Exemption No. 13465A

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

In the matter of the petition of **KANSAS STATE UNIVERSITY** for an exemption from part 21 and §§ 61.113(a) and (b), 61.3(d)(2)(iii), 91.7(a), 91.9(b)(2), 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−2014−1088**

GRANT OF AMENDMENT

The FAA is amending the October 30, 2015 grant of exemption to Kansas State University to clarify the aircraft and Conditions and Limitations. Specifically, in this exemption, the FAA has:

- Clarified safe operations of the gas-powered UAV Factory Penguin B UAS
- Clarified that the Pilot-In-Command (PIC), manipulator of the controls, and the Visual Observer (VO) must maintain visual line of sight with the unmanned aircraft (UA).
- Clarified operations near people
- Clarified condition and limitation #1
- Clarified condition and limitation #25

By letter dated December 18, 2014,[1] Mr. Mark Blanks, Kansas State University (hereinafter petitioner or operator), 2310 Centennial Road, Salina, Kansas 67401, petitioned the Federal Aviation Administration (FAA) for an exemption from part 21, and §§ 61.3(d)(2)(iii),

[1] The petitioner responded to the FAA's request for information on June 1, 2015.

61.113(a) and (b), 91.7(a), 91.9(b)(2), 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 petitioner requested to operate several unmanned aircraft systems (UAS) to conduct flight instruction of UAS.

The petitioner supports its request with the following information:

The petition for exemption describing the proposed operation and the regulations from which the petitioner seeks exemption is posted to the docket. To view the petition, visit http://www.regulations.gov, enter the regulatory docket number found on the first page of this document into the search box and click "Search," then click on the "Open Docket Folder" link next to a result associated with the docket number.

KSU currently operates a pilot school certificated under 14 C.F.R. part 141 that is accredited by the Aviation Accreditation Board International. KSU seeks to leverage its experience training students in manned-aircraft aviation in order to train students to operate small UAS. KSU also has extensive prior experience operating and maintaining UAS to conduct flights within the NAS.

The petitioner has provided the following information along with its petition to support its request for an exemption:

1) Crow Flight Operations and Maintenance Manual
2) Penguin B Flight Operations and Maintenance Manual

The petition and the documents above are hereinafter referred to as the operating documents.

Discussion of Public Comments:

A summary of the petition was published in the Federal Register on January 8, 2015 (80 FR 1068). The Air Line Pilots Association, International (ALPA) and the National Agricultural Aviation Association (NAAA) filed comments opposing the petition.

ALPA expressed concern regarding several aspects of the petition. ALPA noted that while the anticipated operation will occur below 400 feet above ground level (AGL) and in predetermined and sterile areas, the petition does not define "predetermined" nor does it offer a means to control the airspace or areas of operation. Specifically, ALPA stated, "there must be means both to ensure that the sUAS remains within the defined airspace and to ensure that

the hazard of other aircraft intruding on the operation is mitigated. Without clear and specific information detailing the flight operations, airspace, environment and location, and mitigations strategies along with the KSU SOP, the petition does not quantify how the equivalent level of safety is being measured and maintained in the NAS."

The FAA believes the requirements to operate within visual line of sight (VLOS) and fly no higher than 400 feet AGL which allow the operator to see both the aircraft and its operating environment are sufficient mitigations to this risk so that the operations will not adversely affect the safety of the airspace in which the operations occur.

ALPA noted that the petitioner does not clearly state how the pilot and the observer will be able to communicate with each other. ALPA stated that when voice communication is used, both the pilot and observer should be able to maintain visual observation of both the aircraft and the area of operation in accordance with FAA Notice 8900.227. NAAA stated UAS observers must be present and able to communicate with the operator from the most minimal distance possible. The conditions and limitations below require that the PIC, the person manipulating the flight controls, and VO to maintain VLOS capability and communicate verbally during flight operations and address the concerns regarding PIC and VO communication.

