

Exemption No. 11110

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, DC 20591

In the matter of the petition of

TRIMBLE NAVIGATION LTD.

for an exemption from Part 21;
§§ 45.23(b); 61.113(a) and (b);
61.133(a); 91.7(a); 91.9(b)(2);
91.109(a); 91.119; 91.151(a);
91.203(a) and (b); 91.319(a)(1);
91.405(a); 91.407(a)(1);
91.409(a)(2); and 91.417(a) of
Title 14, Code of Federal Regulations

Regulatory Docket No. FAA-2014-0367

GRANT OF EXEMPTION

By letter dated May 30, 2014, Mr. Jonathan B. Hill and Ms. Anne Swanson, of Cooley LLP, Counsel for Trimble Navigation Ltd., 1299 Pennsylvania Avenue, NW, Suite 700, Washington, DC 20004 petitioned the Federal Aviation Administration (FAA) on behalf of Trimble Navigation, Ltd. (Trimble) for an exemption from part 21; §§ 45.23(b), 61.113(a) and (b), 61.133(a), 91.7(a) and (b), 91.9(b)(2), 91.109(a), 91.119, 91.151(a), 91.203(a) and (b), 91.319(a)(1), 91.405(a), 91.407(a)(1), 91.409(a)(2), and 91.417(a) of Title 14, Code of Federal Regulations (14 CFR). The exemption would allow operation of unmanned aircraft systems (UAS) for the purpose of precision aerial surveys.

The petitioner requests relief from the following regulations:

Part 21 prescribes, in pertinent part, the procedural requirements for issuing and changing design approvals, productions approvals, airworthiness certificates, and airworthiness approvals.

Section 45.23(b) prescribes, in pertinent part, that when marks include only the Roman capital letter "N" and the registration number is displayed on limited, restricted or light-sport category aircraft or experimental or provisionally certificated aircraft, the operator must also display on that aircraft near each entrance to the cabin, cockpit, or pilot

station, in letters not less than 2 inches nor more than 6 inches high, the words “limited,” “restricted,” “light-sport,” “experimental,” or “provisional,” as applicable.

Section 61.113(a) and (b) prescribe that—

(a) no person who holds a private pilot certificate may act as a 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.

Section 61.133(a) prescribes, in pertinent part, that a person who holds a commercial pilot certificate may act as pilot in command of an aircraft: (i) Carrying persons or property for compensation or hire, provided the person is qualified in accordance with this part and with the applicable parts of this chapter that apply to the operation; and (ii) For compensation or hire, provided the person is qualified in accordance with this part and with the applicable parts of this chapter that apply to the operation.

Section 91.7(a) prescribes that no person may operate a civil aircraft unless it is in an airworthy condition. Section 91.7(b) prescribes that the pilot in command of a civil aircraft is responsible for determining whether that aircraft is in condition for safe flight. The pilot in command shall discontinue the flight when unairworthy mechanical, electrical, or structural conditions occur.

Section 91.9(b)(2) prohibits operation of U.S.-registered civil aircraft 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.

Section 91.109(a) prescribes, in pertinent part, 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.

Section 91.119 prescribes that, except when necessary for takeoff or landing, no person may operate an aircraft below the following altitudes:

(a) *Anywhere*. An altitude allowing, if a power unit fails, an emergency landing without undue hazard to persons or property on the surface.

- (b) *Over congested areas.* Over any congested area of a city, town, or settlement, or over any open air assembly of persons, an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft.
- (c) *Over other than congested areas.* 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.
- (d) *Helicopters, powered parachutes, and weight-shift-control aircraft.* If the operation is conducted without hazard to persons or property on the surface—
 - (1) A helicopter may be operated at less than the minimums prescribed in paragraph (b) or (c) of this section, provided each person operating the helicopter complies with any routes or altitudes specifically prescribed for helicopters by the FAA; and
 - (2) A powered parachute or weight-shift-control aircraft may be operated at less than the minimums prescribed in paragraph (c) of this section.

Section 91.151(a) prescribes that no person may begin a flight in an airplane under visual flight rules (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* [emphasis added].

Section 91.203(a) prescribes, in pertinent part, that no person operate a civil aircraft unless it has within it (1) an appropriate and current airworthiness certificate; and (2) an effective U.S. registration certificate issued to its owner or, for operation within the United States, the second copy of the Aircraft registration Application as provided for in § 47.31(c).

Section 91.203(b) prescribes, in pertinent part, that no person may operate a civil aircraft unless the airworthiness certificate 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.

Section 91.319(a)(1), Aircraft having experimental certificates: Operating limitations, prescribes in pertinent part that no person may operate an aircraft that has an experimental certificate for other than the purpose for which the certificate was issued.

Section 91.405(a) requires, in pertinent part, that an aircraft operator or owner shall have that aircraft inspected as prescribed in subpart E of the same part and shall, between required inspections, except as provided in paragraph (c) of the same section, have discrepancies repaired as prescribed in part 43 of the chapter.

Section 91.407(a)(1) prohibits, in pertinent part, any person from operating an aircraft that has undergone maintenance, preventive maintenance, rebuilding, or alteration unless it has been approved for return to service by a person authorized under § 43.7 of the same chapter.

Section 91.409(a)(2) prescribes that no person may operate any aircraft unless, within the preceding 12 calendar months, it has had an inspection for the issuance of an airworthiness certificate in accordance with part 21 of this chapter.

Section 91.417(a) prescribes, in pertinent part, that—

- (a) Each registered owner or operator shall keep the following records for the periods specified in paragraph (b) of this section:
 - (1) Records of the maintenance, preventive maintenance, and alteration and records of the 100-hour, annual, progressive, and other required or approved inspections, as appropriate, for each aircraft (including the airframe) and each engine, propeller, rotor, and appliance of an aircraft. The records must include—
 - (i) A description (or reference to data acceptable to the Administrator) of the work performed; and
 - (ii) The date of completion of the work performed; and
 - (iii) The signature, and certificate number of the person approving the aircraft for return to service.
 - (2) Records containing the following information:
 - (i) The total time in service of the airframe, each engine, each propeller, and each rotor.
 - (ii) The current status of life-limited parts of each airframe, engine, propeller, rotor, and appliance.

- (iii) The time since last overhaul of all items installed on the aircraft which are required to be overhauled on a specified time basis.
- (iv) The current inspection status of the aircraft, including the time since the last inspection required by the inspection program under which the aircraft and its appliances are maintained.
- (v) The current status of applicable airworthiness directives (AD) and safety directives including, for each, the method of compliance, the AD or safety directive number and revision date. If the AD or safety directive involves recurring action, the time and date when the next action is required.
- (vi) Copies of the forms prescribed by § 43.9(d) of this chapter for each major alteration to the airframe and currently installed engines, rotors, propellers, and appliances.

