1) through (c5);(d): Aircraft Operations in the DC FRZ*

Approval of these exemptions will allow the Petitioner to offer a unique and real-time commercial UAS services for a host of industries and applications. The exemptions will improve and enhance safety by reducing risk to the public and property owners from the hazards associated with performing equivalent work with conventional aircraft and rotorcraft.

10 Conclusion

Based on the information submitted within, the Petitioner requests that the FAA Administrator grant this exemption. Given the description of proposed operations, procedures and supporting documents, the Petitioner's proposed usage does not pose a hazard to the NAS or to the public. Moreover, the size, weight, speed, operating capabilities, and operations within visual line of

sight and security provides more than adequate justification for granting the requested exemption. Therefore, granting of the exemption will permit the Petitioner to offer aerial inspection services to State and local government agencies using both mUAS and sUAS assets for a host of industries and applications. Accordingly, the Petitioner respectfully requests that the FAA grant the requested exemption without delay.

Submitted on May 23, 2015

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11 References

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12 Supporting Documents

12.1 Aerial Inspection Flight Sign

12.2 DJI Phantom 2 Vision Plus User Manual

12.3 DJI Pilot Training Guide

12.4 DJI Prop Guard Assembly Guide

12.5 DJI Battery Safety Guide

12.6 DJI Flying Flowchart

12.7 DJI Advanced Manual

12.8 Tali H500 GoPro Manual

12.9 Tali H500 Bluetooth Datalink Manual

12.10 Tali H500, Quick Start Guide

12.11 Tali H500 iLook Settings

12.12 ARS Flight Safety and Procedures Manual