

Exemption No. 11171

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

In the matter of the petition of

**ASYMMETRIC TECHNOLOGIES,
LLC**

for an exemption from Part 21,
Subpart H, Part 27, §§ 45.23(b),
45.27(a), 61.113(a) and (b), 91.7(a),
91.9 (b)(2); 91.9(c); 91.103; 91.109(a);
91.119; 91.121; 91.151(a);
91.203(a)and(b); 91.405(a)(1);
91.407(a)(1); 91.409(a)(1); and
91.417(a) and (b) of Title 14, Code of
Federal Regulations

Regulatory Docket No. FAA-2014-0816

GRANT OF EXEMPTION

By letter dated October 6, 2014, Mr. Stuart C. Sparker, Esq., General Counsel for Asymmetric Technologies, LLC, 1395 Grandview Ave, Suite #3, Columbus, OH 43212 petitioned the Federal Aviation Administration (FAA) for an exemption from Part 21, Subpart H, Part 27, §§ 45.23(b); 45.27(a); 61.113(a) and (b); 91.7(a); 91.9(b)(2) and (c); 91.103; 91.109(a); 91.119; 91.121; 91.151(a); 91.203(a) and (b); 91.405(a)(1); 91.407(a)(1); 91.409(a)(1); and 91.417(a) and (b) of Title 14, Code of Federal Regulations (14 CFR). The exemption would allow operation of unmanned aircraft systems (UAS) for the purpose of infrastructure (bridge) inspections.

The petitioner requests relief from the following regulations:

Part 21, Subpart H which prescribes procedural requirements for the issuance of airworthiness certificates.

Part 27 which prescribes airworthiness standards for the issue of type certificates, and changes to those certificates, for normal category rotorcraft with maximum weights of 7,000 pounds or less and nine or less passenger seats.

Section 45.23(b) prescribes requirements for required markings on limited, restricted or light sport category aircraft or experimental or provisionally certificated aircraft.

Section 45.27(a) prescribes the required location for placing marks on rotorcraft.

Section 61.113(a) and (b) prescribes privileges and limitations for private pilots when acting as pilot in command.

Section 91.7(a) prescribes that no person may operate a civil aircraft unless it is in an airworthy condition.

Section 91.9(b)(2) prescribes that no person may operate 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 91.9(c) prescribes that no person may operate a U.S.-registered civil aircraft unless that aircraft is identified in accordance with part 45 of the chapter.

Section 91.103 prescribes that each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight.

Section 91.109(a) prescribes that any civil aircraft operated for the purpose of flight instruction must have fully functioning dual controls.

Section 91.119 prescribes the minimum safe altitudes for operation of aircraft.

Section 91.121 prescribes altimeter setting requirements for any person operating an aircraft.

Section 91.151(a) prescribes fuel requirements for flight in VFR conditions.

Section 91.203(a) prohibits any person from operating 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 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 91.405(a)(1) requires 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) prescribes that no person may operate any 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 this chapter.

Section 91.409(a)(1) prescribes that no person may operate an 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.

Section 91.417(a) and (b) prescribes 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 that 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) 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 petition and the following supporting documentation are hereinafter referred to as the operating documents:

- 1) Asymmetric Technologies Flight Operations Manual, v2.6, 9/30/2014
- 2) Microdrones md4-1000 Operators Handbook, Revision 2013-01-21

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

Unmanned Aircraft System (UAS)

The petitioner has proposed to use the following UAS to conduct infrastructure inspections:

- Microdrones md4-1000, manufactured by Microdrones

The Microdrones md4-1000 is a battery powered quadcopter weighing less than 8.5 pounds, including payload. It has a maximum speed of 27 mph and a maximum flight operating endurance of 88 minutes. The md4-1000 uses global positioning system (GPS) for navigation and has a system to notify the pilot of potential future operational problems.

The aircraft is operated using a remote ground control station and is capable of setting pre-programmed distance and height limits. In the event of a lost link, GPS failure or low battery condition, the aircraft can be programmed to descend and land or return to home.