The petitioner supports its request with the following information:

The petitioner has provided the following information – contained in its petition and proprietary supporting documentation: 1) Trimble UX5 Safety Checklist, 2) Training Manual, 3) UX5 Maintenance and Inspection Manual, and 4) Trimble UX5 Aerial Imaging Solution User Guide (User Guide), – in support of its exemption request. The petitioner submitted additional information dated September 4, 2014 that included 1) FAA Experimental Airworthiness Certificate for its UX5, and 2) "Permission" issued by the Civil Aviation Authority of the United Kingdom (CAA), which grants Gatewing NV, a wholly-owned subsidiary of Trimble that manufactures the UX5, authority to conduct "Aerial Work" using the UX5.

The FAA has organized the petitioner's information into four sections: 1) the UAS, 2) the UAS Pilot In Command (PIC), 3) the UAS operating parameters and 4) Public Interest.

Unmanned Aircraft System (UAS)

Trimble Navigation Limited developed and proposes to operate the UX5 UAS. The petitioner states that given the size, weight, speed, and limited operating area associated with the aircraft to be utilized by the applicant, an exemption from 14 CFR part 21, Subpart H (Airworthiness Certificates), subject to certain conditions and limitations, is warranted and meets the requirements for an equivalent level of safety under 14 CFR part 11 and Section 333 of P.L. 112-95 (Section 333). The petitioner further states that UAS operated without an airworthiness certificate in the limited environment and under the conditions and limitations proposed by the petitioner will be at least as safe, or safer, than a conventional aircraft (fixed

wing or rotorcraft) operating with an airworthiness certificate issued under 14 CFR part 21, Subpart H and not subject to the proposed conditions and limitations.

The petitioner states that the unmanned aircraft (UA) to be operated under this request is a fixed-wing aircraft, weighs less than 6 pounds fully loaded, flies at a maximum speed of no more than 74.5 knots indicated airspeed (KIAS), and a cruise speed of 49 KIAS, carries neither a pilot nor passenger, carries no flammable fuels, and operates exclusively within a pre-disclosed area. Operations under this exemption will be tightly controlled and monitored by both the operator and local public safety requirements.

In addition, 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 precise global positioning system (GPS) guidance and do not require human intervention. The flight mission area and routing cannot be changed after launch. Flights are not directed by positive manual control by the operator, nor are evasive maneuvers. In the case of unplanned events, the operator inputs pre-programmed evasive maneuvers from the GCS and the UX5 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.

Additional automated safety functions and safety enhancing features of the UX5 include:

- a. Auto-pilot detection of lost GPS or of insufficient satellites initiates an immediate spiral landing;
- b. Low power on the aircraft triggers escalating alarms at GCS at 35% and 10% levels;
- c. If the auto-pilot detects a lost-link to the GCS for longer than 30 seconds, landing procedure begins;
- d. The UX5 is inherently unstable; auto-pilot failure will result in a rapid exit from flight;
- e. The UX5 has an on-board fail safe that limits speed of a dive to no more than 14 m/s;
- f. The UX5 weighs less than 6 pounds and is constructed of EPP foam or similar material which is intended to absorb impact energy; and
- g. The UX5's motor is driven by a pulse width modulated signal, not an analog signal.

Regarding the display of appropriate aircraft markings (14 CFR 45.23), the petitioner states that the UX5 has no entrance to the cabin, cockpit, or pilot station on which the word "experimental" can be placed. Further, given the size of the UA, two-inch lettering would be impossible. The petitioner states that an equivalent level of safety will be achieved by having the UX5 marked on its forward fuselage as required by § 45.23(f) where the pilot, observer and others working with the UA will see the identification of the UAS as "experimental."

The petitioner states that maintenance of the UX5 will be accomplished by the owner/operator in accordance with the UX5 Maintenance & Inspection Manual. The UAS is small in size, carries no external payload, and is not a complex mechanical aeronautical device. The

provided UX5 Maintenance & Inspection Manual, the Safety Checklist, and the UX5 User Guide, serves to ensure the UX5 is in a safe condition for operation. Furthermore, the petitioner states that the UX5 operator has attended a manufacturer's training program, is the most familiar with the UX5, and is best suited to maintain the aircraft in an airworthy condition. Additionally, the UX5 Maintenance & Inspection Manual contains procedures for periodic inspections and replacement intervals for UX5 airframe and component parts, including instructions for the performance of inspections, maintenance and record keeping. In a separate endeavor, Trimble has been issued an FAA Special Airworthiness Certificate in the Experimental Category for the UX5. Lastly, the UX5 has accumulated more than 200 registered test flights and more than 475 registered production flights, amounting to a total of more than 170 flight hours of testing.

UAS Pilot In Command (PIC)

The petitioner asserts that operators of the UX5 should not be required to hold a commercial or private pilot certification. The petitioner notes that unlike a conventional aircraft that carries a pilot, passengers, and cargo, the UX5 is remotely controlled with no passengers or property of others on board. The petitioner proposes that operator requirements should take into account the characteristics of the particular UAS. The petitioner states that the 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 its petition for exemption.

The petitioner states that given the UX5 safety features, it proposes that the operators of the UX5 should be required to (1) have successfully completed FAA private pilot ground instruction and passed the FAA Private Pilot written examination or FAA-recognized equivalents; and (2) have successfully completed the manufacturer's training program for operation of the UAS which has been approved by the FAA through its Special Airworthiness Certificate process.

The petitioner 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 when the mandatory operating conditions specified above were present. The petitioner argues that 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.

Trimble also states that the FAA has the statutory authority to grant exemptions to the requirements for, and privileges associated with, the grant of airmen's certificates and then references 49 USC § 44701 (f).

UAS Operating Parameters

The petitioner states that the UX5 will remain within Visual Line of Sight (VLOS) of the pilot or observer which guarantees a cylinder of operations around the operator of no greater than ½ nautical miles. The petitioner further states that the cylinder walls may be expanded by an observer with the ability to control aircraft. The petitioner notes that the UX5 will be restricted to an altitude of 400 feet above ground level (AGL) and will occur in Class G airspace. The petitioner states that all operations will occur during daylight hours and the FAA will have advance notice of all operations through the filing of notices-to-airmen (NOTAMs). The petitioner asserts that all operations will avoid congested or populated areas, which are depicted in yellow on VFR sectional charts. The petitioner further asserts all operations will be conducted over private or controlled access property. The petitioner notes that it will obtain permission from land owner/controller prior to the beginning of every flight. All operations will occur under Visual Flight Rules Meteorological Conditions (VMC) only. The petitioner asserts that 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 petitioner states that the UX5 construction with energy absorbent material provides at least an equivalent level of safety compared to operations being conducted with conventional aircraft that would be orders-of-magnitude larger and would be carrying passengers, cargo, and flammable fuel.

