Exemption No. 11062

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

In the matter of the petition of **ASTRAEUS AERIAL** for an exemption from part 21; §§ 45.23(b); 61.113(a) and (b); 91.7(a); 91.9(b)(2); 91.103; 91.109; 91.119; 91.121; 91.151(a); 91.203(a) and (b); 91.405(a); 91.407(a)(1); 91.409(a)(2); and 91.417(a) and (b) of Title 14, Code of Federal Regulations	**Regulatory Docket No. FAA-2014-0352**

GRANT OF EXEMPTION

By letter dated May 27, 2014, Jonathan B. Hill, Cooley LLC, Counsel for Astraeus Aerial, and John McGraw, Aerospace Consulting, LLC, Agent for Astraeus Aerial, 1299 Pennsylvania Avenue, NW., Suite 700, Washington, DC 20004 petitioned the Federal Aviation Administration (FAA) on behalf of Astraeus Aerial (Astraeus) for an exemption from part 21, §§ 45.23(b), 61.113(a) and (b), 91.7(a), 91.9(b)(2), 91.103, 91.109, 91.119, 91.121, 91.151(a), 91.203(a) and (b), 91.405(a), 91.407(a)(1), 91.409(a)(2), and 91.417(a) and (b) of Title 14, Code of Federal Regulations (14 CFR). The proposed exemption, if granted, would allow operation of unmanned aircraft systems (UAS) for the purpose of scripted, closed-set filming for the motion picture and television industry.

The petitioner requests relief from the following regulations:

> Part 21 prescribes, in pertinent part, the procedural requirements for issuing and changing design approvals, production 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) prescribes 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 91.7(a) prescribes, in pertinent part, that no person may operate a civil aircraft unless it is in an airworthy condition.

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 91.103 prescribes, in pertinent part, that each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight, to include—

(a) For a flight under IFR or a flight not in the vicinity of an airport, weather reports and forecasts, fuel requirements, alternatives available if the planned flight cannot be completed, and any known traffic delays of which the pilot in command has been advised by ATC;

(b) For any flight, runway lengths at airports of intended use, and the following takeoff and landing distance information:

(1) For civil aircraft for which an approved Airplane or Rotorcraft Flight Manual containing takeoff and landing distance data is required, the takeoff and landing distance data contained therein; and

(2) For civil aircraft other than those specified in paragraph (b)(1) of this section, other reliable information appropriate to the aircraft, relating to aircraft performance under expected values of airport elevation and runway slope, aircraft gross weight, and wind and temperature.

Section 91.109 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 91.121 requires, in pertinent part, each person operating an aircraft to maintain cruising altitude by reference to an altimeter that is set "to the elevation of the departure airport or an appropriate altimeter setting available before departure."

Section 91.151(a) prescribes that no person may begin a flight in an airplane under VFR conditions unless (considering wind and forecast weather conditions) there is enough fuel to fly to the first point of intended landing and, assuming normal cruising speed, (1) during the day, to fly after that for at least 30 minutes; or (2) At night, to fly after that for at least 45 minutes. [emphasis added]

Section 91.203(a) prohibits, in pertinent part, 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, 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 91.405(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, in pertinent part, 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 of this chapter.

Section 91.417(a) and (b) 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.

(b) The owner or operator shall retain the following records for the periods prescribed:

(1) The records specified in paragraph (a)(1) of this section shall be retained until the work is repeated or superseded by other work or for 1 year after the work is performed.

(2) The records specified in paragraph (a)(2) of this section shall be retained and transferred with the aircraft at the time the aircraft is sold.

(3) A list of defects furnished to a registered owner or operator under § 43.11 of this chapter shall be retained until the defects are repaired and the aircraft is approved for return to service.

The petitioner supports its request with the following information:

The petitioner has provided the following information – contained in its petition and supplemental proprietary Flight Operations and Procedures Manual (hereafter FOPM) and Motion Picture and Television Operations Manual (hereafter MPTOM) – in support of its exemption request. The petitioner submitted additional information in response to the FAA's August 7, 2014 request which is posted to the docket. The FAA has organized the petitioner's information into three sections: 1) the unmanned aircraft system, 2) the UAS Pilot In Command (PIC), and 3) the UAS operating parameters.

Unmanned Aircraft System

The UAS proposed by the petitioner is a proprietary design, conceived and constructed by Astraeus Aerial, and referred to as the Astraeus Aerial Cinema System V.3CS UAS aircraft variant, serial #001 onward (hereafter referred to as V.3). This aircraft has eight rotors and eight motors in a quadcopter configuration (X8). 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 the FAA Modernization and Reform Act of 2012 (PL 112-95). The petitioner further states that UAS operated without an airworthiness certificate in the restricted 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 less than 55 lbs. fully loaded, flies at a speed of no more than 50 knots, carries neither a pilot nor passenger, carries no explosive materials or flammable liquid fuels, and operates exclusively within a secured area as set out in the MPTOM. In addition, the petitioner has integrated safety features into the design of the UAS, as described in the petitioner's FOPM, to ensure the safety of persons and property within and surrounding the limited operating area. The petitioner further describes that, in the event the UAS loses communications or its GPS signal, the UA will have the capability to return to a pre-determined location within the Security Perimeter and land. It will also have the capability to abort a flight in the event of unpredicted obstacles or emergencies.

The petitioner states that even though its UAS will have no airworthiness certificate, an exemption may be needed from 14 CFR § 45.23 as the UA will have no entrance to the cabin, cockpit, or pilot station on which the word "experimental" can be placed. Given the size of the UA, the petitioner notes that the two-inch lettering will be impossible. The petitioner asserts that an equivalent level of safety will be provided by having the UA marked with the word "experimental" on the fuselage in compliance with 14 CFR § 45.29(f), in a location where the pilot, observer, and others working with the UA will see the identification.

The petitioner states that the maintenance requirements in the pertinent sections of 14 CFR part 91 are only applicable to aircraft with an airworthiness certificate in accordance with part 43. The petitioner states that its V.3 UAS does not have specific maintenance instructions; therefore the petitioner has developed and documented in its MPTOM and FOPM an "on-condition" maintenance process for the V.3 UAS affected by this exemption. The petitioner has also stated that it intends to follow any manufacturers' recommended instructions and procedures when those procedures exist for certain components of its V.3 UAS.