The petitioner also requests relief from maintenance and inspection requirements under §§ 91.405(a)(1), 91.407(a)(1), 91.409(a)(1) and 91.417(a) and (b). The petitioner states that an exemption should be granted under these sections because its UAS does not possess an airworthiness certificate. However, the petitioner has indicated it will employ a maintenance

and quality assurance program in accordance with the manufacturer's requirements, which meets or exceeds applicable regulatory standards for U.S. registered aircraft. Aircraft maintenance will be logged. Maintenance records will be made available upon request and kept with the control station equipment during all operations. Detailed operational checklists were provided in the operating documents.

UAS Pilot In Command (PIC)

The petitioner states that it will utilize commercial or private pilots with considerable experience in multiple unmanned systems. These pilots will be flight current for both manned and unmanned aircraft and will hold at least a current Class III FAA medical certificate. Further, the petitioner indicates that the PICs will possess a minimum of 25 hours and 250 cycles in UAS in addition to at least 10 hours in the particular make and model.

The petitioner notes that for all flight operations a PIC will be designated and this person will be directly responsible for the operation of the UAS and the safety of the operation. It will be the responsibility of the PIC to ensure the operation complies with all applicable regulations and/or ensures professional "best practice" to all applicable regulations.

In addition, for each operation a visual observer (VO) and team leader will be assigned. The VO will be responsible for the Ground Control Station (GCS) assembly, disassembly and pre and post flight procedures. During flight, the visual observer will visually maintain contact with the unmanned aircraft (UA) and scan the area for undetected aircraft and/or obstacles. The observer will also be responsible for all aviation related communications. The team leader will have overall responsibility for the mission.

UAS Operating Parameters

The petitioner states that all flights will remain within visual line of sight (VLOS) of the pilot or observer. The petitioner further states that if the UAS loses communications or GPS signal, the UAS is equipped with advanced safety features that will allow the attempt to re-establish contact with the GCS (hover in place), and after 3 minutes the UAS will automatically return to a pre-determined location. The petitioner notes that the UAS will operate at or below 400 feet above ground in remote, sterile areas. The petitioner further notes that it will launch and recover the UA from the area below the bridge. The petitioner states that all flights will take place with optimal weather conditions and only under visual flight rules. No flights will occur from sunset to sunrise.

The petitioner will use the small UAS to visually inspect the support structure of the bridge and the roadway. Because the structure supporting the roadway is below the roadway, in the rare occurrence that a malfunction occurs to the small UAS, the small UAS would fall to the canyon floor rather than onto a roadway. Moreover, the structure of the bridge and the space between the members of the bridge allow the pilot and observer to maintain line of sight on the sUAS for the duration of the flight. Thus, the risk to the public is greatly reduced because

the PIC will be able to avoid any obstacles and other aircraft in real time. Flights will not last any longer than 45 minutes.

Public Interest:

The petitioner states that, performing infrastructure inspections with unmanned systems is a benefit to the public for the following reasons: 1) the operation significantly improves safety and reduces risk by alleviating human exposure to the dangers associated with aerial survey and inspection; 2) it will not be necessary to close a lane on the bridge while the inspection is being conducted; this significantly improves traffic flow and safety; 3) the UAS being operated are very small and contain no flammable fuel and in the remote event of an accident, will cause no damage or injuries; and 4) given that the cost to conduct an inspection using a UAS is considerably less than available alternatives, this important task can be accomplished which will benefit everyone utilizing this infrastructure..

Discussion of Public Comments:

A summary of the petition was published in the Federal Register on November 13, 2014 (79 FR 67534). The petition received two comments with one supporting the proposed operation and one against.

In support of the petition, the Small UAV Coalition (Coalition) stated the petitioner has proposed to abide by stronger safety measures than hobby and modeler groups operating similar aircraft. The Coalition stated that it does not believe that heightened safety measures should be required for the petitioner simply because of the commercial nature of its operations. The Coalition urged the FAA to adopt an evaluation framework for UAS operations under section 333 of Pub. L. 112-95 that weighs the relative safety issues and risks of UAS by class and operational circumstances, rather than adopting artificial distinctions among unmanned aerial vehicles based on commercial and noncommercial operations. The Coalition suggested FAA safety regulations be proportionate to the risks posed by the particular proposed UAS operations by distinguishing between UAS. The petitioner's UAS pose considerably less safety risk than larger UAS used for defense and aerospace purposes. The Coalition asserted that because UAS operations like the petitioner's pose minimal risk to safety, they should be subject to minimal and appropriate regulations.