ALPA asserted the unmanned aircraft's (UA) lithium polymer batteries have numerous associated fire and explosion hazards as outlined in DOT/FAA/AR-09/55, "Flammability Assessment of Lithium-Ion and Lithium-Ion Polymer Battery Cell Designed for Aircraft Power Usage (January 2010)," and that the safe carriage of the batteries and the mitigations in place for known risks should be addressed. The FAA notes that the referenced study was primarily conducted to determine how certain battery cells react in a fire situation aboard manned airplanes. Given the size of the battery and the operating conditions of the UAS, the FAA concludes that the use of a lithium polymer battery will not pose an undue safety risk for the proposed operations.

ALPA commented that the petitioner's system does not have a barometric altimeter as required by 14 CFR § 91.121. ALPA stated that processes or mitigations must be in place to ensure the UA can accurately maintain altitude including engineering processes, software development and control, electronic hardware development and control, configuration management, and design assurance to ensure the aircraft and its control system(s) operate to the same level of safety as other aircraft operated commercially in the National Airspace System (NAS). The FAA has inserted conditions and limitations in this exemption to mitigate the risk associated with the absence of a traditional barometric altimeter, including the

condition that the PIC and VO must maintain VLOS capability during all flight operations and the limitation of a maximum operating altitude of 400 feet AGL.

ALPA commented 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 has inserted conditions and limitations in this exemption requiring operators to reestablish link, immediately recover or land the UA, or terminate the flight to mitigate the risk associated with such failures.

ALPA also noted that the petitioner's proposed commercial operations are for "compensation or hire," and therefore contends 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, ALPA asserted a current second-class airman medical certificate should be required. NAAA also commented on pilot qualification, stating—

> Just as manned aircraft pilots are required to undergo a rigorous training curriculum and show that they are fit to operate a commercial aircraft, so too must UAS operators. Holding a commercial certificate holds UAS operators to similar high standards as commercial aircraft operators and ensures they are aware of their responsibilities as commercial operators within the NAS. Medical requirements ensure they have the necessary visual and mental acuity to operate a commercial aircraft repeatedly over a sustained period of time.

The FAA has reviewed the knowledge and training requirements of sport, recreational, private and commercial certificates and concluded that a UAS PIC holding a minimum of a sport pilot certificate, and operating under this exemption, would not adversely affect operations in the NAS or present a hazard to persons or property on the ground. Additional discussion of the FAA's review is found in the FAA's analysis section of this exemption.

ALPA noted the petitioner must specify a means to meet see and avoid requirements in § 91.113 given the absence of an onboard pilot. The FAA notes that all flights must be operated within VLOS of the PIC, the person manipulating the flight controls of the small UAS, and VO.

ALPA also expressed concern that the petition makes no reference to compliance with, or a request for waiver from, 14 CFR 61.195, *Flight instructor limitations and qualifications*, which defines the requirements for flight instructors. The FAA notes that a certificated flight instructor is authorized to provide the instruction required for the certificates or ratings or

currency listed in 14 CFR § 61.193. A person instructing on how to operate the UAS under the petitioner's training program would not need to be a certificated flight instructor because the instruction is not being provided for a certificate or rating listed in § 61.193. The FAA has determined that none of the UAS operations proposed by the petitioner require such flight instruction because § 61.31(*l*) allows for operation of the UAS by an airman who is current per 14 CFR § 61.56 without a category and class rating. However, instruction provided toward obtaining the pilot certificate required by this exemption would need to be provided by a certificated flight instructor.

ALPA opposed the petitioner's request to avoid providing aircraft documentation (such as used for aircraft maintenance tracking, AD issuance, related performance information) of its small UAS. The FAA has granted relief from 14 CFR 91.417 (a) and (b) to the extent necessary, requiring that the PIC determine that the UAS is in a condition for safe flight prior to every operation.