UAS Pilot In Command (PIC)

The petitioner asserts that since the UA will not carry a pilot or passengers on board, the proposed operations will not adversely affect safety by requiring the PIC operating the aircraft to have a private pilot's license rather than a commercial pilot's license. In support of its position, the petitioner argues that, since there are no standards for either private or commercial UAS pilot certificates, knowledge of airspace regulations and dexterity in the control and operation of the UAS acquired from actual operation of the aircraft will be the most important factors in establishing an equivalent level of safety. Furthermore, the petitioner explains that, given the restricted and controlled airspace within which operations will take place, the key factors needed by the PIC are knowledge of the airspace within which the "closed-set filming" operation will take place and how that airspace fits into the National Airspace System (NAS). The petitioner also states that it cannot be assumed that a commercial pilot, approved to operate a helicopter or fixed wing aircraft, has the skill or ability to safely operate an unmanned aerial vehicle, operating at 400 feet AGL or lower, within strictly controlled pre-approved airspace. The petitioner asserts that there are relatively few certificated pilots who are also qualified to fly the type of UAS utilized in motion picture industry image-capture operations. Astraeus further asserts that there are even fewer commercially certificated pilots that can fly these UAS, to the point that to do both is considered rare.

Additionally, the petitioner states that the aircraft will be operated within a secure environment, which no one will be allowed to enter unless they are part of the production, have been fully briefed of the risks prior to operation of the UAS, and have consented to the risks associated with being in the operating area. Should there be a mishap, the UA being flown pose significantly less of a threat than the helicopters and fixed wing aircraft now being employed because they are a fraction of the size, carry no flammable fuel, and do not carry crew or passengers. This is in stark contrast to conventional aircraft that are flown to the site, carry flammable fuel, carry passengers and crew, and operate in a much larger area.

UAS Operating Parameters

The petitioner states that all flights will be operated within visual line of sight (VLOS) of a pilot and/or observer, and that the UA flights will be limited to a maximum altitude of 400 feet AGL. The petitioner further states that an operator will ensure that only consenting production personnel will be allowed within 100 feet of the UA operation, but this radius may be reduced to 30 feet based upon an equivalent level of safety determination, as stated in their MPTOM, with the advance permission of the local Flight Standards District Office (FSDO). The petitioner asserts that an equivalent level of safety can be achieved given the size, weight,

and speed of the UAS, as well as the location where it is operated. The petitioner states that the UAS will be operated within a safe operating perimeter, the boundaries of which will be determined by production personnel and the UAS PIC based on the site-specific filming activities and speed of the UAS required for the operation, and coordinated with the jurisdictional FAA FSDO and local government officials as applicable, as outlined in the MPTOM and FOPM. The petitioner states that only participating and consenting production personnel will be allowed within this perimeter; the petitioner also states their intention to comply with the guidelines outlined in Order 8900.1 V3, C8, S1 with regard to nonparticipating personnel outside the safety perimeter. The petitioner argues that, compared to flight operations with aircraft or rotorcraft weighing far more than its maximum 55 lb. UA, and the lack of flammable fuel, any risk associated with its UAS operations is far less than those with conventional aircraft operating at or below 500 feet AGL in the movie industry.

With respect to preflight actions, the petitioner notes it may need an exemption from 14 CFR § 91.103, because it will not have approved rotorcraft flight manuals. The petitioner asserts that an equivalent level of safety will be achieved by the PIC taking all preflight actions as set forth in their MPTOM and FOPM, including reviewing weather, flight battery requirements, landing and takeoff distances, and aircraft performance data before initiation of flight. Additionally, the petitioner states that a briefing will be conducted prior to each day's filming regarding planned UAS operations, and all personnel who will be performing duties within the boundaries of the safety perimeter will be required to attend.

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 10 minutes. The petitioner argues that, given the limitations on the UA's proposed flight area and the location of its proposed operations within a predetermined area, a longer time frame for flight in daylight or night VFR conditions is reasonable. The petitioner believes that an equivalent level of safety can be achieved by limiting flights to 30 minutes or 25% of battery power, whichever occurs first.

The petitioner notes that it may need an exemption from 14 CFR § 91.121, as its UAS may have a GPS altitude read out instead of a barometric altimeter. The petitioner asserts that an equivalent level of safety will be achieved, as outlined in its MPTOM. Specifically, the altitude information will be provided to the UAS PIC via a digitally encoded telemetric data feed. Prior to each flight, a zero altitude initiation point will be established and confirmed for accuracy by the PIC.

Public Interest

The petitioner states that, given the small size of the UA involved and the restricted sterile environment within which it will operate, its proposed operation "falls squarely within that zone of safety (an equivalent level of safety) in which Congress envisioned that the FAA must, by exemption, allow commercial operations of UAS to commence immediately." Also due to the size of the UA and the restricted areas in which the UAS will operate, approval of the application presents no national security issue. The petitioner states that, given the clear direction in Section 333, the strong equivalent level of safety surrounding the proposed operations, and the significant public benefit, including enhanced safety, reduction in

environmental impacts, and including reduced emissions associated with allowing UAS for movie and television operations, granting the requested exemptions is in the public interest.

Discussion of Public Comments:

A summary of the petition was published in the Federal Register on June 26, 2014 (79 FR 36378). Eighty-six comments were received.

Of the 86 comments received, including eight from associations, 50 comments supported the exemption request, 22 opposed, and 14 were neutral. The petition received comments on the following topics: economic impact, UAS, PIC, operational capabilities, airspace, privacy, sense and avoid, and data 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), the National Association of Realtors, the News Media Coalition, and the National Press Photographers Association. Supporting comments cited the petitioner's intent to use controlled access airspace, licensed airmen, and preflight safety briefings, as well as the economic benefits of UAS.

Several trade organizations submitted letters to the docket, expressing various issues and concerns with the Astraeus petition for exemption, including the Air Line Pilots Association International (ALPA), the National Agricultural Aviation Association (NAAA), and the United States Hang Gliding and Paragliding Association (USHPA).