The Coalition noted the FAA is to consider the seven factors¹ in section 333 as a minimum. The Coalition stated the petition shows the FAA should consider factors other than those specified in section 333, such as the remote location and altitude of its small UAS. The Coalition maintained that the petitioner's proposed operations satisfy the seven factors in

¹ Section 333(b) of P.L. 112-95 states, in part: "In making the determination under subsection (a), the Secretary shall determine, at a minimum-- (1) which types of unmanned aircraft systems, if any, as a result of their size, weight, speed, operational capability, proximity to airports and populated areas, and operation within visual line of sight do not create a hazard to users of the national airspace system or the public or pose a threat to national security; ..."

section 333 and include several additional mitigating factors to ensure the safety and security of the proposed UAS operations. The Coalition emphasized the FAA must evaluate each factor within the context of the petitioner's proposed UAS operations.

The Coalition also commented that the FAA should grant relief from the requirement to hold an airman's certificate, but stated that at a minimum the FAA should provide an exception from part 61 and approve training and testing regiments that pertain to UAS commercial operations pertinent to the aircraft and operation proposed. The Coalition also asserted that Congress intended the section 333 national security criterion to focus on the operation rather than on the pilot and that shifting that focus imposes an unnecessary burden.

In response, as discussed in the grant of exemption to Trimble Navigation Ltd. (Exemption No. 11110), neither section 333 nor the FAA's authority to exempt from its regulations found in 49 USC § 44701(f), authorizes the FAA to provide exemption to the statutory requirement to hold an airman certificate as prescribed in 49 USC § 44711. The FAA notes that under this exemption the petitioner proposed to use pilots holding private certificates and it will be able to use the training program it proposed. Finally, the FAA does not agree that relying on the pilot certificate for a national security finding poses an unnecessary burden because pilots under this exemption, and the exemptions granted previously to section 333 requests, are already required to hold a pilot certificate to satisfy 49 USC § 44711.

The Coalition commented that a VO should not be required for all small UAS operation. The Coalition further asserted that the presence of one or more VOs may allow the UAS to be operated beyond VLOS of the PIC and that the petitioner's proposal to operate the UA within VLOS of the PIC *and/or* VO should be permitted. The FAA notes that one of the determinations for operations under section 333 is operation within visual line of sight. As the PIC is determined to be in command of the UA, he must maintain VLOS while operating the UA. The FAA also notes that a VO complements the PICs capability to see and avoid other aircraft, including when the PIC may be momentarily attending to other flying tasks (e.g., maneuvering the aircraft close to actors and actresses and other objects on a film set). The VO provides an additional level of operational safety.

The National Agricultural Aviation Association (NAAA) states it represents the interests of small business owners and pilots licensed as commercial applicators. NAAA explains that its members operate in low-level airspace, and clear low-level airspace is vital to the safety of these operators.

NAAA states 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 believes UA operations at low altitudes will increase the potential of collision hazards with agricultural aircraft. NAAA argues that until adequate see-and-avoid technology is developed, the FAA should require UAS operators to post a Notice to Airmen (NOTAM) 48 to 72 hours before

operations. NAAA proposes UAS aircraft be painted a highly visible color, be equipped with strobe lights, and use Automatic Dependent Surveillance–Broadcast (ADS–B) or other similar location reporting technology. To address these concerns the FAA has incorporated associated conditions and limitations into this exemption, including: a) NOTAMs issued for all operations, b) operations conducted within VLOS of the PIC and the VO, and c) the UAS PIC must always yield right-of- way to manned aircraft.

NAAA also proposes a number of operating limitations and requirements for UAS operators. NAAA states UAS operators should have procedures to immediately ground the UAS if another low-flying aircraft is within 2 miles; be attentive and free from distractions; comply with all applicable regulations, policies, and procedures; be equipped with aviation radios set to a locally defined frequency; have a separate VO with a second-class medical certificate and perform duties for only one UAS at a time; maintain line-of-sight operations; and be well-versed in the UAS operator document. NAAA further states UAS should be properly maintained, have a registered N-Number on an indestructible and unmovable plate, and be required to have an airworthiness certificate and liability insurance. These comments are addressed in the FAA’s analysis and conditions and limitations.