ALPA opposed the petitioner's request for an exemption from the aircraft maintenance and record keeping requirements. ALPA asserted that the petitioner's small UAS "should comply to the same level of safety as other aircraft operated commercially in the NAS." The FAA finds that adherence to the petitioner's operating documents, as required by the conditions and limitations below, is sufficient to ensure that safety is not adversely affected.

ALPA also expressed concern that the petitioner's request is not for a single specific operation or location, but for all operations of the same general type. ALPA stated that this results in a considerable increase in the FAA's oversight tasks. The FAA notes ALPA's concern and in order to minimize potential impact to the NAS, the FAA requires that UAS operated under this exemption comply with a Certificate of Waiver or Authorization (COA) issued by the Air Traffic Organization. The COA covers specific air traffic requirements. The FAA recognizes that UAS integration will generate new NAS access demand and will review and adjust accordingly.

NAAA noted that its members operate in low-level airspace, and therefore 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 that agricultural pilots depend on pilots of other aircraft to perform their see-and-avoid functions to prevent collisions. NAAA believes UAS operations at low altitudes will increase the potential for collision with agricultural aircraft.

The FAA recognizes these concerns and has incorporated associated conditions and limitations into this exemption, including: (a) operator must operate under a COA issued by

ATO, which covers specific air traffic requirements for all operations; (b) operations conducted within VLOS of the pilot in command (PIC), the person manipulating the flight controls of the small UAS, and the VO; and (c) the small unmanned aircraft must always yield right-of-way to manned aircraft.

NAAA stated that FAA airworthiness certification should be a requirement for all unmanned aircraft to operate within the NAS. NAAA recommended UAS be equipped with ADS-B or similar identification and positioning systems, strobe lights, high-visibility markings and registration numbers. NAAA also recommended UAS be operated strictly within the line-of-sight of the ground controller, with the assistance of a VO and clear of any low-flying manned aircraft.

As discussed in greater detail below, Section 333 of the FAA Modernization and Reform Act of 2012 authorizes the Secretary of Transportation to determine, considering a number of factors laid out in the statute, that an airworthiness certificate is not necessary for certain operations. The Secretary has made that determination in this case and therefore the aircraft operated by the petitioner will not need to be certificated by the FAA.

The FAA's analysis is as follows:

The FAA has organized its analysis into five sections: (1) Unmanned Aircraft Systems (UAS), (2) the UAS pilot in command (PIC), (3) Training Operations, (4) the UAS operating parameters, and (5) the public interest.

Unmanned Aircraft Systems (UAS)

The petitioner requested relief from 14 CFR part 21, *Certification procedures for products and parts*. 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 their operation, the Secretary of Transportation has determined that these aircraft meet the conditions of Section 333 and that an airworthiness certificate is not required. 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.

The petitioner requested operating with both gas and electrically powered UA. The petitioner requested to operate the gas powered UAV Factory Penguin B at an altitude of 1,200 feet AGL and indicated that operating this aircraft poses lower risk at higher altitudes. Because the petitioner has not defined that risk, the FAA is not prepared to act on the request to operate the gas-powered UAV Factory Penguin B UAS above 400 feet AGL. It is the

operator's responsibility to determine that the UAV Factory Penguin B can be safely operated below 400 feet AGL under the conditions and limitations of this exemption. In accordance with the conditions and limitations, the petitioner must not operate so close to persons or property as to create an undue hazard. The petitioner may submit additional data for future FAA review and consideration to allow the petitioner to operate the UAV Factory Penguin B UAS above 400 feet AGL.

The petitioner requested relief from the following sections 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). Prior UAS specific relief has been granted in Grant of Exemption No. 11213 to Aeryon Labs, Inc. 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.

UAS Pilot in Command (PIC)

The petitioner stated that all its UAS pilots will possess a private pilot certificate and second class medical certificate. The petitioner also stated that students and non-current UAS operators may participate in UAS operations under the supervision of an appropriately qualified UAS flight instructor, as discussed in the UAS Operating Parameters section below.