ALPA expressed concern regarding certain conditions outlined in Astraeus' petition. ALPA notes that the proposed operations will be for "compensation or hire," and ALPA believes that the 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 as well as specific and adequate training on the UAS make and model intended to be used. Similarly, a current 2nd Class FAA Medical certificate should be required for a UAS pilot operating an aircraft for compensation or hire commercial operations as is required in the NAS today. NAAA and USHPA also commented on pilot qualification. Specifically,

> NAAA believes that the Part 61 regulations currently in effect do not address the licensing of pilots of an unmanned aircraft used for commercial purposes. We believe it is necessary for the FAA to evaluate pilots of these aircraft on their knowledge and skills in UAV operations. Requirements for this licensing should be developed along with other rigorous rules and qualifications to ensure safe integration of the unmanned aircraft into the NAS.

The FAA has carefully reviewed the knowledge and training required by holders of both private and commercial certificates, as well as the separation of Astraeus' proposed operations from other manned operations. Additional details are available in the ensuing analysis of this issue with regards to 14 CFR § 61.113.

ALPA commented that although the anticipated operation is expected to occur below 400 feet above the surface, the petition also makes reference to operations 200 feet above structures of unspecified and therefore unlimited height. This would put the aircraft at the same altitude

strata as other aircraft in the NAS, with only geographic separation to mitigate the risk of collision. However, in subsequent materials posted to the docket, Astraeus has removed operation from elevated platforms. All operations will be limited to 400 feet AGL, which is specified in the conditions and limitations below.

ALPA further notes that the aircraft "may not have a barometric altimeter" so the ability to accurately maintain altitude must be addressed. NAAA noted the same in its comments. The FAA agrees with ALPA and NAAA and addresses this concern in its analysis of the exemption from 14 CFR § 91.121, finding that the alternative means of compliance proposed by Astraeus does not adversely affect safety.

ALPA and an individual comment that Command and Control (C2) link failures are one of the most common failures on a UAS, and that lost link mitigations should require safe modes to prevent fly-aways or other scenarios. The FAA agrees and carefully examined the proposed operation to ensure that the vehicle design and the petitioner's MPTOM and FOPM addressed potential hazards related to C2 failure. The FAA finds that the UAS to be operated by Astraeus has sufficient design features to address these hazards. The FAA also finds that the MPTOM and FOPM have incorporated safety procedures to be followed by all operational participants should a C2 failure occur. 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. 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 believes that UA operations at low altitudes will increase the potential of collision hazards with agricultural aircraft. In its comments, the USHPA submitted similar concerns relative to activities of other low altitude user groups including ballooning, skydiving, powered ultralights, etc.

NAAA acknowledged Astraeus' plan to submit a written Plan of Activities to the FSDO three days before the proposed operations, as required by the petitioner's MPTOM. However, NAAA maintains, as does the USHPA, that in addition to this, issuance of a NOTAM advising nonparticipating pilots of the planned activity is vital to disseminating this safety information. The FAA agrees and has incorporated this into the conditions and limitations of this exemption. Further detail is contained in the analysis of the operating parameters below.

NAAA commented that 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 USHPA commented similarly, noting that while the current identification standards are not feasible on small UA given their reduced size, identification appropriate for these design parameters could be defined and created without undue burden or negative impacts on UAS operations. The FAA partially agrees with NAAA and USHPA. 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.

USHPA states that it is a nonprofit member organization with the specific and primary purpose to engage exclusively for scientific and educational purposes in the development, study, and use of fuel-less flight systems and aircraft capable of being launched by human power alone. USHPA commented that it believes with proper notification of time and place, along with other considerations, safety can be maintained. USHPA's notification concerns will be 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.

Related to the operation of the UA within visual line of sight (VLOS) of the pilot and/or observer, USHPA believes operation of any UA in three-dimensional space presents unique challenges in accurately determining position in relation to stationary or mobile objects. USHPA comments that utilization of an observer for operational redundancy is prudent and encouraged, but should not be considered a viable replacement for the pilot in command. USHPA believes that the identification of navigational requirements and accurately conveying them to the pilot in command would not be provided with adequate precision or sufficient response time in a crisis situation and recommends that dual control systems be utilized as a redundant safety measure common in commercial aviation environments. The FAA notes USHPA's concerns; additional detail is provided in the analysis of the UAS below.

USHPA also asserts that manned flight should always maintain right of way over all UA operations. The FAA agrees and has incorporated this into the conditions and limitations of this exemption.

Several comments noted that small UAS can be hard to see during the day, due to their small size and factors such as sun glare. Commenters also noted concerns with regard to weather and wind conditions affecting operations. The FAA addressed these concerns by adding operating restrictions in the conditions and limitations regarding 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 petition received several comments suggesting that UAS operated under this exemption should have the ability to monitor and communicate with other aircraft or install transponders, or that the UAS should not operate until they can sense and avoid other aircraft. One commenter suggested that the FAA should implement a buffer between these UAS operations and manned operations, while another raised concern with near misses with other aircraft. Two comments noted that UAS are susceptible to accidents and GPS jamming. 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 FOPM and MPTOM 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.

One commenter suggested that the FAA should require testing of software and systems prior to operation, including testing to RTCA standards. The FAA believes the preflight checks discussed in the analysis of the UAS operating parameters are sufficient to mitigate this risk, and addresses this in the conditions and limitations below.

The FAA also received comments not related to the UA and its operation as proposed by the petitioner, but rather addressing more general UAS issues, which are discussed below.

The FAA received two comments asking how the FAA plans to monitor or conduct surveillance of the petitioner's UAS operations. The FAA expects operators to comply with its regulations and the terms of the exemption. The jurisdictional FSDO will be the primary office responsible for oversight of the operations.

The FAA received several comments that integrating UAS operations via a broadly applicable rule was a more suitable method than the exemption process, and that industries other than the motion picture industry should be allowed to participate. Section 333 provides interim authority to the Secretary of Transportation, which facilitates limited, controlled UAS operations prior to the completion of a UAS regulatory structure. The FAA is using its exemption process to facilitate implementation of Section 333 and to address FAA rules that would be applicable to the proposed operations. We have received and are considering exemption petitions from a broad array of industries and applications for this technology. Additionally, the FAA is engaged in a rulemaking process that will allow broader applications of UAS operations.

Two commenters suggested this exemption process should be available to anybody, regardless of organizational size or resources. The FAA will consider any request for exemption submitted to it, no matter the source.

One commenter stated that meaningful public review of the petition was not possible because some of the documents submitted by the petitioner are confidential. The FAA routinely considers confidential materials in its exemption process. The FAA reviewed and considered the petitioner's information in its analysis of the petition.