With respect to the fuel requirements, the petitioner notes that, in order to meet the 30 minute reserve requirements in 14 CFR 91.151, UAS flights would have to be limited to approximately 20 minutes. The petitioner states that limiting UX5 flights to 20 minutes would greatly reduce their utility. The petitioner argues that, given the limitations on the UA's proposed operations and the location of those proposed operations, a longer time frame for flight in daylight VFR conditions is reasonable. The petitioner 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 adequate to return the UAS to its planned landing zone from anywhere in its operating area.

Public Interest:

The petitioner states that approval of the exemption allowing commercial operations of the UX5 for precision survey work will enhance safety by reducing risk and providing environmental benefits and thus is in the public interest. Conventional aerial survey operations, using jet or piston-powered aircraft present risks associated with aircraft that weigh in the neighborhood of 5,000 to 7,000 pounds or more, carry large quantities of fuel, passengers, and, in some cases, cargo. Such aircraft must fly to and from the survey location.

In contrast, a UX5 weighs less than 6 pounds and is powered by batteries eliminating a portion of that risk given the reduced mass and lack of combustible fuel carried on board. Further, the

UX5 is carried to the survey location, not flown there; it will carry no passengers and thus will not expose any individuals to the risks associated with manned aircraft flights. Thus, the petitioner states it is in the public interest to grant this petition.

Discussion of Public Comments:

A summary of the petition was published in the Federal Register on June 30, 2014 (79 FR 36859). The petition received ten comments.

Of the ten comments received, including four from associations, six comments supported the exemption request, and four opposed it. The petition received comments on the following topics: safety, economic impact, UAS, PIC requirements, operational capabilities, airspace, sense and avoid, and lost link.

Comments supporting the exemption request came from individuals and industry groups, including the Association of Unmanned Vehicle Systems International (AUVSI), Aerospace Industries Association (AIA), North Dakota State University, Aims Community College, and the Newmont Mining Corporation. Supporting comments cited the low weight of the UX5 and the increased safety using the UX5 for the proposed operations relative to the same operations conducted by manned aircraft. Comments also cited the safety benefits relative to the petitioner's intent to limit operations to above private and controlled access properties, in daylight VFR conditions, within VLOS, at low altitude, and only after issuing a NOTAM.

Comments also noted the UX5 safety and control design features, the Trimble training program, public interest, and the economic benefits derived from the proposed operations.

Two trade organizations and two individuals submitted letters to the docket expressing various issues and concerns with the Trimble petition for exemption, including the Air Line Pilots Association International (ALPA) and the National Agricultural Aviation Association (NAAA).

Several commenters expressed concerns about the certification requirements for the pilots involved in Trimble's proposed UAS operation. ALPA noted that the proposed operations will be for "compensation or hire," and believes the UX5 pilot must hold at least a current FAA Commercial Pilot Certificate with an appropriate category and class rating for the type of aircraft being flown and a current second-class airman medical certificate. ALPA also noted that this is the requirement for compensation or hire operations in the national airspace system (NAS) today. NAAA also commented on pilot qualification. NAAA stated that the part 61 regulations currently in effect do not address the licensing of pilots of an UA used for commercial purposes and believes it is necessary for the FAA to evaluate pilots of these aircraft on their knowledge and skills in unmanned aerial vehicle operation. NAAA asserted that the operator should hold a pilot certificate and be thoroughly familiar with the limitations

of manned aircraft flight. NAAA further stated that requirements for UAS pilot licensing should be developed along with other rigorous rules and qualifications to ensure safe integration of the UA into the NAS. An anonymous commenter stated that the ability to sense and avoid other aircraft is key to the safe operation of UAS in the NAS and acknowledged the widely approved practice of using a ground-based visual observer (VO) to provide an equivalent level of safety. The commenter further stated that the observer and pilot must be able to visually acquire the small UAS they are responsible for and other incoming aircraft, and asserted that at a minimum, both the pilot and observer should be required to obtain a third-class airman medical certificate for vision requirements, and other basic health requirements.

NAAA stated that the UX5 is designed to operate with pre-programmed GPS guidance and does not require human intervention and according to the application, the aircraft's mission area and routing cannot be changed after launch. NAAA further stated that if an unplanned event occurs, the operator inputs pre-programmed evasive maneuvers into the control unit and asserted that the pilot/operator of the UX5 may become less vigilant and complacent since he or she has no piloting duties to perform during normal flight operations.

The FAA has carefully reviewed the concerns expressed in these comments and the discussion regarding knowledge, training, and medical certification required by holders of both private and commercial pilot certificates. Additional details are available in the ensuing analysis of this issue with regard to 14 CFR part 61.

ALPA commented that Communication and Command (C2) (typically referred to as command and control) link failures are one of the most common failures on UAS and lost link mitigations require safe modes to prevent fly-a-ways or other scenarios, including mitigations such as, auto-land, return-to-home and geo-fencing boundary protection, incorporated into the navigation and control systems for a UA to safely land or re-establish C2. ALPA further stated that the radio frequency spectrum that is commonly accessed for small UAS is unprotected and asserted that mitigations for spectrum interference, weather, terrain and obstacles (man-made or natural) should be developed to ensure safe operations. Also, an individual commenter stated that a System Safety Assessment for the specific failure modes that can result in lost link or failure to recover within a safe area would be needed.

The FAA agrees and carefully examined the proposed operation to ensure that the vehicle design and the petitioner's supporting documentation addressed potential hazards related to C2 failure. The FAA finds that the UAS to be operated by Trimble has sufficient design features to address these hazards. Further detail is contained in the analysis of the UAS below.

NAAA requested that operators of UAS develop ways of making the presence of UAS known to VFR air traffic if they are to be integrated into the NAS and for areas with less UAS activity, recommended a procedure for issuing NOTAMs when they are present. The FAA

agrees and has incorporated this into the conditions and limitations of this exemption. NAAA's notification concerns are addressed by the conditions and limitations that will require an Air Traffic Organization issued Certificate of Waiver or Authorization (COA) to address airspace requirements and notification. Further detail is contained in the analysis of the UAS operating parameters below.

