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

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

August 20, 2015

Exemption No. 12534
Regulatory Docket No. FAA−2015−1364

Mr. John W. Gunnett, P.G.
Skelly and Loy, Inc.
449 Eisenhower Boulevard
Suite 300
Harrisburg, PA 17111-2302

Dear Mr. Gunnett:

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 letters dated April 20 and June 8, 2015, you petitioned the Federal Aviation Administration (FAA) on behalf of Skelly and Loy, Inc. (hereinafter petitioner or operator) for an exemption. The petitioner requested to operate an unmanned aircraft system (UAS) to conduct aerial photography and surveys.

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

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

Airworthiness Certification

The UAS proposed by the petitioner is a Trimble UX5.

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, Skelly and Loy, Inc. is granted an exemption from 14 CFR §§ 61.23(a) and (c), 61.101(e)(4) and (5), 61.113(a), 61.315(a), 91.7(a), 91.119(c), 91.121, 91.151(a)(1), 91.405(a), 91.407(a)(1), 91.409(a)(1) and (2), and 91.417(a) and (b), to

[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.

the extent necessary to allow the petitioner to operate a UAS to perform aerial data collection. This exemption is subject to the conditions and limitations listed below.

Conditions and Limitations

In this grant of exemption, Skelly and Loy, Inc. is hereafter referred to as the operator.

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

1. Operations authorized by this grant of exemption are limited to the Trimble UX5 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

449 Eisenhower Boulevard, Suite 300
Harrisburg, PA 17111-2302

E-mail: skellyloy@skellyloy.com
Internet: www.skellyloy.com

SKELLY AND LOY
ENGINEERING - ENVIRONMENTAL CONSULTANTS

Phone: 717-232-0593
800-892-6532

Fax: 717-232-1799

April 20, 2015

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

Re: Application for Issuance of Section 333 Exemption Based on Exemption 11110 Issued to Trimble Navigation Ltd.

To Whom It May Concern:

Skelly and Loy, Inc. ("Skelly and Loy") herewith applies for the issuance of an exemption under Section 333 of the FAA Modernization and Reform Act of 2012 based on Exemption 11110 issued to Trimble Navigation Ltd. ("Trimble") on December 10, 2014, in FAA Docket 2014-0367. The requested exemption would allow Skelly and Loy to operate the UX5 aircraft manufactured by Trimble or other Trimble aircraft approved for commercial operations under Exemption 11110, as amended, such as the UX5hp for which an amendment has been filed. Skelly and Loy notes that the FAA recently authorized use of the Trimble UX5 by a third party in Exemption No. 11257, Regulatory Docket No. FAA-2014-0889, on April 2, 2015, under updated conditions, and Skelly and Loy hereby confirms that it will accept such conditions as well as those set forth in Exemption No. 11240, Regulatory Docket No. FAA-2014-0894.

The name and contact information for the applicant are:

John W. Gunnett, P.G.
Skelly and Loy, Inc.
Suite 300
449 Eisenhower Blvd
Harrisburg, Pennsylvania 17111
Telephone: 717-232-0593
E-mail: jgunnett@skellyloy.com

Skelly and Loy intends to operate the UX5 or the UX5hp from Trimble and will operate it in strict compliance with the conditions set forth in Exemption 11110, as such conditions may be amended or modified by the FAA from time to time, as was done in Exemption Nos. 11240 and 11257, or such other conditions as the FAA shall specify, and the following manuals:

1) Trimble UX5 Data Sheet; and
2) Trimble UX5 Aerial Imaging Solution User Guide (User Guide)

Copies of these manuals are enclosed.

These manuals are very similar to the manuals submitted by Trimble in support of the issuance of Exemption 11110, updated to reflect changes reported in Trimble's March 4, 2015, amendment to Exemption 11110. The manuals will be updated by Trimble, as needed to reflect any changes to Exemption 11110, based on amendments thereto.

Skelly and Loy acknowledges that, under current FAA guidance, a separate Certificate of Waiver or Authorization ("COA") is required to fly at altitudes in excess of 200 feet AGL, and it will apply for COAs where required. Skelly and Loy hereby requests a blanket COA for flights up to 200 feet AGL in the form approved by the FAA. Skelly and Loy will also file NOTAMs for its flights, as required.

To the extent necessary, Skelly and Loy refers the FAA to the original exemption and the amended exemption requests submitted by Trimble in Docket FAA-2014-0367 for demonstration of the public interest and an equivalent level of safety. Because the UX5 and the UX5hp specified in this request are the same, or essentially the same, as the craft already approved in Exemption 11110, and Skelly and Loy will operate the aircraft in strict compliance with the conditions in existing exemptions previously granted by the FAA, or as they may be amended, notice need not be provided in the Federal Register nor public comment solicited.[1]

If you have any questions, do not hesitate to contact us.