The petition received several comments on privacy. A commenter expressed concern that the UAS could be used for spying. Other commenters stated that there are strong privacy regulations in place. Specifically, a commenter states that the petitioner addressed privacy issues in its request by mandating that all filming be within a contained environment with all participants fully aware that they are being filmed. The petitioner states that all UAS flights will occur over private or controlled access property with the property owner's prior consent and knowledge, and that only people who have consented or otherwise have agreed to be in the area where filming will take place will be filmed. The FAA notes that the terms of this grant of exemption are consistent with the petitioner's proposal in this area.

The FAA's analysis is as follows:

Unmanned aircraft system (UAS)

Regarding the petitioner's requested relief from 14 CFR part 21 Certification procedures for products and parts, the FAA finds that, based on the limited size, weight, operating conditions, design safety features, and the imposed conditions and limitations, the petitioner has demonstrated that its operations would not adversely affect safety compared to similar

operations conducted with aircraft that have been issued an airworthiness certificate under 14 CFR part 21, Subpart H.

Commercial motion picture and television aerial filming operations with manned aircraft are typically conducted with aircraft holding standard airworthiness certificates issued under part 21, subpart H. These aircraft are normally modified via the Supplemental Type Certificate (STC) process to install cameras and other equipment not included in the original aircraft design.

Manned helicopters conducting motion picture and television aerial filming can weigh 6,000 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 55 lbs. with no onboard pilot or crew. The pilot and crew will be remotely located from the aircraft. The limited weight significantly 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 aerial filming operation.

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.

During motion picture and television aerial filming with manned aircraft under the conditions of an FAA issued Certificate of Waiver, aircraft can be operated in very close proximity to participating persons. The safety of these individuals is maintained through use of an aircraft with standard airworthiness certification under 14 CFR part 21, Subpart H, operation of the aircraft by a qualified and competent pilot, and operating according to limitations necessary to ensure safety. In these situations, the filming subject and production personnel are exposed to risk by virtue of their close proximity to an aircraft in flight. Compared to manned aircraft, the UA being operated by the petitioner reduces the risk to participating persons in close proximity to the aircraft due to the limited size, weight, operating conditions, and design safety features of the UAS.

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 stand-off distance from clouds, permitting daytime operations only, and requiring that the UA be operated within visual line of sight and yield right of way to all other manned operations. Additionally, the exemption provides that the operator will request a NOTAM prior to operations to alert other users of the NAS.

The petitioner's UAS 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. With regard to USHPA's concerns about dual control systems, current FAA regulations permit motion picture and television filming operations by manned aircraft that do not require a copilot. Additionally, under this exemption, the FAA requires that the UAS PIC hold a current third class medical certificate. Historically, instances of complete PIC incapacitation are rare. In all other cases other than complete incapacitation,

the PIC has the ability to terminate the flight operation or initiate the automated return to home procedure outlined within the FOPM. The FAA also believes that the multiple control redundancies described in the petitioner's FOPM are sufficient to mitigate risks associated with the loss of GPS signal. In consideration of these factors and the UA size, weight, speed and other operating limitations associated with this aerial filmmaking operation, the FAA finds that there is no adverse safety affect relative to similar operations conducted by manned aircraft with a flight crew complement of one.

These safety features also provide for no adverse safety affect to participating and nonparticipating individuals compared to a manned aircraft that holds a standard airworthiness certificate performing a similar operation.

In accordance with the statutory criteria provided in Section 333 of PL 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. Therefore, the FAA finds that the requested relief from 14 CFR part 21, and any associated noise certification and testing requirements of part 36, is not necessary.

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

The petitioner's UA 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.

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 petitioner's FOPM contains the maintenance requirements for the V.3 UAS, to include "on-condition" maintenance and modifications. The petitioner's MPTOM and FOPM were reviewed and do not sufficiently support the regulatory relief sought under 14 CFR part 91, Subpart E. The FAA has carefully considered the petitioner's supplemental information and determined that its operations will not adversely affect safety with regard to the regulatory maintenance and alteration requirements of 14 CFR §§ 91.405(a)(1), 91.407(a)(1), 91.409(a)(1) and (2), and 91.417(a) and (b), provided changes are made to the MPTOM and FOPM as required by the conditions and limitations included in this exemption. These changes include: requirements to develop and document maintenance, overhaul, replacement, and inspection requirements in the absence of manufacturer's requirements; procedures to document and maintain maintenance records with regard to the petitioner's UAS; and UAS

technician qualification criteria. They also require the petitioner's FOPM to include preflight inspection procedures that account for any discrepancies not already covered in the manual. The FAA finds these additional requirements are necessary to ensure the petitioner's proposed UAS operations do not adversely affect safety in the NAS and of people and property on the ground. Therefore, 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, comments were received that voiced concerns about pilot certification. One such comment came from ALPA, which states that one of the "areas that must be addressed to ensure safe operations" is Astraeus' proposal to use a private pilot with a third class medical as its UAS PIC. ALPA believes that the UAS pilot should possess a commercial pilot certificate with appropriate category and class rating for the type of aircraft being flown and the corresponding second class medical certificate, as well as specific and adequate training on the UAS make and model intended to be used. Similar concerns were also raised by other associations such as USHPA and NAAA.

Given these grounds, the FAA must determine the appropriate level of pilot certification for Astraeus' proposed operation. Title 14 CFR part 61 requires that operations conducted for compensation or hire necessitate a commercial pilot certificate and at least a second class medical certificate. In considering the petitioner's requested relief from 14 CFR § 61.113(a) and (b), the FAA must consider the following factors as they relate specifically to Astraeus' proposed operations:

Separation from manned aircraft operations: Astraeus proposes operations in a "sterile environment" of closed-set motion-picture filming. In this controlled environment, their operations will remain within visual line of site (VLOS) and below 400 feet AGL. Additionally, the FAA has added further conditions and limitations that will require a Certificate of Waiver or Authorization (COA) from the FAA Air Traffic Organization to address airspace requirements and notification requiring Astraeus to request a Notice to Airman (NOTAM) not more than 72 hours in advance, but not less than 48 hours prior to the operation. Astraeus will also be required to avoid and yield right-of-way to all manned operations.

The current aeronautical knowledge requirements for a private pilot compared to a commercial pilot: The FAA analyzed the areas of knowledge specified in 14 CFR part 61 for that of a commercial pilot versus a private pilot. The results show that the required areas of knowledge for a commercial versus private pilot cover the same fundamental principles, as shown in the following table.