NAAA commented that the UA should have assigned numbers that can be read from a suitable distance to aid in identification when enforcement of flight regulations is required. The FAA partially agrees with NAAA. The UA operated under this exemption will be marked in accordance with 14 CFR part 45 or as otherwise authorized by the FAA. Further detail is contained in the analysis of the UAS below.

NAAA stated that it represents the interests of small business owners and pilots licensed as commercial applicators and ensuring safe low-level airspace includes minimizing obstructions which are difficult to be seen and identified by the pilots. NAAA members operate in low-level airspace, and clear low-level airspace is vital to the safety of these operators. NAAA stated that seeing and avoiding other aircraft and hazardous obstructions is the backbone for agricultural safety, and agricultural pilots depend on pilots of other aircraft to perform their see and avoid functions needed to prevent collisions. NAAA believed that UA operations at low altitudes will increase the potential of collision hazards with agricultural aircraft.

Related to the operation of the UA within VLOS of the pilot and/or observer, NAAA believed that the UA should remain within line of sight of the pilot/operator so that a person can take immediate evasive action if a collision is imminent and asserted that this duty not be delegated to an observer that will be less qualified than the pilot/operator. Also, an anonymous commenter stated that the key to the safe operation of UAS in the NAS is the ability to sense and avoid aircraft. The commenter noted that in lieu of the ability to do this onboard, and in a widely approved practice, a ground-based VO is used to provide an equivalent level of safety. The commenter asserted that paramount to this concept, the observer and pilot must be able to visually acquire not only the small UAS they are responsible for, but also other incoming aircraft.

Regarding 14 CFR 91.113 Right of Way, "See and Avoid" requirements, ALPA also stated that given the absence of an onboard pilot, a means to meet this statutory requirement is necessary. The FAA notes these concerns; additional detail is provided in the analysis of the UAS below.

Regarding the ability to carry out maneuvers to avoid other aircraft, an anonymous commenter stated that the UX5 does not give the operator the ability to maneuver the aircraft in normal operation, and further stated that the operator only has the following options in flight: "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).” The commenter stated that Trimble’s case for safety is in part based on the assumption that an aircraft flying under 400 feet over “non-populated” areas will have less possibility for conflicts with manned aircraft. The commenter asserted that this argument is misleading, given that the proposed areas of flying (farmland) are actually more routinely serviced by manned aircraft at low altitudes, such as aerial crop spraying. The commenter further asserted that this type of “pop-up” target gives observers very little warning time to alert the operator and take corrective action to avoid the incoming aircraft, and that when this happens it is paramount that the operator has a full range of options to divert the aircraft completely as necessary.

The FAA shares these concerns and has incorporated associated conditions and limitations into this exemption, including: a) NOTAMs issued for all UX5 operations, b) operations conducted within VLOS of the PIC and the VO, and c) the UX5 PIC must always yield right-of-way to manned aircraft

The petition received several comments expressing concerns regarding the UX5 operating areas. For example, ALPA stated that the petitioner’s anticipated operations are expected to occur in Class G Airspace below 400 feet above the surface while remaining more than 2.5 nautical miles (NM) either side of all of runway centerline azimuths from all runway thresholds at the airport, and as written it is difficult to understand the actual area that is to be avoided, introducing risk inherent to operating within an Airport Traffic Area. ALPA further asserted that since the petitioner proposes no separation capabilities to mitigate the risk of collision, the proposed operation increases the likelihood of unanticipated safety impacts to an already burdened NAS. ALPA also states that there must be means both to ensure that the UA remains within the defined airspace and to ensure that the hazard of other aircraft intruding on the operation is mitigated.

The FAA has addressed these concerns by adding operating conditions and limitations regarding operations in the proximity of airports (the UA may not operate within 5 nautical miles of the geographic center of an airport as denoted on current FAA-published aeronautical charts unless a letter of agreement with that airport’s management is obtained), stand-off distance from clouds, altitude restrictions, and operating distance from non-participating personnel. Further detail is contained in the analysis of the UAS operating parameters below.

The FAA believes the limitations under which the petitioner will operate (i.e. VLOS and at or below 400 feet AGL) and the UAS emergency procedures as outlined in the petitioner’s supplemental documentation are sufficient mitigations to this risk so that the operations will not adversely affect safety. Further information is contained in the analysis of the UAS below.

The FAA's analysis is as follows:Unmanned Aircraft System (UAS)

The petitioner requested relief from 14 CFR part 21. In accordance with the statutory criteria provided in Section 333 of P.L. 112-95 in reference to 49 USC § 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. Because the Secretary of Transportation has determined that no airworthiness is required the requested relief from 14 CFR part 21, and any associated noise certification and testing, is not necessary.

The FAA has issued an experimental airworthiness certificate for the UX5 under 14 CFR 21.191 following the process in FAA Order 8130.34C for the purposes of research and development, crew training, and market survey. The UX5 aircraft and its operation was subject to a comprehensive safety risk assessment by the FAA, as part of that process, and it was determined that the UAS could be operated safely subject to certain operating limitations to ensure the safety of persons, property, and other aircraft in the NAS. Those operating limitations prescribed as part of the experimental airworthiness certification process that are appropriate and necessary to ensure safety will be included in the exemption conditions and limitations below (including condition and limitation nos. 15 and 16 below).

Manned aircraft conducting aerial surveying operations can weigh 5,000 to 7,000 lbs. or more and are operated by an onboard pilot, in addition to other onboard crewmembers, as necessary. The petitioner's UA will weigh less than 6 lbs. The pilot and crew will be remotely located from the aircraft. The limited weight and construction with impact absorbent materials significantly reduces the potential for harm to persons or damage to property in the event of an incident or accident. The risk to an onboard pilot and crew during an incident or accident is eliminated with the use of a UAS for the aerial surveying operation.

Manned aircraft are at risk of fuel spillage and fire in the event of an incident or accident. The UX5 carries no fuel and therefore the risk of fire following an incident or accident due to fuel spillage is eliminated.

The petitioner's UAS has the capability to operate safely after experiencing certain in-flight contingencies or failures and uses an auto-pilot system to maintain UAS stability and control. The UAS is also able to respond to a loss of GPS or a lost-link event with a pre-coordinated, predictable, automated flight maneuver. These safety features provide an equivalent level of safety compared to a manned aircraft holding a restricted airworthiness certificate performing a similar operation.