In this exemption the FAA is exempting KSU pilots from the prohibition on receiving compensation for providing UAS flight training to non-certificated student pilots. As in previously issued exemptions, KSU pilots will be required to hold an FAA pilot certificate. We note that during these operations, the PIC is responsible for the safety of flight regardless of whether the PIC or the student is manipulating the aircraft controls.

KSU has stated that all of its pilots will hold at least a private pilot certificate with a second class airman medical certificate. In Exemption No. 11213, the FAA compared the aeronautical knowledge requirements of the commercial and private pilot certificates to the recreational and sport pilot certificates to determine how they differed and what would be required for a UAS pilot. The FAA determined that the UAS PIC must hold either an airline transport, commercial, private, recreational, or sport pilot certificate along with a current FAA airman medical certificate or a valid U.S. driver's license. Therefore, as in Exemption No.

11213, KSU instructors that will serve as PICs under operations conducted under this exemption may hold any of those pilot certificates.[2]

14 CFR §1.1 defines a PIC as the person who has final authority and responsibility for the operation and safety of the flight, has been designated as pilot in command before or during the flight, and holds the appropriate category, class, and type rating, if appropriate for the conduct of the flight. Accordingly, based on KSU's request, the FAA grants relief from §§ 61.101(e)(4) and (5), and 61.113(a), to allow a PIC holding a private pilot certificate to operate a UAS for compensation and hire, subject to the conditions and limitations below.[3] The petitioner also requested relief from § 61.113(b); however relief is not necessary since relief is already granted to § 61.113(a). The FAA is also granting relief from § 61.315(a) as previously determined in Exemption No. 11213, to permit the holder of a sport pilot certificate to act as the PIC of UAS operated under this exemption.

Additionally, the PIC must hold either a medical certificate issued under 14 CFR part 67 or a U.S. issued driver's license as previously determined in Exemption No. 11213. The PIC must also comply with 14 CFR § 61.53, *Prohibition on operations during medical deficiency*. *See* Exemption 11213 (Aeryon Labs) for relief granted from *Medical certificates: Requirement and duration* § 61.23(a) and § 61.23(c).

The FAA also considered medical certificate requirements for a visual observer. As in Exemption No. 11213, the FAA determined that this is not necessary subject to the conditions and limitations below. In particular, the UA must never be operated beyond the actual visual capabilities of the VO, and the VO, any student manipulating the controls, and the 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.

The petitioner also requested relief from 14 CFR § 61.3(d)(2)(iii), *Requirements for certificates, ratings, and authorizations.* Given that the training the petitioner intends to provide is not for an FAA airman certificate and the log books recording training given are not part of an FAA certificate program, the FAA finds that relief from 14 CFR § 61.3(d)(2)(iii) is not necessary.

Training Operations

[2] Note that, as discussed under Training Operations, below, a KSU instructor will be required to serve as PIC during student training flights even when students are manipulating the aircraft's controls.

[3] Similar relief from § 61.315(c)(2) and (3) is not necessary because these limitations on sport pilot certificate privileges only apply to light-sport aircraft (LSA). The UAS being operated under this exemption are not LSA.

The petitioner proposes to conduct flight operations to provide UAS training or instruction to non-certificated persons for compensation or hire. The proposal included training scenarios with a trainer holding a private pilot certificate and second class airman medical certificate serving as the PIC. The FAA is granting the exemption to permit KSU instructors to receive compensation for providing flight instruction to students.

These operations will be consistent with the FAA's approach for student pilots of manned aircraft. Student pilots may manipulate the controls of an aircraft in most part 91 operations unless specifically restricted. Students do not need to obtain a medical certification or pass a knowledge test prior to flights where a qualified instructor serves as the PIC. *See* 14 CFR § 61.87. When a student, or other non-qualified person, is manipulating the controls of an aircraft, the PIC retains responsibility for the safety of the flight. Student flight operations under this exemption must always be conducted under the supervision of a PIC and the PIC must always have the ability to immediately take direct control of the aircraft.