Sincerely yours,

SKELLY and LOY, Inc.

John W. Gunnett, P.G.
President

Enclosures

cc: Richard Johnston
Sandy Basehore
ZZZ-ADMIN.000.101
File: Skellly and Loy exemption letter_JWG.docx

[1] Applicant reads Section 333 as placing the duty on the Administrator not only to process applications for exemptions under Section 333 but, if he determines that the conditions set forth herein do not fulfill the statutory requirements for approval, to craft conditions for the safe operation of the UAS.

449 Eisenhower Boulevard, Suite 300
Harrisburg, PA 17111-2302

E-mail: skellyloy@skellyloy.com
Internet: www.skellyloy.com

SKELLY AND LOY
ENGINEERING - ENVIRONMENTAL CONSULTANTS

Phone: 717-232-0593
800-892-6532

Fax: 717-232-1799

June 8, 2015

Ms. Brenda Robeson
Program Analysis, Airmen and Airspace Rules Division
Federal Aviation Administration
800 Independence Avenue
Washington, D.C. 20591

Re: Public Docket Number FAA-2015-1364

Dear Ms. Robeson:

In response to your June 1, 2015, letter, Skelly and Loy, Inc. is providing the following supplemental information to Public Docket FAA-2015-1364.

Skelly and Loy is seeking relief from the following regulations.

14 C.F.R. §45.23(b): Marking of the Aircraft

The regulation provides:

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

The UX5 has no entrance to the cabin, cockpit, or pilot station on which the word "Experimental" can be placed. Given the size of the UAV, two-inch lettering will be impossible. The word "Experimental" will be placed on the forward fuselage in compliance with §45.29(f).

The equivalent level of safety will be achieved by having the UX5 marked on its forward fuselage as required by §45.29(f) where the pilot, observer, and others working with the UAV will see the identification of the UAS as "Experimental." The FAA has issued the following exemptions to this regulation to Trimble, Exemption No. 10700, and to others, including Exemption Nos. 8738, 10167 and 10167A.

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

Section 91.203(a)(1) requires all civil aircraft to have a certificate of airworthiness. Part 21, Subpart H, entitled Airworthiness Certificates, establishes the procedural requirements for the issuance of airworthiness certificates as required by FAR §91.203(a)(1). Given the size

of the aircraft (5.5 lbs.) and the limited operating area associated with its utilization, it is unnecessary to go through the certificate of airworthiness process under Part 21 Subpart H to achieve or exceed current safety levels.

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

In this case, an analysis of these criteria demonstrates that the UX5 operated without an airworthiness certificate, under the conditions proposed herein, will be at least as safe, or safer, than a conventional aircraft (fixed wing or rotorcraft) with an airworthiness certificate. The UX5 weighs less than 6 lbs. fully loaded. It will not carry a pilot or passenger, will not carry flammable fuel, and will operate exclusively within an area pre-disclosed and in compliance with conditions set forth herein. Operations under this exemption will be tightly controlled and monitored by both the operator, pursuant to the conditions set forth above, and by local public safety requirements. The FAA will have advance notice of all operations through the filing of NOTAMs. Receipt of the prior permission of the land owner, the size of the aircraft, the lack of flammable fuel, and the fact that the aircraft is carried to the location and not flown there all establish the equivalent level of safety. The UX5 construction with absorbent material provides at least an equivalent level of safety to that of such operations being conducted with conventional aircraft that would be orders-of-magnitude larger and would be carrying passengers, cargo, and flammable fuel.

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

Section 61.113(a) and (b) limit private pilots to non-commercial operations. Unlike a conventional aircraft that carries a pilot, passengers, and cargo, the UX5 in this case is remotely controlled with no passengers or property of others on board. Section 61.133(a) requires an individual with a commercial pilot's license to be pilot in command of an aircraft for compensation or hire. Trimble respectfully proposes that operator requirements should take into account the characteristics of the particular UAS. Trimble's UX5 has a high degree of pre-programmed control and various built-in technical capabilities that strictly limit the potential for operation outside of the operating conditions set forth in the exemption application.

The UX5 has a semi-autonomous navigation and control system comprised of a Ground Control Station (GCS) and auto-pilot system. All flights are pre-programmed with precision GPS guidance and do not require human intervention. Flight mission area and routing cannot be changed after launch. Flights are not directed by positive manual control nor are evasive maneuvers. In the case of unplanned events, the operator inputs pre-programmed evasive maneuvers from the control unit, and the control unit executes that maneuver. Pre-programmed operator interventions include diversion to the right; initiation of holding at present position; suspension of mission; fly back to launch point; fly to point and hold; abort mission and land; and emergency power cut off and land (Flight Termination System).