Regarding the petitioner's requested relief from 14 CFR 45.23(b) *Display of marks*, the petitioner requests this relief under the assumption that marking with the word "experimental" will be required as a condition of a grant of exemption. However, this marking is reserved for aircraft that are issued experimental certificates under 14 CFR 21.191. The petitioner's UAS will not be certificated under § 21.191, and therefore the "experimental" marking is not required. Since the petitioner's UAS will not be certificated under § 21.191, a grant of exemption for § 45.23(b) is not necessary.

Regarding the petitioner's requested relief from 14 CFR 91.405 (a) *Maintenance required*, § 91.407(a)(1) *Operation after maintenance, preventive maintenance, rebuilding, or alteration*, § 91.409(a)(2) *Inspections*, and § 91.417(a) and (b) *Maintenance records*, the FAA has determined that relief from § 91.409(a)(1) is also necessary because it is an alternate inspection requirement of § 91.409(a)(2). The FAA has carefully evaluated the petitioner's request and determined that cause for granting the exemption is warranted. The FAA notes that the petitioner's Maintenance and Inspection Manual, Safety Checklist, and User Guide contain sufficient information for the preparation and care of UX5 equipment; the petitioner's extensive UX5 flight testing further validates these procedures. The FAA finds that adherence to these documents, as required by the conditions and limitations below, is sufficient to ensure that safety is not adversely affected. In accordance with the petitioner's UAS maintenance, inspection, and recordkeeping requirements, the FAA finds that exemption from 14 CFR 91.405(a), 91.407(a)(1), 91.409(a)(1) and (2), and 91.417(a) and (b) is warranted subject to the conditions and limitations below.

Pilot In Command of the UAS

Regarding the petitioner's requested relief from 14 CFR 61.113(a) and (b) *Private pilot privileges and limitations* and 14 CFR 61.133(a) *Commercial pilot privileges and limitations*, Trimble requested regulatory relief to operate its UAS without an FAA-certificated pilot. In support of its request, Trimble states that "the FAA has the statutory authority to grant exemptions to the requirements for and privileges associated with the grant of airmen's certificates."¹ Although Section 333 provides limited statutory flexibility relative to 49 USC § 44704 for the purposes of airworthiness certification, it does not provide flexibility relative to other sections of Title 49. The FAA does not possess the authority to exempt from the statutory requirement to hold an airman certificate as prescribed in 49 USC § 44711.²

¹ Trimble references 49 USC § 44701(f) in support of this statement which states that "[the] Administrator may grant an exemption from a requirement of a *regulation* prescribed under subsection (a) or (b) of this section or any of sections 44702–44716 of this title if the Administrator finds the exemption is in the public interest." [emphasis added]. .

² 49 USC § 44711 prohibits a person from serving "in any capacity as an airman with respect to a civil aircraft, aircraft engine, propeller, or appliance used, or intended for use, in air commerce...without an airman certificate authorizing the airman to serve in the capacity for which the certificate was issued"

Unlike operations pursuant to public COAs, the FAA is requiring a pilot certificate for UAS operations for two reasons, the first of which is to satisfy the statutory requirements as stated above. The second is because pilots holding a private pilot certificate are subject to the security screening by the Department of Homeland Security that certificated airmen undergo. As previously determined by the Secretary, the requirement to have an airman certificate ameliorates security concerns over civil UAS operations conducted in accordance with Section 333.

Given these grounds, the FAA must determine the appropriate level of pilot certification for Trimble's proposed operation.

Under current regulations, civil operations for compensation or hire require a PIC holding a commercial pilot certificate per 14 CFR part 61. Based on the private pilot limitations in accordance with pertinent parts of 14 CFR 61.113(a) and (b), a pilot holding a private pilot certificate cannot act as a PIC of an aircraft for compensation or hire unless the flight is only incidental to a business or employment. However, in Grant of Exemption No. 11062 to *Astraeus Aerial (Astraeus)* (*see* Docket FAA-2014-0352), the FAA determined that a PIC with a private pilot certificate operating the *Astraeus* UAS would not adversely affect operations in the NAS or present a hazard to persons or property on the ground.

As discussed above, Trimble's petition received two comments registering concern about pilot certification. ALPA stated its opposition to Trimble's proposed operation by a non-certificated pilot without a required medical certificate. ALPA believes that the operation should be conducted by a PIC holding a current FAA commercial pilot certificate with an appropriate category and class rating for the type of aircraft being flown and a current second-class airman medical certificate. NAAA stated that "the operator should hold a pilot certificate and be thoroughly familiar with the limitations of manned aircraft flight."

The FAA has analyzed Trimble's proposed operation and has determined that it does not differ significantly from the situation described in Grant of Exemption No. 11062. Trimble plans to operate in uncontrolled airspace – Class G airspace – over private property with controlled access. Given: 1) the similar nature of Trimble's proposed operating environment to that of *Astraeus*, 2) the parallel nature of private pilot aeronautical knowledge requirements to those of commercial requirements as discussed in Exemption No. 11062, and 3) the limited airmanship skills necessary to operate the UX5, the FAA finds that the additional manned airmanship experience of a commercially certificated pilot would not correlate to the airmanship skills necessary for Trimble's specific proposed operations. The FAA finds that a PIC holding a private pilot certificate and a third-class airman medical certificate, and who has completed Trimble's UX5 training program, can conduct the proposed UX5 operations without adversely affecting the safety of the NAS. Upon consideration of the overall safety case presented by the petitioner and the concerns of the commenters, the FAA finds that granting the requested relief from 14 CFR 61.113(a) and (b), provided the conditions and

limitations outlined below, is warranted. Furthermore, the FAA finds that the requested relief from 14 CFR 61.133(a) is not necessary for Trimble to conduct its operations.

Trimble has also indicated it will supplement its proposed operation(s) with a visual observer (VO). The FAA also received a comment regarding the appropriate level of medical certification for the VO, asserting that the VO's responsibilities necessitate a third-class airman medical certificate. In Grant of Exemption No. 11062, the FAA agreed with the petitioner's proposed use of a VO and required a VO to be used in all UAS operations; however, the FAA considers the PIC's ability to maintain VLOS with the UAS to be of primary significance and thus the medical certification requirement falls on the PIC. In accordance with regulations, a third-class airman medical certificate is the appropriate level of certificate to exercise the privileges of a private pilot certificate. There are no regulatory requirements for visual observer medical certificates. Although a medical certificate is not required for a VO, the UA must never be operated beyond the actual visual capabilities of the VO, and the VO and PIC must have the ability to maintain VLOS with the UA at all times. It is the responsibility of the PIC to be aware of the VO's visual limitations and limit operations of the UA to distances within the visual capabilities of both the PIC and VO. Moreover, the VO will not be operating the aircraft. Therefore, as in Grant of Exemption No. 11062, the FAA does not consider a medical certificate necessary for the VO.