The FAA's analysis is as follows:

Unmanned aircraft system (UAS)

In accordance with the statutory criteria provided in section 333 of Public Law 112–95 in reference to section 44704 of Title 49, United States Code (49 U.S.C.), 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 relief from 14 CFR part 21, part 27, and any associated noise certification and testing requirements of part 36, is not necessary.

Bridge inspection is hazardous and presents unique difficulties for persons conducting inspections and maintenance of this infrastructure. The inspections are typically conducted by personnel who physically inspect the bridge structure. Helicopters may also be used for bridge and similar infrastructure inspections. The petitioner plans to utilize a UAS to inspect the structure, which reduces the need for inspectors to physically access and view the structure. Manned helicopters assisting in inspections can weigh 6,000 lbs. or more and are operated by an onboard pilot, in addition to other onboard crewmembers, as necessary. Although the petitioner stated that the UAS weighs less than 15 pounds the UA manufacturer’s flight operations manual provided with the petition indicates the UA’s maximum weight, including payload, is 8.5 pounds. Therefore, operations conducted under this exemption must conform to the UA’s maximum weight specified in the flight operations manual. The pilot and crew will be remotely located from the aircraft. The limited weight reduces the potential for harm to participating and nonparticipating individuals or 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 UA for the inspection operation. In addition,

utilizing UAS to conduct bridge inspections will reduce the need for inspection personnel to perform this hazardous activity as well as traffic hazards related to blocking lanes on the roadway.

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

This exemption does not require an electronic means to monitor and communicate with other aircraft, such as transponders or sense and avoid technology. Rather the FAA is mitigating the risk of these operations by placing limits on altitude, requiring enhanced stand-off distance from clouds, permitting daytime operations only, and requiring that the UA be operated within VLOS and yield right of way to all manned operations. Additionally, the operator will be required to request a NOTAM prior to operations to alert other users of the NAS.

The petitioner's UA has the capability to operate safely after experiencing certain in-flight failures. The UA is also able to respond to a lost-link event with a pre-coordinated, predictable, automated flight maneuver. The PIC has the ability to terminate the flight operation or initiate the automated return to home procedure outlined within the operating documents. These safety features provide an equivalent level of safety compared to a manned aircraft 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.

The petitioner has also requested relief from 14 CFR § 45.27(a), *Location of marks*. Given that an exemption from § 45.23(b) is not necessary, an exemption from § 45.27(a) is also not necessary. Markings must be as large as practicable per § 45.29(f).

The petitioner's operating documents reflect all maintenance of the UAS will be conducted as specifically required by the Original Equipment Manufacturer (OEM) and that all maintenance will be documented in the maintenance logs, which must be in possession of the operator at all times. The operating documents further state that only qualified OEM maintainers will perform higher level inspections and maintenance per OEM standards. The operating documents indicate that the petitioner will implement a maintenance and quality assurance program.

The petitioner requests relief from 14 CFR §§ 91.405 (a)(1) *Maintenance required*, 91.407(a)(1) *Operation after maintenance, preventive maintenance, rebuilding, or alteration*, 91.409(a)(1) *Inspections*, and 91.417(a) and (b) *Maintenance records*. The FAA has evaluated the petitioner's request and determined that cause for exemption to these requirements is warranted. The FAA notes that the petitioner's operating documents contain preflight and post flight checks for the UAS. The FAA has also determined that relief from § 91.409(a)(2) is also necessary because the aircraft will not require an airworthiness certificate and thus an inspection for this purpose is not necessary. The FAA finds that adherence to the operating documents, as required by the conditions and limitations below, is sufficient to ensure that safety is not adversely affected.

UAS Pilot In Command (PIC)

The petitioner states the aircraft will be operated in the field with a minimum of a private pilot PIC, a ground-based VO, and a team leader in accordance with its operating documents.

Regarding the petitioner's requested relief from 14 CFR § 61.113 *Private pilot privileges and limitations*, the FAA must consider the appropriate level of pilot certification for the petitioner's proposed operations. The petitioner states it would operate its UAS with a private pilot holding a third-class airmen medical certificate. 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)*, 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. Additionally, as previously determined by the Secretary of Transportation, the requirement to have an airman certificate ameliorates security concerns over civil UAS operations conducted in accordance with Section 333.