Commercial Knowledge	Private Knowledge
****Airplane Single Engine Land (ASEL) used for comparison****	
§ 61.125 Aeronautical knowledge. *(a) General.* A person who applies for a commercial pilot certificate must receive and log ground training…	**§ 61.105 Aeronautical knowledge.** *(a) General.* A person who is applying for a private pilot certificate must receive and log ground training…
(b) **Aeronautical knowledge areas.**	(b) **Aeronautical knowledge areas.**
(1) Applicable Federal Aviation Regulations of this chapter that relate to commercial pilot privileges, limitations, and flight operations;	(1) Applicable Federal Aviation Regulations of this chapter that relate to private pilot privileges, limitations, and flight operations;
(2) Accident reporting requirements of the National Transportation Safety Board;	(2) Accident reporting requirements of the National Transportation Safety Board;
(3) Basic aerodynamics and the principles of flight;	(10) Principles of aerodynamics, powerplants, and aircraft systems;
(4) Meteorology to include recognition of critical weather situations, windshear recognition and avoidance, and the use of aeronautical weather reports and forecasts;	(6) Recognition of critical weather situations from the ground and in flight, windshear avoidance, and the procurement and use of aeronautical weather reports and forecasts;
(5) Safe and efficient operation of aircraft;	(7) Safe and efficient operation of aircraft, including collision avoidance, and recognition and avoidance of wake turbulence;
(6) Weight and balance computations;	(9) Weight and balance computations;
(7) Use of performance charts;	(8) Effects of density altitude on takeoff and climb performance;
(8) Significance and effects of exceeding aircraft performance limitations;	**Related to other areas within the private requirements but not referenced specifically**
(9) Use of aeronautical charts and a magnetic compass for pilotage and dead reckoning;	(4) Use of aeronautical charts for VFR navigation using pilotage, dead reckoning, and navigation systems;
(10) Use of air navigation facilities;	(4) Use of aeronautical charts for VFR navigation using pilotage, dead reckoning**, <u>and navigation systems</u>**; (5) Radio communication procedures;
(11) Aeronautical decision making and judgment;	(12) Aeronautical decision making and judgment; and
(12) Principles and functions of aircraft systems;	(10) Principles of aerodynamics, powerplants, and aircraft systems;
(13) Maneuvers, procedures, and emergency operations appropriate to the aircraft;	(7) Safe and efficient operation of aircraft, including collision avoidance, and recognition and avoidance of wake turbulence; (11) Stall awareness, spin entry, spins, and spin recovery techniques for the airplane and glider category ratings;
(14) Night and high-altitude operations; **	**Although not mentioned in § 61.105, 3 hours of night flight training is required for the private per § 61.107 and § 61.109. For this comparison, high-altitude operations are considered not applicable.**
(15) Procedures for operating within the National Airspace System; and	(3) Use of the applicable portions of the "Aeronautical Information Manual" and FAA advisory circulars; (13) Preflight action that includes— (i) How to obtain information on runway lengths at airports of intended

	use, data on takeoff and landing distances, weather reports and forecasts, and fuel requirements; and (ii) How to plan for alternatives if the planned flight cannot be completed or delays are encountered.
(16) Procedures for flight and ground training for lighter-than-air ratings.**	**For this comparison (ASEL), these operations are considered not applicable.**
§ 61.127 Flight proficiency. (a) *General.* A person who applies for a commercial pilot certificate must receive and log **ground** and flight training	**§ 61.107 Flight proficiency.** (a) *General.* A person who applies for a private pilot certificate must receive and log **ground** and flight training
(b) *Areas of operation.* (1) For an airplane category rating with a single-engine class rating:	(b) *Areas of operation.* (1) For an airplane category rating with a single-engine class rating:
(i) Preflight preparation;	(i) Preflight preparation;
(ii) Preflight procedures;	(ii) Preflight procedures;
(iii) Airport and seaplane base operations;	(iii) Airport and seaplane base operations;
(iv) Takeoffs, landings, and go-arounds;	(iv) Takeoffs, landings, and go-arounds;
(v) Performance maneuvers;	(v) Performance maneuvers;
(vi) Ground reference maneuvers;	(vi) Ground reference maneuvers;
(vii) Navigation;	(vii) Navigation;
(viii) Slow flight and stalls;	(viii) Slow flight and stalls;
(ix) Emergency operations;	(x) Emergency operations;
(x) High-altitude operations; and	**For this comparison, high-altitude operations are considered not applicable.**
(xi) Postflight procedures.	(xii) Postflight procedures.
Not referenced specifically	(ix) Basic instrument maneuvers;
Not referenced specifically	(xi) Night operations, except as provided in §61.110 of this part; and

The specific UAS airmanship skills required for Astraeus' PIC(s): Some of the requirements for Astraeus' PIC(s) are provided in their proprietary documents. However, as with other exemptions that contain specific pilot qualifications, e.g. Exemption Nos. 7830, 6802K, and 6540N, those pilot requirements become conditions and limitations within the grant of exemption. An abbreviated summary of those PIC requirements include the following:

a. The PIC must possess a Private Pilot's Certificate and a valid third-class medical certificate;

b. The PIC must have accumulated and logged a minimum of 200 flight cycles and 25 hours of total time as a UAS rotorcraft pilot and at least 10 hours logged as a UAS pilot with a similar UAS type (single blade or multirotor).

c. The PIC must have accumulated and logged a minimum of five hours as UAS pilot with the make and model of UAS to be utilized for operations under the exemption and three take-offs and landings in the preceding 90 days.

d. The PIC must have successfully completed the qualification process as specified in the MPTOM and FOPM, to include a knowledge and skill test.

The FAA's analysis regarding PIC requirements: The parallel foundation of aeronautical knowledge required for private and commercial pilots is shown in the above table. Private

pilot airmanship skills are furthered through manned flights in the NAS. Commercially certificated pilots build additional experience through these manned flights as well. The additional experience and airmanship skills obtained by commercially certificated airmen contribute to their ability to overcome adverse situations that could be encountered in flights conducted for compensation or hire. However, the experience obtained beyond a private pilot certificate in pursuit of a commercial pilot certificate in manned flight does not necessarily aid a pilot in the operational environment proposed by the petitioner; the FAA considers the overriding safety factor for the limited operations proposed by the petitioner to be the airmanship skills acquired through UAS-specific flight cycles, flight time, and specific make and model experience, culminating in verification through testing.