Related to VO duties, Trimble's petition states that, "Aircraft to remain within Visual Line of Sight (VLOS); VLOS guaranteed with a cylinder of operation around operator of ½ nautical miles (NM); and, *cylinder walls may be expanded by observer with ability to control aircraft.*" [Emphasis added.] The petitioner does not describe how control of the UA could be safely passed to the VO to facilitate expansion of the "cylinder walls." Nevertheless, the FAA considers the PIC to be designated for the duration of the flight. Therefore, per the conditions and limitations below, the PIC must be designated before the flight and cannot transfer his or her designation for the duration of the flight.

Operating parameters of the UAS

Regarding the petitioner's requested relief from 14 CFR 91.7(a) *Civil aircraft airworthiness*, Trimble's request is based on its belief that "no standard will exist for airworthiness of the UX5." It claims "an equivalent level of safety will be achieved by insuring compliance with the Trimble manuals prior to each flight." While the UX5 will not require an airworthiness certificate in accordance with 14 CFR part 21, Subpart H, the FAA considers the petitioner's compliance with its manuals, UX5 User Guide, UX5 Maintenance and Inspection Manual, and Training Manual, and the Safety Checklist (hereinafter collectively referred to as the operator's manual) to be sufficient means for determining an airworthy condition. Therefore, relief from § 91.7(a) is granted. The petitioner is still required to ensure that its aircraft is in an airworthy condition – based on compliance with the operator's manuals identified above – prior to every flight, and as stated in condition and limitation number 6.

Additionally, in accordance with 14 CFR 91.7(b), the PIC of the UAS is responsible for determining whether the aircraft is in a condition for safe flight. Although the petitioner seeks relief from § 91.7(b), as in grant of Exemption No. 11062 to Astraeus, the FAA finds that the PIC is responsible for determining whether the aircraft is in condition for safe flight. Therefore, relief from § 91.7(b) is not warranted.

Regarding the petitioner's requested relief from 14 CFR 91.9(b)(2) *Civil aircraft flight manual, marking, and placard requirements* and 14 CFR 91.203(a) and (b) *Civil aircraft: Certifications required*, the FAA has previously determined that relief from these sections is not necessary. Relevant materials may be kept in a location accessible to the PIC in compliance with the regulations.

Regarding the petitioner's requested relief from 14 CFR 91.109(a) *Flight instruction; Simulated instrument flight and certain flight tests* and 91.319(a)(1) *Aircraft having experimental certificates: Operating limitations*, the petitioner did not describe training scenarios in which a dual set of controls would be utilized or required, i.e. dual flight instruction, provided by a flight instructor or other company-designated individual, that would require that individual to have fully functioning dual controls. Rather, Trimble intends to accomplish training through the procedures referenced in the operator's manual. Furthermore, the FAA is requiring that PIC's of the UX5 possess at least a private pilot's certificate. This exemption will require that training operations only be conducted during dedicated training sessions. The FAA finds an equivalent level of safety will be achieved by the manufacturer providing the training as outlined in the operator's manual. As such, the FAA finds that the petitioner can conduct its operations without the requested relief from § 91.109. With regard to § 91.319(a)(1), aircraft operating under this grant of exemption will not possess an experimental airworthiness certificate. Therefore, relief from § 91.319(a)(1) is not required.

Regarding the petitioner's requested relief from 14 CFR 91.119 *Minimum safe altitudes*, the petitioner specifies that relief from § 91.119(c) is necessary because "aerial survey work must be accomplished at relatively low altitudes and at altitudes less than 500 feet AGL." Section 91.119(c) states that no person may operate an aircraft below the following altitudes; *over other than congested areas*, 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. Trimble states that it will operate pursuant to the following, self-imposed, restrictions related to § 91.119:

- All operations will avoid congested or populated areas, which are depicted in yellow on VFR charts.
- All operations will be conducted over private or controlled access property.
- Permission from land owner/controller will be obtained prior to the beginning of every flight.
- Operator will file a NOTAM for each flight.

Relative to Trimble's proposal to "avoid" congested or populated areas, which are depicted in "yellow" on VFR charts; the FAA acknowledges that avoidance of these areas is a practicable step in assuring that operations are not conducted over congested or densely populated areas. However, using these "yellow" areas only, to make this determination, is not sufficient. The FAA has stated that there is no precise definition of a "congested area" and official U.S. Government aeronautical charts and NOTAMs provide general guidance for developing a proposed route that complies with § 91.119. Furthermore, aeronautical charts would not be expected to reflect all required local information. Pilots may obtain such information in a briefing from the local Flight Standards District Office (FSDO). This information along with the pilot's prior knowledge of the area and information the pilot obtains from other sources may require an adjustment to the planned flight path before or during flight. Ultimately, it is the pilot's responsibility to maintain the minimum safe altitudes required by § 91.119. *See* Legal Interpretation to Melvin O. Cintron, from Rebecca B. MacPherson (Aug. 28, 2012).

Therefore, operations within "yellow" areas as shown on World Aeronautical Charts (WAC), Sectional Aeronautical Charts (Sectionals), or Terminal Area Charts (TAC) are prohibited as proposed by Trimble. In addition, operations over congested or densely populated areas other than those depicted in "yellow" are also prohibited as stated in the conditions and limitations below.

Flight operations will be required to be conducted at least 500 feet from all nonparticipating persons, vessels, vehicles, and structures. However, the FAA finds that the UA may be operated at distances less than 500 feet from unoccupied vessels, vehicles or structures owned by the land owner/controller when the land owner/controller grants such permission and the PIC makes a safety assessment of the risk of operating closer to those objects. With regard to operations near persons, operations closer than 500 feet from the UAS PIC or VO are permitted when operationally necessary. However at no time can operations be conducted so close to present an undue hazard to the PIC or VO, per § 91.119 (a).

The FAA finds that relief from § 91.119(c) is warranted provided adherence to the procedures in the operator's manual and the FAA's additional conditions and limitations outlined below. Relief from § 91.119(a) is unwarranted as the FAA expects the petitioner to be able to perform an emergency landing without undue hazard to persons or property on the surface. Relief from §§ 91.119(b) and 91.119(d) are not applicable.