The FAA has analyzed the petitioner's proposed operation and determined it does not differ significantly from the situation described in Grant of Exemption No. 11062 (*Astraeus*). Given: 1) the similar nature of the petitioner's proposed operating environment to that of *Astraeus*, 2) the parallel nature of private pilot aeronautical knowledge requirements to those of commercial requirements, and 3) the airmanship skills necessary to operate the UAS, the FAA finds that the additional manned airmanship experience of a commercially certificated pilot would not correlate to the airmanship skills necessary for the petitioner's proposed operations. Therefore, the FAA finds that a PIC holding a private pilot certificate and a third-class airman medical certificate is appropriate for the proposed operations. As proposed by the petitioner, the FAA also finds that the PIC may also hold a commercial pilot certificate. In accordance with 14 CFR § 61.23(a)(2), PICs exercising commercial certificate privileges must hold a second-class airman medical certificate.

With regard to the airmanship skills necessary to operate the UAS, in accordance with the petitioner's operating documents, the PIC will be current in both airplanes or helicopters and UAS. Each PIC will have a minimum of 200 flight cycles and 25 hours in UAS. Each PIC will also have at least 10 hours experience in the particular UAS to be operated under this exemption.

Additionally, the conditions and limitations below stipulate that the petitioner may not permit any PIC to operate unless that PIC has demonstrated through petitioner's training and currency requirements that the PIC is able 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 people, vessels, vehicles and structures.

The petitioner has also indicated all flights will be operated within VLOS of the PIC and/or VO. The VO must complete the training prescribed in the petitioners operating documents. The conditions and limitations below stipulate that the PIC must ensure that the VO can perform the functions prescribed in the operating documents. Additionally, as discussed in Exemption No. 11109 to Clayco, Inc., 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 both 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 to Astraeus, the FAA does not consider a medical certificate necessary for the VO.

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.

UAS Operating Parameters

The petitioner has requested relief from 14 CFR § 91.7(a) *Civil aircraft airworthiness*, and the FAA finds that relief from § 91.7(a) is necessary. While the petitioner's UAS will not require an airworthiness certificate in accordance with 14 CFR part 21, Subpart H, the FAA considers the petitioner's compliance with its operating documents to be a sufficient means for determining an airworthy condition. The petitioner is still required to ensure that its aircraft is in an airworthy condition – based on compliance with the operating documents prior to every flight, and as stated in the conditions and limitations below.

In accordance with 14 CFR § 91.7(b) *Civil Aircraft Airworthiness*, the PIC of the UAS is responsible for determining whether the aircraft is in a condition for safe flight. Although the petitioner did not seek relief from § 91.7(b) in its petition, the FAA, as in grant of Exemption No. 11062 to Astraeus, has determined that the operating documents include procedures to be

used prior to each flight that can ensure compliance with § 91.7(b). The petitioner is required to ensure that its aircraft is in a condition for safe flight – based on compliance with the operating documents– prior to every flight.

Regarding the petitioner’s requested relief from 14 CFR § 91.9 *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 in Grant of Exemption 11062, *Astraeus*, 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 § 91.103 *Preflight Action*, although there will be no approved Airplane or Rotorcraft Flight Manual as specified in paragraph (b)(1), the FAA believes the petitioner can comply with the other applicable requirements in § 91.103(b)(2). The procedures outlined in the petitioner’s operating documents address the FAA’s concerns regarding compliance with § 91.103(b). The PIC will take all actions including reviewing weather, flight battery requirements, landings, and takeoff distances and aircraft performance data before initiation of flight. The FAA has imposed stricter requirements with regard to visibility and distance from clouds; this is to both keep the UA from departing the VLOS and to preclude the UA from operating in the NAS. The FAA also notes the risks associated with sun glare; the FAA believes the that PIC’s and VO’s ability to still see other air traffic, combined with the PIC’s ability to initiate a return-to-home sequence, are sufficient mitigations in this respect. The PIC will also account for all relevant site-specific conditions in their preflight procedures. Therefore, the FAA finds that exemption for 14 CFR § 91.103 is not necessary.