The FAA shares ALPA's concerns regarding appropriate training on the UAS being utilized. The FAA has reviewed the petitioner's knowledge and experience criteria for its PICs. The FAA finds that the combination of aeronautical knowledge, UAS airmanship skills, and verification through testing is a sufficient method for Astraeus to evaluate a pilot's qualifications, given that operations will be conducted within the limitations outlined in this exemption.

The knowledge and airmanship test qualifications have been developed by Astraeus for the UAS operations proposed in their petition for exemption. There are no established practical test standards that support a jurisdictional FAA FSDO evaluation and approval of company designated examiners. The petitioner will conduct these tests in accordance with its FOPM and the conditions and limitations noted below. Given the constraints of the proposed operations, the FAA believes this would not adversely affect the safety of the NAS.

The petitioner plans to operate in a unique and limited environment. Given the 1) separation of these closed-set filming operations from other manned operations, 2) the parallel nature of private pilot aeronautical knowledge requirements to those of commercial requirements, and 3) the UAS airmanship skills of Astraeus' PICs, the FAA finds that the additional manned airmanship experience of a commercially certificated pilot would not correlate to the airmanship skills necessary for Astraeus' specific proposed operations. 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, would not adversely affect the safety of the NAS.

Another consideration supporting the certificate requirement is that pilots holding a private pilot certificate are subject to security screening by the Department of Homeland Security. This requirement should ameliorate security concerns over UAS operations under this exemption.

Operating parameters of the UAS

Astraeus has stated that it plans to comply with the waiver process as described in FAA Order 8900.1, Volume 3, Chapter 8, Section 1 (V3, C8, S1) Issue a Certificate of Waiver for Motion Picture and Television Filming. The FAA agrees with this philosophy; however, the current section of Order 8900.1 has specific processes that preclude a jurisdictional FAA FSDO from issuing the required Certificate of Waiver, because the section did not originally provide for

UA operations. One example of this is the minimum pilot qualifications – the pertinent section of Order 8900.1 provides no way to relieve Astraeus from the pilot requirements. Also, the sample form 7711-1 used for issuing the Certificate of Waiver specifically states "this section not used for Unmanned Air Vehicle authorizations."

Therefore, the FAA will exempt Astraeus from the applicable regulations normally waived during that process. The FAA will then include the required notifications and coordination with jurisdictional FSDOs through the conditions and limitations listed below. Motion picture and television filming waivers similar to Astraeus' operation are normally issued from one jurisdictional FSDO and can be used in locations covered by other geographically responsible FSDOs through notification. Those local FSDOs then have the ability to review the proposed plan of activities and associated operations manual(s) and levy any additional local special provisions. Since Astraeus' operation deals specifically with UAS, this exemption will take the place of the Certificate of Waiver normally issued by a jurisdictional FSDO under 8900.1 V3, C8, S1. Every FSDO with jurisdiction over the area that Astraeus plans to operate within must still be notified, just as with manned filming operations, and those FSDOs will have the ability to coordinate further conditions and limitations with the UAS Integration Office to address any local concerns, as stated below in the conditions and limitations section of this exemption.

The petitioner must also obtain a Certificate of Waiver or Authorization (COA) from the FAA's Air Traffic Organization (ATO) prior to conducting any operations. This is an existing process that not only makes local Air Traffic Control (ATC) facilities aware of UAS operations, but also provides ATO the ability to consider airspace issues that are unique to UAS operations. The COA will require the operator to request a Notice to Airman (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 Astraeus to conduct their proposed UAS operations. The conditions and limitations below prescribe the requirement for Astraeus to obtain an ATO-issued COA.

Regarding the petitioner's requested relief from 14 CFR § 91.7(a) Civil Aircraft Airworthiness, Astraeus' request is based on the fact that no airworthiness certificate will be issued for the UAS. As previously noted, the petitioner's UAS will not require an airworthiness certificate in accordance with 14 CFR part 21, Subpart H. Based on the fact that an airworthiness certificate will not be issued, exemption from § 91.7(a) is not necessary.

In accordance with the pertinent part of 14 CFR § 91.7(b), the PIC of the UAS is responsible for determining whether the aircraft is in condition for safe flight. The petitioner's manuals for maintenance and operations include safety checklists to be used prior to each flight.

Regarding the petitioner's requested relief from 14 CFR § 91.9(b)(2) Civil aircraft flight manual, marking, and placard requirements and § 91.203(a) and (b) Civil aircraft: Certifications required, the original intent of these regulations was to display an aircraft's airworthiness, certification, and registration documents so they would be easily available to inspectors and passengers. Based on the FAA Memorandum subject "Interpretation regarding whether certain required documents may be kept at an unmanned aircraft's control station,"

dated August 8, 2014, the requested relief from 14 CFR §§ 91.9(b)(2) and 91.203(a) and (b) is not necessary.

Regarding the petitioner's requested relief from 14 CFR § 91.103 Preflight action, although there will be no approved Airplane or Rotorcraft Flight Manual as specified in paragraph (b)(1), the FAA believes that the petitioner can comply with the other applicable requirements in 14 CFR § 91.103(b)(2). The procedures outlined in the petitioner's MPTOM and FOPM address the FAA's concerns regarding compliance with § 91.103(b). The petitioner has also stated its intent to comply with § 91.103(a): "The PIC will take all actions including reviewing weather, flight battery requirements, landing 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 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. The FAA also notes the risks associated with sun glare; the FAA believes that the 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 from 14 CFR § 91.103 is not necessary.

Regarding the petitioner's requested relief from 14 CFR § 91.109 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, Astraeus evaluates the qualification of its PICs based on their experience with the UAS to be operated and verifies through testing, in lieu of formalized training. As such, the FAA finds that the petitioner can conduct its operations without the requested relief from 14 CFR § 91.109.

Regarding the petitioner's requested relief from 14 CFR § 91.119 Minimum safe altitudes, the petitioner failed to specify the pertinent part of 14 CFR § 91.119 from which they require relief. Relief from 14 CFR § 91.119(a) , which requires operating at an altitude that allows a safe emergency landing if a power unit fails, is unprecedented and unwarranted. Relief from § 14 CFR 91.119(b), operation over congested areas, is not applicable, because the petitioner states that operations will only be conducted within the sterile area described in the MPTOM.