The instructor is designated the PIC for the entire duration of the operation. Students are not required to hold any certification to manipulate the controls of an unmanned aircraft under this exemption. However, the PIC must have sufficient override capability to immediately take direct control of the aircraft and safely abort the operation if necessary.

The FAA considered whether to require the instructor/trainer to hold an-FAA issued flight instructor certificate. However, the agency previously determined that risk posed by UAS operations under FAA exemptions is mitigated in part by demonstration of aeronautical knowledge through a pilot certificate and UAS specific training rather than flight hours in a manned aircraft. *See* Exemption Nos. 11062, 11213. Moreover, a certificated flight instructor would not have a basis for evaluating a student's proficiency as the FAA has not established UAS flight training standards. Accordingly, the FAA has determined that a PIC qualified under this exemption has the requisite knowledge to ensure that instructional operations are conducted safely.

When conducting training, the PIC is responsible for conducting safe operations and for meeting all applicable conditions and limitations as prescribed in this exemption and ATO-issued COA, and operating in accordance with the operating documents. All training operations must be conducted during dedicated training sessions and trainers may receive compensation under this exemption. The petitioner may not conduct operations during training sessions for any purpose other than training. In accordance with the conditions and limitations, the training operation must be conducted with a dedicated VO. The visual observer's responsibility is to maintain constant visual contact with the unmanned aircraft to be able to advise the PIC if other aircraft or unexpected people or objects have entered the

operational area. Given the nature of this task, the VO must be dedicated only to visual observer responsibilities. Students receiving instruction or observing an operation may not serve as visual observers. A student who is focused on learning the UAS operation would not be able to focus on VO duties as well because that would increase the risk of the operation.

Regarding the petitioner's requested relief from 14 CFR § 91.109 *Flight instruction; Simulated instrument flight and certain flight tests,* the petitioner describes training scenarios in which a dual set of controls will be utilized. The petitioner proposed using two types of dual controls: either (1) a "buddy box" system using two transmitters, with one being operated by the PIC and the other operated by the student; or (2) a ground control system (GCS) operated by the student and the PIC having a secondary transmitter with full override capability. The FAA finds that the PIC must have sufficient override capability to immediately take direct control of the aircraft and safely abort the operation if necessary such as through proposed mitigations above. The capability to safely abort the operation provides that safety will not be adversely affected even if the UAS does not have a dual set of controls. Therefore, the FAA is granting relief from 14 CFR § 91.109(a) subject to the applicable conditions and limitations stated below.

UAS Operating Parameters

The petitioner has requested relief from 14 CFR § 91.7(a), *Civil aircraft airworthiness*. While the petitioner's UAS will not require an airworthiness certificate, the FAA has determined that for the purposes of this exemption the pilot may determine the aircraft is in an airworthy condition prior to flight. The FAA's regulations state that the PIC of a civil aircraft is responsible for determining whether the aircraft is in a condition for safe flight. Therefore, relief from § 91.7(a) is granted.

The petitioner 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 FAA has previously determined that relief from these sections is not necessary. *See* Exemption No. 11213. Relevant materials may be kept in a location accessible to the PIC in compliance with the regulations.

The petitioner has requested relief from 14 CFR § 91.119, *Minimum safe altitudes*. In previous exemptions, the FAA classified UAS operations as closed-set motion picture and television filming operations or aerial data collection. S*ee* Exemption No. 11213. Due to the close proximity to persons, only closed-set filming operations were required to have a Motion Picture and Television Operations Manual (MPTOM) in accordance with their exemption. Aerial data collection and any operation not classified as closed-set filming were not required

to have an MPTOM or similar manual because their operations were not conducted within close proximity to people unless adequate barriers were provided.

Operations Near People

For the reasons discussed below, the FAA finds that KSU may allow a small unmanned aircraft to fly closer than 500 feet to a student who is part of a flight training class. KSU may also allow the small unmanned aircraft to fly directly over the student manipulating the flight controls of the small UAS and people who are directly participating in the flight operation, such as the PIC and the visual observer.