Regarding the petitioner’s requested relief from 14 CFR § 91.109(a) *Flight instruction; Simulated instrument flight and certain flight tests*, 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, the petitioner intends to accomplish training as referenced in the operating documents. Furthermore, the FAA is requiring that the petitioner’s PICs possess at least a private pilot’s certificate. Also, this exemption will require that training operations only be conducted during dedicated training sessions. The FAA finds that safety will not be adversely impacted if the petitioner follows the training outlined in the operating documents. As such, the FAA finds that the petitioner can conduct its operations without the requested relief from § 91.109.

The petitioner seeks relief from 14 CFR § 91.119, *Minimum safe altitudes*, and states that it will operate pursuant to the following, self-imposed, restrictions the FAA has determined are related to § 91.119:

- The UA will remain below 400 feet above ground level (AGL) at all times;
- The UA will be launched, operated and recovered from the canyon floor below the bridge;

- The supporting structure to be inspected is all below the roadway, therefore the UA will remain below the roadway at all times;
- A NOTAM will be issued 48 hours prior to the operation describing the location and times of the operation;
- The PIC and VO will have excellent visibility over the sterile operating area;and
- Securing approvals prior to launch and recovery from state and local governments, VO, and PIC.

Regarding the petitioner's requested relief from 14 CFR § 91.119, the petitioner did not specify the paragraph(s) in 14 CFR § 91.119 from which it requires relief. Relief from § 91.119(a), which requires operating at an altitude that allows a safe emergency landing if a power unit fails, is not granted. The FAA expects the petitioner to be able to perform an emergency landing without undue hazard to persons or property on the surface if a power unit fails. Relief from 14 CFR § 91.119(b), operation over congested areas, is not granted because the petitioner did not provide sufficient information necessary for the FAA to determine whether the operation poses an adverse impact to safety were it to operate over congested areas.

The petitioner proposes to conduct all operations below the roadway, thus maintaining separation from nonparticipating persons and vehicles located on the bridge surface. With regard to nonparticipants, the petitioner did not provide an explanation for exposing those persons to increased risk than what is provided for in the rule. Therefore, the FAA is requiring that prior to conducting UAS specific operations, all persons not essential to flight operations (nonparticipants) must remain at appropriate distances. In open areas this requires the UA to remain 500 feet from all persons other than essential flight personnel (i.e. the PIC, VO, and other essential personnel as defined in the operating documents). The FAA has also considered that the UA in this case will weigh 8.5 pounds or less. If barriers or structures are present that can sufficiently protect nonparticipating persons, vehicles, vessels operating above or below the bridge, from debris in the event of an accident, then the UA may operate closer than 500 feet to persons afforded such protection. At no time shall the UA be operated in any way that could create a hazard to these persons, vehicles, and vessels. The operator must ensure that nonparticipating persons, vehicles, and vessels remain under such protection. If a situation arises where nonparticipating persons, vehicles, and vessels are no longer protected by any such barriers or structures and are within 500 feet of the UA, flight operations must cease immediately. When considering how to immediately cease operations, the primary concern is the safety of those nonparticipating persons, vehicles, and vessels. In addition, the FAA finds that operations may be conducted closer than 500 feet to structures, such as the bridge itself, when the property owner/controller grants such permission and the PIC makes a safety assessment of the risk of operating closer to those objects. Whenever the UA is operated at altitudes above the bridge roadway level, the PIC must comply with all the requirements of § 91.119(c).

Thus, the FAA finds that relief from § 91.119(c) is necessary because all operations will be conducted below 400 feet AGL and may be operated closer than 500 feet from persons, vessels, vehicles, and structures as described above. Provided adherence to the procedures

in the operating documents and the additional conditions and limitations outlined below, the FAA finds that relief from § 91.119(c) is warranted. Because of the conditions and limitations below, relief from § 91.119(d) is not applicable.

Regarding the petitioner's requested relief from 14 CFR § 91.121 *Altimeter Settings*, the UAS uses a GPS altitude indicator rather than a barometric altimeter. As stated in the conditions and limitations below, the FAA requires any altitude reported to Air Traffic Control (ATC) to be in feet AGL. The petitioner may choose to set the GPS altitude indicator to zero feet AGL rather than local barometric pressure or field altitude before flight. Considering the limited altitude of the proposed operations, relief from 14 CFR § 91.121 is granted to the extent necessary to comply with the applicable conditions and limitations stated below.