Although the petitioner specifically mentioned relief from 14 CFR § 91.119(d), the FAA finds that relief is only needed from 14 CFR § 91.119(c), which is consistent with the relief typically provided to manned operations in FAA Order 8900.1 V3, C8, S1 Issue a Certificate of Waiver for Motion Picture and Television Filming. This Order allows for relief from § 91.119(c) with respect to those participating persons, vehicles, and structures directly involved in the performance of the actual filming. In accordance with the petitioner's stated intention to adhere to Order 8900.1 V3, C8, S1, persons other than participating persons[1] are not allowed

[1] Per Order 8900.1 V3, C8, S1, participating persons are all persons associated with the filming production, and they must be briefed on the potential risk of the proposed flight operation(s) and must acknowledge and accept those risks. Nonparticipating persons are the public, spectators, media, etc., not associated with the filming production.

within 500 feet of the operating area. This provision may be reduced to no less than 200 feet if an equivalent level of safety can be achieved and the Administrator has approved it. For example, an equivalent level of safety may be determined through evaluation by an aviation safety inspector of the filming production area to note terrain features, obstructions, buildings, etc. Such barriers may protect nonparticipating persons (observers, the public, news media, etc.) from debris in the event of an accident.

The FAA notes the petitioner's additional guidelines in its MPTOM to protect its participating production personnel, and finds that relief from 14 CFR § 91.119(c) is warranted, provided adherence to the procedures outlined in the petitioner's MPTOM and FOPM, and the FAA's additional conditions and limitations outlined below. However, all nonparticipating personnel will be required to be at least 500 feet from flight operations, with possible relief to allow reductions to 200 feet, as specified above.

Regarding the petitioner's requested relief from 14 CFR § 91.121 *Altimeter Settings*, the FAA believes that an altitude reading is a critical safety component of the petitioner's proposed operation. Although the petitioner will not have a typical barometric altimeter onboard the aircraft, the FAA finds the petitioner's intention to operate the UA within VLOS and at or below 400 feet AGL, combined with the petitioner's intention to provide altitude information to the UAS pilot via a digitally encoded telemetric data feed, which downlinks from the aircraft to a ground-based on-screen display, to be a sufficient method for ensuring the UAS operations do not adversely affect safety. The altitude information will be generated by equipment installed onboard the aircraft, as specified using GPS triangulation, or digitally encoded barometric altimeter, or radio altimeter, or any combination thereof. Prior to each flight, a zero altitude initiation point will be established and confirmed for accuracy by the UAS PIC. The FAA has determined that good cause exists for granting the requested relief to 14 CFR § 91.121.

Regarding the petitioner's requested relief from 14 CFR § 91.151(a) Fuel requirements for flight in VFR conditions, relief has been granted for manned aircraft to operate at less than the minimums prescribed in 14 CFR § 91.151(a), 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, Visual Flight Rules (VFR) conditions. The petitioner states that its UAS operations will be conducted in a controlled closed-set filming environment, with UA under 55 pounds, at speeds below 50 Knots, and within VLOS. These factors, combined with Astraeus' stated intention to terminate flights after 30 minutes or with 25% remaining battery power (whichever occurs first), provides the FAA sufficient reason to grant the relief from 14 CFR § 91.151(a) as requested in accordance with the conditions and limitations proposed by Astraeus.

With respect to the petitioner's request to operate at night, the FAA finds that the petitioner has not provided a sufficient safety case and mitigations, per FAA Order 8900.1 V16, C5, S3 General Operational Requirements, to avoid collision hazards at night. All previous UAS-specific grants of relief from 14 CFR § 91.151(a) have restricted flights to daytime VFR conditions only. While the FAA acknowledges the petitioner's stated film set lighting techniques to mitigate the risks of nighttime operations, the petitioner has not provided

sufficient data and analysis regarding the PICs' and VOs' ability to maintain VLOS with the UA and conduct their functions to see and avoid other potential obstacles and air traffic, relative to the lighting configuration on the film set. There is a limitation outlined below that precludes nighttime UAS operations. The petitioner may provide additional data and seek an amendment to its exemption to permit night operations.

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.

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 filmmaking industry, 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:

Relief sought by petitioner (14 CFR)	**FAA determination (14 CFR)**
Part 21	Not necessary
45.23(b)	Not necessary
61.113(a) and (b)	Granted with conditions and limitations
91.7(a)	Not necessary
91.9(b)(2)	Not necessary
91.103	Not necessary with conditions and limitations
91.109	Not necessary
91.119	Paragraph (c) granted with conditions and limitations
91.121	Granted with conditions and limitations
91.151(a)	91.151(a)(1), day, granted with conditions and limitations; 91.151(a)(2), night, denied
91.203(a) and (b)	Not necessary
91.405(a)	Granted with conditions and limitations
91.407(a)(1)	Granted with conditions and limitations

91.409(a)(2)	Granted with conditions and limitations; relief from 91.409(a)(1) also granted with conditions and limitations
91.417(a) and (b)	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, Astraeus Aerial is granted an exemption from 14 CFR §§ 61.113(a) and (b); 91.119(c); 91.121; 91.151(a); 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 Astraeus to operate unmanned aircraft systems (UAS) for the purpose of scripted, closed-set filming for the motion picture and television industry. This exemption is subject to the conditions and limitations listed below.

Conditions and Limitations

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

The Flight Operations and Procedures Manual (FOPM) and Motion Picture and Television Operations Manual (MPTOM) 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.

The operator proposed the following conditions and/or limitations, which were accepted by the FAA.[2]

1. The unmanned aircraft (UA) must weigh less than 55 pounds (25 Kg), including energy source(s) and equipment. Operations authorized by this grant of exemption are limited to the following aircraft described in the operator's manual: Astraeus Aerial Cinema System V.3CS UAS aircraft variant, serial #001 onward (V.3). 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 a ground speed exceeding 50 knots.

3. Flights 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.

[2] Conditions and limitations outlined by the operator may have been modified for clarity.

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 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.