KSU is a certificated part141 pilot school. Part 141 pilot schools are closely overseen by the FAA and must satisfy a number of regulatory requirements. Those requirements include establishing a high pass rate for their students who take aviation knowledge and practical tests and maintaining a minimum graduation rate.

In its petition for exemption, KSU described the following safety mitigations it will exercise during small UAS operations. The small unmanned aircraft will not exceed a speed of 50 knots. The person operating as a flight instructor and PIC will possess at least a private pilot certificate with a Class 2 airman medical certificate. The PIC and the student will use a "buddy box" system that utilizes two transmitters. The transmitter of the student (trainer transmitter or buddy box) will be connected by a trainer cable to another transmitter (master transmitter) controlled by the PIC instructor. The PIC instructor will be able to control the UAS with his or her transmitter then flip a switch to turn control over to the student and flip the switch again to reclaim control at any time. In this way, the PIC instructor will be able to easily demonstrate how to fly the UAS or rescue the UAS if the student makes a poor aeronautical decision without passing the same transmitter back and forth (which could result in delays and crashes.) Further, all operations will take place in a sterile environment maintained according to the standard KSU operating procedure. Some operations will be conducted within a gated and sterile environment operated by the Kansas Department of Emergency Management.

Based on KSU's experience and qualifications as a part 141 pilot school, the qualifications of people acting as the PIC, and the parameters under which the flight operations will be conducted, the FAA finds that a small unmanned aircraft that flies closer than 500 feet to a student who is manipulating the flight controls of the small UAS for purposes of flight training will not adversely affect safety. The FAA also finds a small unmanned aircraft flying over that student will not adversely affect safety. Additionally, the FAA finds a small

unmanned aircraft flying closer than 500 feet to and/or over people who are directly participating in the flight operation, such as the PIC and the visual observer will not adversely affect safety. Finally, the FAA finds that KSU operating a small unmanned aircraft closer than 500 feet but not directly over a student who is part of the training class but is not manipulating the flight controls of the small UAS will not adversely affect safety.

With the exception of the people directly participating in the flight operation of a small UAS or students who are part of the flight training class, a UA may only be operated within 500 feet of a person when barriers or structures are present that sufficiently protect that person from the UA and/or debris or hazardous materials such as fuel or chemicals in the event of an accident. Under these conditions, the operator must ensure that nonparticipating persons remain under such protection for the duration of the operation. If a situation arises where nonparticipating persons leave such protection and are within 500 feet of the UA, flight operations must cease immediately in a manner that does not cause undue hazard to persons.

Additionally, operations for training, proficiency, or experience building for PICs to qualify to operate under this exemption may not be conducted within 500 feet of nonparticipating persons to ensure the safety of others.

A small UA may be flown over or near people subject to the conditions and limitations below.

All people associated with the operations must be briefed by the PIC on the potential risk of the proposed flight operation(s) and acknowledge and consent to those risks. The FAA routinely uses briefings as a means to notify passengers and others of safety information and to risks of certain operations. *See, e.g.*, 14 CFR §§ 91.319(d)(1) (advising passengers of experimental nature of an aircraft); 136.7 (air tour briefings). The requirement to obtain consent provides an additional margin of safety by building upon the briefing requirement to ensure that participants have acknowledged that a UA will be operated within 500 feet. The consent requirement is consistent with exemptions authorizing UAS closed-set filmmaking. *See* Exemption No. 11062.

In Exemption No. 11062 (Astraeus Aerial), the FAA granted exemption to the part 91 minimum safe altitude rules 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*. The order allows UA to be operated within 500 feet of participating persons, vehicles, and structures directly involved in the performance of the actual filming. That exemption required the operator to have an approved Motion Picture and Television Operations Manual (MPTOM). Based on existing motion picture filming practice, Exemption

No. 11062 established the requirement that UAS operations must comply with the petitioner's MPTOM when conducting closed-set filming operations.