The petitioner 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 by Exemption Nos. 8811, 10808, and 10673 for daytime, Visual Flight Rules (VFR) conditions. The UA batteries provide up to 88 minutes of powered flight (with payload) and provide battery level remaining to the PIC. In the event that the UAS should run low on power, the PIC will be alerted and can land the UAS immediately. The operating documents indicate that flights are limited to 45 minutes or until battery power reserve falls to 25% prior to the 45 minute limit. These operational limitations provide the FAA with sufficient reason to grant the relief from § 91.151(a) in accordance with the conditions and limitations below.

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.

As stated Section II of the petition, the scope of the petitioner's proposed operation is the conduct of bridge inspections using UAS. Although the petition describes a broader scope of potential infrastructure operations, the petitioner did not provide information, descriptions, or data in support of these use cases. Therefore the FAA's analysis was limited to use of UAS for the inspection of bridges and the conditions and limitations below restrict the UAS operation to this purpose only.

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 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. The conditions and limitations below prescribe the requirement for the petitioner 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 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, Subpart H	Relief not necessary
Part 27	Relief not necessary
45.23(b)	Relief not necessary
45.27(a)	Relief not necessary
61.113 (a) and (b)	Relief granted with conditions and limitations
91.7(a)	Relief granted with conditions and limitations
91.9(b)(2)	Relief not necessary
91.9(c)	Relief not necessary
91.103	Relief not necessary
91.109(a)	Relief not necessary
91.119	Paragraphs (a) and (b) relief are not granted; paragraph (c) granted with conditions and limitations; paragraph (d) relief is not warranted
91.121	Relief granted with conditions and limitations
91.151(a)	91.151(a)(1), day, granted with conditions and limitations
91.203(a) and (b)	Relief not necessary

91.405(a)(1)	Relief granted with conditions and limitations
91.407(a)(1)	Relief granted with conditions and limitations
91.409 (a)(1) and (2)	Relief granted with conditions and limitations
91.417(a) and (b)	Relief 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 U.S.C. §§ 106(f), 40113, and 44701, delegated to me by the Administrator, Asymmetric Technologies, LLC is granted an exemption from 14 CFR §§ 61.113(a) and (b), 91.7(a), 91.119(c), 91.121; 91.151(a), 91.405(a)(1); 91.407(a)(1); 91.409(a)(1) and (2); and 91.417(a) and (b) to the extent necessary to allow Asymmetric Technologies, LLC to operate unmanned aircraft systems for the purpose of infrastructure inspections. This exemption is subject to the conditions and limitations listed below.

Conditions and Limitations

Relative to this grant of exemption, Asymmetric Technologies, LLC is hereafter referred to as the operator.

The petition and the following supporting documentation are hereinafter referred to as the operating documents:

- 1) Asymmetric Technologies Flight Operations Manual, v2.6, 9/30/2014
- 2) Microdrones md4-1000 Operators Handbook, Revision 2013-01-21

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 operating documents which has four rotors and four motors in a quadcopter configuration and weighing less than 8.5 pounds: Microdrones md4-1000, manufactured by Microdrones. Proposed operations of any other aircraft will require a new petition or a petition to amend this grant.
2. UAS operations under this exemption are limited to the inspection of bridge infrastructure.
3. The UA may not be flown at a ground speed exceeding 27 mph.

4. The UAS 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.
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 medical certificate.
6. All operations must utilize a visual observer (VO) and within VLOS of the VO at all times. This requires the VO to be able to use human vision unaided by any device other than corrective lenses. 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 functions prescribed in the operating documents.
7. The VO must not perform any other duties beyond assisting the PIC with seeing and avoiding other air traffic and other ground based obstacles/obstructions and is not permitted to operate the camera or other instruments.
8. The operating documents and this grant of exemption 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 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 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.
9. 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.
10. 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. The PIC who conducts the functional test flight must make an entry of the flight in the UAS aircraft records.