6. The operator's manual is considered acceptable to the FAA, provided the additional requirements identified in these conditions and limitations are added or amended. 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 extension or amendment. If the operator determines that any update or revision would affect the basis for which the FAA granted this exemption, then the operator must petition for amendment to their 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, if utilized, 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 operator must follow the manufacturer's UAS aircraft/component, maintenance, overhaul, replacement, inspection, and life limit requirements. When unavailable, aircraft maintenance/component/overhaul, replacement, and inspection/maintenance requirements must be established and identified in the operator's manual. At a minimum, requirements for the following must be included in the operator's manual:

a. Actuators / Servos;

b. Transmission (single rotor);

c. Powerplant (motors);

d. Propellers;

e. Electronic speed controller;

f. Batteries;

g. Mechanical dynamic components (single rotor);

h. Remote command and control;

i. Ground control station (if used); and

j. Any other components as determined by the operator;

10. The Pilot In Command (PIC) must possess at least a private pilot certificate and at least a current third-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.

11. Prior to operations conducted for the purpose of motion picture filming (or similar operations), the PIC must have accumulated and logged, in a manner consistent with 14 CFR § 61.51(b), a minimum of 200 flight cycles and 25 hours of total time as a UAS rotorcraft pilot and at least ten hours logged as a UAS pilot with a similar UAS type (single blade or multirotor). 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 flight cycles and flight time. During training, proficiency, and experience-building flights, all persons not essential for flight operations are considered nonparticipants, and the PIC must operate the UA with appropriate distance from nonparticipants in accordance with 14 CFR § 91.119.

12. Prior to operations conducted for the purpose of motion picture filming (or similar operations), the PIC must have accumulated and logged, in a manner consistent with 14 CFR § 61.51(b), a minimum of five hours as UAS pilot operating the make and model of UAS to be utilized for operations under the exemption and three take-offs and three landings in the preceding 90 days. Training, proficiency, experience-building, and take-off and landing currency flights can be conducted under this grant of exemption to accomplish

the required flight time and 90 day currency. During training, proficiency, experience-building, and take-off and landing currency flights all persons not essential for flight operations are considered nonparticipants, and the PIC must operate the UA with appropriate distance from nonparticipants in accordance with 14 CFR § 91.119.

13. Prior to any flight operations authorized by this grant of exemption, the PIC and VO must have successfully completed a qualification process, as outlined in the operator's manual. As this is a requirement stipulated by the operator, the test must be developed and implemented by a qualified person designated at the sole discretion of the operator. A record of completion of this qualification process must be documented and made available to the Administrator upon request.

14. Prior to operations conducted for the purpose of motion picture filming (or similar operations), a flight demonstration, administered by an operator-approved and -qualified pilot must be successfully completed and documented. This documentation must be available for review upon request by the Administrator. Because the knowledge and airmanship test qualifications have been developed by the operator, and there are no established practical test standards that support a jurisdictional FAA FSDO evaluation and approval of company designated examiners, the petitioner will conduct these tests in accordance with the operator's manual.

15. The UA may not be operated directly over any person, except authorized and consenting production personnel, below an altitude that is hazardous to persons or property on the surface in the event of a UAS failure or emergency.

16. Regarding the distance from participating persons, the operator's manual has safety mitigations for authorized and consenting production personnel. At all times, those persons must be essential to the closed-set film operations. Because these procedures are specific to participating persons, no further FSDO or aviation safety inspector approval is necessary for reductions to the distances specified in the petitioner's manuals. This is consistent with the manned aircraft procedures described in FAA Order 8900.1, V3, C8, S1 Issue a Certificate of Waiver for Motion Picture and Television Filming.

17. Regarding distance from nonparticipating persons, the operator must ensure that no persons are allowed within 500 feet of the area except those consenting to be involved and necessary for the filming production. This provision may be reduced to no less than 200 feet if it would not adversely affect safety and the Administrator has approved it. For example, an equivalent level of safety may be determined by an aviation safety inspector's evaluation of the filming production area to note terrain features, obstructions, buildings, safety barriers, etc. Such barriers may protect nonparticipating persons (observers, the public, news media, etc.) from debris in the event of an accident. This is also consistent with the same FAA Order 8900.1, V3, C8, S1.

18. If the UAS loses communications or loses its GPS signal, the UA must return to a pre-determined location within the security perimeter and land or be recovered in accordance with the operator's manual.

19. The UAS must abort the flight in the event of unpredicted obstacles or emergencies in accordance with the operator's manual.

20. Each UAS operation must be completed within 30 minutes flight time or with 25% battery power remaining, whichever occurs first.

In addition to the conditions and limitations proposed by the operator, the FAA has determined that any operations conducted under this grant of exemption must be done pursuant to the following conditions and limitations:

21. 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.

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

23. The operator must develop procedures to document and maintain a record of the UAS maintenance, preventative maintenance, alterations, status of replacement/overhaul component parts, and the total time in service of the UAS. These procedures must be added to the operator's manual.

24. Each UAS operated under this exemption must comply with all manufacturer Safety Bulletins.

25. The operator must develop UAS technician qualification criteria. These criteria must be added to the operator's manual.

26. 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.

27. 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.

28. At least three days before scheduled filming, the operator of the UAS affected by this exemption must submit a written Plan of Activities to the local FSDO with jurisdiction over the area of proposed filming. The 3-day notification may be waived with the concurrence of the FSDO. The plan of activities must include at least the following:

    a. Dates and times for all flights;

    b. Name and phone number of the operator for the UAS filming production conducted under this grant of exemption;

    c. Name and phone number of the person responsible for the on-scene operation of the UAS;

    d. Make, model, and serial or N-number of UAS to be used;

    e. Name and certificate number of UAS PICs involved in the filming production event;

    f. A statement that the operator has obtained permission from property owners and/or local officials to conduct the filming production event; the list of those who gave permission must be made available to the inspector upon request;

    g. Signature of exemption-holder or representative; and

    h. A description of the flight activity, including maps or diagrams of any area, city, town, county, and/or state over which filming will be conducted and the altitudes essential to accomplish the operation.

29. 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.

30. 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.).

31. 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.

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

33. 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.

34. The UA may not operate in Class B, C, or D airspace without written approval from the FAA. The UA may not operate within 5 nautical miles of the geographic center of a non-towered 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.

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.ntsb.gov. Further flight operations may not be conducted until the incident, accident, or transgression is reviewed by AFS-80 and authorization to resume operations is provided.

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 September 30, 2016, unless sooner superseded or rescinded.

Issued in Washington, DC, on September 25, 2014. .

/s/
Michael J. Zenkovich
Deputy Director, Flight Standards Service