Regarding the petitioner's requested relief from § 91.151(a) *Fuel requirements for flight in VFR conditions*, prior relief has been granted for manned aircraft to operate at less than the prescribed minimums, including Exemption Nos. 2689, 5745, and 10650. In addition, similar UAS-specific relief has been granted in Exemption Nos. 8811, 10808, and 10673 for daytime, VFR conditions. The UAS provides battery power remaining in percent and battery time remaining in minutes and seconds to the PIC. The UX5 batteries provide approximately 50

minutes of powered flight. The FAA agrees with Trimble's proposal to limit UX5 flights to not more than 40 minutes, maintaining 10 minutes of reserve power which is adequate to return the UAS to its planned landing zone from anywhere in its operating area. In the event that the UX5 should run out of power, it would simply land within the access controlled operating area. Given the limitations on its proposed operations and the location of those proposed operations, a reduced minimum power reserve for flight in daylight VFR conditions is reasonable. These factors provide the FAA with sufficient reason to grant the relief from 14 CFR 91.151(a) as requested in accordance with the conditions and limitations below, that prohibit the PIC from beginning a UX5 flight unless (considering wind and forecast weather conditions) there is enough power to fly to the first point of intended landing and, assuming normal cruising speed, to fly after that for at least 10 minutes.

Regarding basic VFR weather minimums, Trimble proposes to operate exclusively within Class G airspace, which normally requires that no person operate an aircraft when the flight visibility is less than one statute mile and operations must remain clear of clouds (14 CFR 91.155). The FAA is requiring, through the conditions and limitations below, that 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. The FAA is imposing these stricter requirements on Trimble's operations to both keep the UA from departing VLOS and to preclude the UA from operating so close to a cloud as to create a hazard to other aircraft operating in the NAS. These requirements, combined with the PIC's ability to initiate a return to a preplanned position, are sufficient mitigations to ensure the safety of the NAS is not adversely affected.

Additionally, in evaluating the petitioner's proposed operating parameters with regard to VLOS and a safe operating perimeter, the FAA considered operations from a moving device or vehicle. Since the petitioner did not discuss provisions for these circumstances, the conditions and limitations below preclude operations from moving devices or vehicles.

Regarding an Air Traffic Organization (ATO) issued Certificate of Waiver or Authorization (COA), the majority of current UAS operations occurring in the NAS are being coordinated through Air Traffic Control (ATC) by the issuance of a COA. This is an existing process that not only makes local ATC facilities aware of UAS operations, but also provides ATC the ability to consider airspace issues that are unique to UAS operations. The COA will require the operator to request a NOTAM, which is the mechanism for alerting other users of the NAS to the UAS activities being conducted. Therefore, the FAA believes that adherence to this process is the safest and most expeditious way to permit Trimble to conduct its proposed UAS operations. The conditions and limitations below prescribe the requirement for Trimble to obtain an ATO-issued COA.

Public Interest

The FAA finds that a grant of exemption is in the public interest. The enhanced safety achieved using a 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. The FAA also finds that UAS provide an additional tool for the agricultural, mining, and professional surveying industries, adding a greater degree of flexibility, which supplements the current capabilities offered by manned aircraft.

The table below summarizes the FAA's determinations regarding the relief sought by the petitioner:

<u>Relief sought by petitioner (14 CFR)</u>	<u>FAA determination (14 CFR)</u>
Part 21	Relief not necessary
45.23(b)	Relief not necessary
61.113(a) and (b)	Relief granted with conditions and limitations
61.133(a)	Relief not necessary
91.7(a) and (b)	Relief granted from 91.7(a), with conditions and limitations 91.7(b), relief not necessary
91.9(b) (2)	Relief not necessary
91.109(a)	Relief not necessary
91.119	Relief granted from paragraph (c) with conditions and limitations
91.151(a)	Relief granted from 91.151 (a) (1), day, with conditions and limitations 91.151 (a) (2), night, not applicable
91.203(a) and (b)	Relief not necessary
91.319(a)(1)	Not applicable
91.405(a)	Relief granted with conditions and limitations
91.407(a)(1)	Relief granted with conditions and limitations
91.409(a)(2)	Relief granted with conditions and limitations; relief from 91.409(a)(1) also granted with conditions and limitations
91.417(a)	Relief granted with conditions and limitations; relief from 91.417 (b) also granted with conditions and limitations

The FAA's 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 USC 106 (f), 40113, and 44701, delegated

to me by the Administrator, Trimble Navigation, Ltd. is granted an exemption from 14 CFR 61.113(a) and (b); 91.7(a); 91.119 (c); 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 Trimble to operate the UX5 UAS for the special purpose of precision aerial surveys that consist of still photographs taken by an onboard camera. This exemption is subject to the conditions and limitations listed below.

Conditions and Limitations

Relative to this grant of exemption, Trimble is hereafter referred to as the operator.

The Trimble UX5 Safety Checklist (Petition Exhibit 1), the Training Manual (Petition Exhibit 2), the UX5 Maintenance and Inspection Manual (Petition Exhibit 3), and the UX5 User Guide (Petition Exhibit 4), are hereafter collectively referred to as the operator's manual.

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 following aircraft described in the operator's manual which is a fixed-wing aircraft weighing less than 6 pounds: Trimble Navigation Limited UX5 UAS. Proposed operations of any other aircraft will require a new petition or a petition to amend this grant.
- 2) The UA may not be flown at an indicated airspeed exceeding 74.5 knots.
- 3) The UA must be operated at an altitude of no more than 400 feet above ground level (AGL), as indicated by the procedures specified in the operator's manual. All altitudes reported to ATC must be in feet AGL.
- 4) 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.
- 5) All operations must utilize a visual observer (VO). 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. 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 functions prescribed in the operator's manual.
- 6) Provided the additional requirements identified in these conditions and limitations are added or amended, the operator's manual is considered acceptable to the FAA. The

operator's manual and this grant of exemption must be maintained 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 operator's manual, the conditions and limitations herein take precedence and must be followed. Otherwise, the operator must follow the procedures as outlined in its operator's manual.

The operator may update or revise its operator's manual. It is the operator's responsibility to track such revisions and present updated and revised documents to the Administrator upon request. The operator must also present updated and revised documents if it petitions for an extension or amendment of this 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 amendment to its exemption. The FAA's UAS Integration Office (AFS-80) may be contacted if questions arise regarding updates or revisions to the operator's manual.