11. The pre-flight inspection must account for all potential discrepancies, e.g. inoperable components, items, or equipment, not already covered in the relevant sections of the operating documents.
12. The operator must follow the UAS manufacturer's aircraft/component, maintenance, overhaul, replacement, inspection, and life limit requirements.
13. The operator must carry out its maintenance, inspections, and record keeping requirements, in accordance with the operating documents. Maintenance, inspection, alterations, and status of replacement/overhaul component parts must be noted in the aircraft records, including total time in service, description of work accomplished, and the signature of the authorized person returning the UAS to service.
14. Each UAS operated under this exemption must comply with all manufacturer Safety Bulletins.
15. The authorized person must make an entry in the aircraft record of the corrective action taken against discrepancies discovered between inspections.
16. The PIC must possess at least a private pilot certificate and at least a current third- class medical certificate. In accordance with 14 CFR 61.23, a pilot holding a commercial certificate must possess at least a second-class 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.
17. Prior to operations conducted for the purpose of bridge infrastructure inspection, the PIC must have completed the operator's training as prescribed in the operating documents. During that training, the PIC must have accumulated and logged, in a manner consistent with 14 CFR § 61.51(b), the minimum hours prescribe in the operating documents as UAS pilot operating the make and model of the UAS to be utilized for operations under the exemption. Training, proficiency, and experience-building flights can be conducted under this grant of exemption to qualify the operator's PIC(s), VO(s) and other essential personnel as defined in the operating documents. However, said training operations may only be conducted during dedicated training sessions. During training, proficiency, and experience-building flights the PIC is required to operate the UA with appropriate distances in accordance with 14 CFR § 91.119.
18. Prior to operations conducted for the purpose of bridge infrastructure inspection, the PIC must have completed the operator's currency requirements as prescribed in the operating documents. The PIC must have completed at least three take-offs and three landings in the preceding 90 days as UAS pilot operating the make and model of the UAS to be

utilized for operations under the exemption to maintain currency. Take-off and landing currency flights can be conducted under this grant of exemption. When establishing or regaining currency, said currency flights may only be conducted during dedicated training/currency sessions. During training, proficiency, experience-building flights, and dedicated currency flights the PIC is required to operate the UA with appropriate distances in accordance with 14 CFR § 91.119.

19. Prior to operations conducted for the purpose of bridge infrastructure inspection, the PIC, VO, and other essential personnel as defined in the operating documents, must have met all qualification, training, and currency requirements, as outlined in the operating documents. A record of completion of these requirements must be documented and made available to the Administrator upon request.
20. The operator may not permit the PIC to operate the UAS for the purpose of bridge infrastructure inspection unless the PIC has demonstrated and logged in a manner consistent with 14 CFR § 61.51(b), 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 people, vessels, vehicles, and structures.
21. 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.
22. The UA may not operate within 5 nautical miles of the airport reference point as denoted on a current FAA-published aeronautical chart.
23. 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.
24. If the UAS loses communications or loses its GPS signal, the UA must return to a pre-determined location within the planned operating area and land or be recovered in accordance with the operating documents.
25. The PIC must abort the flight in the event of unpredicted obstacles or emergencies in accordance with the operating documents.
26. The PIC is prohibited from beginning a flight unless (considering wind and forecast weather conditions) there is enough power to fly at normal cruising speed to the intended landing point and land the UA with 25% battery power remaining.
27. 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. All operations shall be conducted in accordance with airspace requirements in the ATO issued COA including class of airspace, altitude level and potential transponder requirements.

28. 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.
29. 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.
30. 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 UAS is operating. These documents must be made available to the Administrator or any law enforcement official upon request.
31. The UA must remain clear and yield the right of way to all manned operations and activities at all times.
32. The UAS may not be operated by the PIC from any moving device or vehicle.
33. The UA may not be operated over congested or densely populated areas.
34. 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 are no longer under such protection and are within 500 feet of the UA, flight operations must cease immediately, and/or;
 - b. The aircraft is operated near vessels, vehicles or structures where the owner/controller of such vessels, vehicles, or structures has granted permission 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, and;
 - c. Operations nearer to the PIC, VO, Sensor Operator, other essential personnel as defined in the operating documents, do not present an undue hazard to those persons per § 91.119(a).

35. All operations shall be conducted with permission from the state or local government agency, organization, or owner, with authority for operating the bridge under inspection. Permission from the authority will be obtained for each flight to be conducted.
36. 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 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 February 28, 2017, unless sooner superseded or rescinded.

Issued in Washington, DC, on February 10, 2015.

/s/

John Barbagallo
Acting Deputy Director, Flight Standards Service