Additional automated safety functions and safety enhancing features of the UX5 include the following.

- Auto-pilot detection of lost GPS or of insufficient satellites initiates an immediate spiral landing.
- Low power on the aircraft triggers escalating alarms at GCS at 35% and 10% levels.
- If the auto-pilot detects a lost-link to the GCS for longer than 30 seconds, landing procedure begins.
- The UX5 is inherently unstable, so auto-pilot fail will result in very rapid exit from flight.
- Aircraft has an on-board failsafe that limits speed in the event of dive to approximately 14 m/s.
- The aircraft, weighing less than 6 lbs. fully loaded, is constructed of EPP foam or similar material which is intended to absorb impact energy.
- The motor is driven by a pulse width modulated signal, not an analog signal.

Given these safety features, Trimble proposes that operators of the UX5 should not be required to hold a commercial or private pilot certification. Instead, operators should be required to

- have successfully completed, at a minimum, FAA private pilot ground instruction and passed the FAA Private Pilot written examination or FAA-recognized equivalents and
- have completed the manufacturer's training program for operation of the UAS. The manufacturer's training program will have been satisfactorily reviewed through the SAC process.

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

Given these conditions and restrictions, an equivalent level of safety will be provided by allowing operation of the UX5 without a private pilot's certificate or a commercial pilot's certificate, under the conditions set forth herein.

The risks associated with the operation of the UX5 (given its size, speed, operational capabilities, and lack of combustible fuel) are so diminished from the level of risk associated with private pilot operations or commercial operations contemplated by Part 61 with conventional aircraft (fixed wing or rotorcraft), that allowing operations of the UAS as set forth above meets or exceeds the present level of safety provided under 14 C.F.R. § 61.113(a) and (b) and does not rise to the level of requiring a commercial pilot to operate the aircraft under §61.133(a).

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

This regulation requires that no person may operate a civil aircraft unless it is in airworthy condition. Should the exemption be granted allowing commercial operation of the UX5 without an airworthiness certificate, no standard will exist for airworthiness of the UX5. Given the size of the aircraft and the requirements that have presumably already been met in the SAC approval process for the UX5 (for instance, the UX5's Maintenance and Inspection Manual and Safety Checklist), an equivalent level of safety will be achieved by insuring compliance with the Trimble manuals prior to each flight.

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

The regulation provides the following.

No person may operate a U.S.-registered civil aircraft …

> (2) For which an Airplane or Rotorcraft Flight Manual is not required by §21.5 of this chapter, unless there is available in the aircraft a current approved airplane or Rotorcraft Flight Manual, approved manual material, markings, and placards, or any combination thereof.

Given the size and configuration of the UX5, it has no ability or place to carry such a flight manual on the aircraft, not only because there is no pilot on board, but because there is no room or capacity to carry such an item on the aircraft.

The equivalent level of safety will be achieved by keeping the flight manual (e.g., User Guide, Exhibit 4) at the ground control point where the pilot flying the UAS will have immediate access to it. The FAA has issued to Trimble and others the following exemptions to this regulation: Exemption Nos. 8607, 8737, 8738, 9299, 9299A, 9565, 9565B, 10167, 10167A, 10602, 32827, and 10700.

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

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

The UX5 is a remotely piloted aircraft and, by design, does not have fully functional dual controls. Flight control is accomplished through the use of a control box that communicates with the aircraft via radio communications. The flight plan is pre-programmed into the autopilot before flight and only in unusual circumstances will the pilot input control functions to alter the pre-programmed flight. If instruction is accomplished through a training program, as set forth in Exhibit 2, an equivalent level of safety will be assured. The FAA has approved exemptions for flight training without fully functional dual controls for a number of aircraft and for flight instruction in experimental aircraft. See Exemption Nos. 5778K and 9862A. The equivalent level of safety will be achieved by the manufacturer providing training and through the use of experienced and qualified pilots familiar with the UX5.

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

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

As set forth herein, the UX5 will never operate at higher than 400 feet AGL. It will, however, be operated to avoid congested or populated areas that are depicted in yellow on VFR sectional charts. Because aerial survey work must be accomplished at relatively low altitudes and at altitudes less than 500 feet AGL, an exemption from Section 91.119(c) is needed.