- 7) Prior to each flight the PIC must inspect the UAS to ensure it is in a condition for safe flight. 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. The Ground Control Station must be included in the preflight inspection. All maintenance and alterations must be properly documented in the aircraft records.
- 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 in accordance with the operator's manual. The PIC who conducts the functional test flight must make an entry in the UAS aircraft records of the flight. The requirements and procedures for a functional test flight and aircraft record entry must be added to the operator's manual.
- 9) The preflight inspection section in the operator's manual must be amended to include the following requirement: The preflight inspection must account for all discrepancies, i.e. inoperable components, items, or equipment, not covered in the relevant preflight inspection sections of the operator's manual.
- 10) The operator must follow the manufacturer's UAS aircraft/component, maintenance, overhaul, replacement, inspection, and life limit requirements, with particular attention to flight critical components that may not be addressed in the manufacturer's manuals.
- 11) Trimble must carry out its maintenance, inspections, and record keeping requirements in accordance with the operator's manual. Maintenance, inspection, and alterations must be noted in the aircraft logbook, including total flight hours, description of work

accomplished, and the signature of the authorized UX5 technician returning the UX5 to service.

- 12) UX5 technicians must receive and document training referenced in the operator's manual.
- 13) Each UAS operated under this exemption must comply with all manufacturer System and Safety Bulletins.
- 14) Trimble UX5 maintenance personnel must make a record entry in the UAS logbook or equivalent document of the corrective action taken against discrepancies discovered between inspections.
- 15) The PIC must possess at least a private pilot certificate and a third-class airman medical certificate. 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.
- 16) Prior to operating for hire, the PIC must have completed Trimble's five-day UX5 Training Syllabus as outlined in the Safety Checklist. The Training Manual must also be updated to reflect the specific five day Training Syllabus presented by Trimble. The Training Manual specifies the minimum flight and skill requirements for the Remote Pilot, Instructor Pilot and Examiner. Those Manuals and records of those requirements must be documented and made available upon request by the Administrator. Those minimum flight requirements are repeated here as conditions and limitations:

Remote pilot [PIC]

- Minimum 2 flights on the UX5 as a remote pilot during the Type Rating module
- Minimum 2 flights on the UX5 as visual observer during the Type Rating module
- When failed: Minimum 4 flights on the UX5 for the failed part

Instructor pilot

- A minimum of 25 flights and 4 hours where:
 - The flights occurred on 4 different calendar days.
 - Two long endurance flights that last near the maximum permissible endurance (40 min for operations conducted under this exemption) or have a minimum duration of 45 min for

previously logged flights or flights not conducted under this exemption (per the Trimble operation's manual).

- One flight with a minimum measured wind speed of 30 kph (18.64 mph). If the wind speed cannot be measured, you can provide proof from METAR as close as 25km from the weather station.
- One flight with a minimum programmed leg distance of 1 km (if possible by CAA regulations, otherwise as long as possible.)
- 11 flights with a different selected height where:
 - 2 flights are at the minimum height
 - 2 flights are at the maximum allowable height

Examiner

- 100 flights and 20 hours (regardless of aircraft type) or as approved by a team of examiners.

Prior documented flight experience that was obtained in compliance with applicable regulations may satisfy this requirement. Training, proficiency, and experience-building flights can also be conducted under this grant of exemption to accomplish the required flights and flight time.

- 17) 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 and land or be recovered in accordance with the operator's manual.
- 18) The PIC must abort the flight in the event of unpredicted obstacles or emergencies in accordance with the operator's manual.
- 19) The PIC is prohibited from beginning a UX5 flight unless (considering wind and forecast weather conditions) there is enough power to fly to the first point of intended landing and, assuming normal cruising speed, to fly after that for at least 10 minutes.
- 20) The operator must obtain an Air Traffic Organization (ATO) issued Certificate of Waiver or Authorization (COA) prior to conducting any operations under this grant of exemption. This COA will also require the operator to request a Notice to Airman (NOTAM) not more than 72 hours in advance, but not less than 48 hours prior to the operation.

- 21) 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.
- 22) Before conducting operations, the radio frequency spectrum used for operation and control of the UA must comply with the Federal Communications Commission (FCC) or other appropriate government oversight agency requirements.
- 23) The 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 yield the right of way to all other manned operations and activities at all times (including, but not limited to, ultralight vehicles, parachute activities, parasailing activities, hang gliders, etc.).
- 25) The UAS may not be operated by the PIC from any moving device or vehicle.
- 26) UAS operations may not be conducted during night, as defined in 14 CFR 1.1.
- 27) All operations shall be conducted in Class G airspace.
- 28) All operations must be conducted under visual meteorological conditions (VMC). 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.
- 29) During operations in Class G airspace, the UA may not operate within 5 nautical miles of the geographic center of an airport as denoted on a current FAA-published aeronautical chart unless a letter of agreement with that airport's management is obtained, and the operation is conducted in accordance with a NOTAM as required by the operator's COA. The letter of agreement with the airport management must be made available to the Administrator upon request.
- 30) The UA may not be operated over congested or densely populated areas. These areas include but are not limited to the yellow areas depicted on World Aeronautical Charts (WAC), Sectional Aeronautical Charts (Sectionals), or Terminal Area Charts (TAC). However, aeronautical charts may not reflect pertinent local information. Ultimately, it is the PIC's responsibility to maintain the minimum safe altitudes required by § 91.119.

- 31) Operation of the UA must be conducted at least 500 feet from all nonparticipating persons, vessels, vehicles, and structures.
- 32) Operations of the UA may be conducted at distances less than 500 feet from participating persons, vessels, vehicles or structures that perform an essential function in connection with these special purpose operations. Operations closer than 500 feet from the PIC, VO, operator trainees and essential persons, are permitted when operationally necessary; but never so close as to present an undue hazard, per § 91.119(a).
- 33) Operations of the UA may be conducted at distances less than 500 feet from unoccupied vessels, vehicles or structures owned by the land owner/controller when the land owner/controller grants such permission and the PIC makes a safety assessment of the risk from operations closer to these objects.
- 34) All operations shall be conducted over private or controlled-access property with permission from the land owner/controller or authorized representative. Permission from land owner/controller or authorized representative will be obtained for each flight to be conducted.
- 35) Any incident, accident, or flight operation that transgresses the lateral or vertical boundaries of the operational area as defined by the applicable COA must be reported to the FAA's UAS Integration Office (AFS-80) within 24 hours. Accidents must be reported to the National Transportation Safety Board (NTSB) per instructions contained on the NTSB Web site: www.nts.gov.

Unless otherwise specified in this grant of exemption, the unmanned aircraft system (UAS), pilot in command (PIC), and operator must comply with all applicable parts of 14 CFR including, but not limited to, parts 45, 47, 61, and 91.

This exemption terminates on December 31, 2016, unless sooner superseded or rescinded.

Issued in Washington, DC, on December 10, 2014.

/s/

John S. Duncan
Director, Flight Standards Service