The equivalent level of safety will be achieved given the size, weight, speed, and material with which the UX5 is built. Also, no flight will be taken without the permission of the landowner or those who control the land. Because of the advance notice to the landowner, all affected individuals will be aware of the survey flights. Compared with aerial survey operations conducted with aircraft or rotorcraft weighing far more than 5.5 lbs. and carrying flammable fuel, any risk associated with these operations will be far less than those currently allowed with conventional aircraft operating at or below 500 feet AGL. Indeed, the low-altitude operations of the UAS will maintain separation between these small-UAS operations and the operations of conventional aircraft that must comply with Section 91.119.

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

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

The UX5 batteries provide approximately 50 minutes of powered flight. Without an exemption from 14 C.F.R. §91.151, the UAS's flights would be limited to approximately 20 minutes in length. Given the limitations on its proposed operations and the location of those proposed operations, a longer time frame for flight in daylight VFR conditions is reasonable.

Trimble believes that an exemption from 14 C.F.R. §91.151(a) is safe and within the scope of a prior exemption. See Exemption 10673 [allowing Lockheed Martin Corporation to operate without compliance with 91.151(a)]. Operating the small UAS without 30 minutes of reserve fuel does not engender the type of risks that Section 91.151(a) was meant to prevent given the size and speed at which the UAS operates. The fact that it carries no pilot, passenger, or cargo also enhances its safety. Additionally, limiting UX5 flights to 20 minutes would greatly reduce their utility. In the unlikely event that the UX5 should run out of fuel, it would simply land. Given its weight and construction material, the risks are less than contemplated by the current regulation.

Trimble believes that an equivalent level of safety can be achieved by maintaining 10 minutes of reserve fuel, which, allowing 40 minutes of flight time, would be more than adequate to return the UAS to its planned landing zone from anywhere in its operating area.

Trimble holds an Exemption from this FAR, Exemption No. 10808 for its X-100 UAS and has applied for such an exemption for the UX5 as part of its SAC application. Similar exemptions have been granted to others, including Exemptions 2689F, 5745, and 10673.

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

This regulation provides as follows.

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

The UX5 fully loaded weighs no more than 6 lbs. As such, there is no ability or place to carry certification and registration documents or to display them on the UAS. In addition, there is no pilot on board the aircraft.

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

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

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

Maintenance of the UX5 will be compleated by the owner/operator pursuant to the manuals provided by Trimble. An equivalent level of safety will be achieved because the UAS is small in size, will carry no external payload, will operate only in restricted predetermined areas, and is not a complex mechanical devise. As provided in the attached Maintenance Manual and the Safety Checklist, which were reviewed as part of Trimble's SAC application, the operator of the UX5 will ensure that the UAS is in working order prior to initiating flight, perform required maintenance, and keep a log of any maintenance that is performed. Moreover, the operator is the person most familiar with the aircraft and is best suited to maintain the aircraft in an airworthy condition and to ensure an equivalent level of safety.

The UX5's Maintenance Manual provides for replacement of the airframe every 50 hours of flight. This will ensure an equivalent level of safety to the maintenance requirements in Part 91. In addition, between such air frame replacements, should a mechanical issue arise, the aircraft will either return to its launch site or immediately land.

Public Interest

The requested exemption would permit commercial operation of Trimble's UX5, which weighs 5.5 lbs. and performs precision aerial surveys that consist of still photographs taken by onboard cameras. The UX5 takes a series of high quality, still digital images that are used to produce precision digital point clouds, triangulated models, and contour maps of the surveyed area. Applications for these UAS devices and associated data processing functions include agriculture, mining, and professional surveying. Use of the UX5 for aerial surveys reduces the need to operate conventional aircraft for the same purpose and provides very high quality imagery at a fraction of the cost of surveys using conventional aircraft. These savings result in enhanced efficiency and productivity for the affected activities, as well as environmental benefits.

Equivalent Level of Safety

The applicant respectfully submits that because this small, unmanned aerial vehicle—the UX5—will be used in lieu of comparatively hazardous operations now conducted with fixed wing and rotary conventional aircraft, the FAA can have confidence that the operations will achieve at least an equivalent level or greater level of safety. Approval of this exemption would thereby enhance safety and fulfill the Secretary of Transportation's (the FAA Administrator's)

responsibilities under Section 333(c) of the Reform Act to "establish requirements for the safe operation of such aircraft systems in the national airspace system."

Pilot Information

Richard S. Johnston
FAA Certificate Number: 3374141
Trimble UX5 Aerial Imaging Remote Pilot Certificate Number: 3722467

If you have further questions or need additional information please contact us.

Sincerely yours,

SKELLY and LOY, Inc.

John W. Gunnett P.G.
Chief Operating Officer, President

cc: Rick Johnston
File: ROBESON_JWG.docx