Additionally, the FAA recognizes that there are additional risks when operating a UA close to people, whether for the purpose of closed-set filming or otherwise. As such the FAA has determined that when conducting these types of operations, the operator must have an operations manual addressing the items as specified in the conditions and limitations below. Unmanned aircraft operations conducted in close proximity to people (less than 500 feet) invoke added safety risks. Regardless of the operation type (closed set film-making or other operation types), the operations manual requirement helps ensure that safety will not be adversely affected because the operator must document and address operational safety practices relevant to its operation. An operations manual must include items such as; the operator's contact information, distribution and revision information, persons authorized, plan of activities, permission to operate, security methodology, briefing instructions, essential flight personnel minimum requirements, communications information, and accident notification plan. Documented operational safety practices and procedures help ensure a safe and repeatable process for conducting flight operations. Formal procedures ensure adequate safety guidelines are available and adhered to in normal operational environments, but also during emergency circumstances. The operations manual is considered part of the operating documents and must be accessible to the PIC during operations. This operations manual is based on the requirement in previous exemptions for a MPTOM for closed-set filming.

Operators conducting these operations must also submit a written Plan of Activities to the local Flight Standards District Office at least 24 hours prior to initiating operations as described in the conditions and limitations below. The written plan of activities includes pertinent items provided to Flight Standards District Offices. The written plan of activities is necessary for Aviation Safety Inspectors to conduct surveillance of activities and ensure compliance with the provisions of the authorization and waiver, associated special provisions, operations manual, and the plan of activities in accordance with FSIMS 8900.1 to ensure the safety of the NAS.

Operations Near Vessels, Vehicles, and Structures

Operations near vessels, vehicles, and structures are those operations in which a UA is operated within 500 feet of such objects. To conduct such operations, the PIC must: (1) have permission from a person with legal authority over any vessels, vehicles or structures located within 500 feet of the UA's operating area; and (2) make a safety assessment of the risk of operating closer to those objects and determine that no undue hazard would result from the operation.

In consideration of the above, the FAA finds that:

a. 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.
b. Relief from § 91.119(b), operation over congested areas, is not granted, because this exemption prohibits operations over congested or densely populated areas.
c. Relief from § 91.119(c) is necessary because the aircraft will be operated at altitudes below 500 feet AGL. Section 91.119(c) states that no person may operate an aircraft below the following altitudes: *over other than congested areas,* an altitude of 500 feet above the surface, except over open water or sparsely populated areas. The FAA finds operations conducted in compliance with the conditions and limitations in this exemption warrant relief from § 91.119(c).
d. Relief from § 91.119(d) is not necessary. Although this section allows operations below the minimums set forth in the other paragraphs of 91.119 for helicopters, the conditions and limitations below control operations under this exemption.

Per 14 CFR § 91.119, manned aircraft are commonly flown at altitudes of 500 feet above the surface in areas over other than congested areas. The petitioner has proposed operating its gas-powered aircraft at altitudes up to 1,200 feet above ground level (AGL). The petitioner states that operating gas-powered aircraft at higher altitudes reduces the risks associated with internal combustion engine powered aircraft. In all previous grants of exemption under Section 333, the FAA has limited operating altitudes to less than 400 feet AGL. The FAA finds that UAS operations at altitudes above 400 feet AGL introduce greater risks to manned aviation because of see-and-avoid difficulties when manned and unmanned aircraft operate in shared airspace. As in prior exemptions, the FAA is limiting operations under this exemption to 400 feet AGL as stated in the conditions and limitations below.

The petitioner requested relief from 14 CFR § 91.121, *Altimeter settings*. When the UA is equipped with a barometric altimeter, relief from § 91.121 is not necessary. When the UA is not equipped with a barometric altimeter, an alternate means for measuring and reporting UA altitude is necessary, such as global positioning system (GPS). As stated in the conditions and limitations below, the FAA requires altitude be reported in feet AGL. The petitioner may choose to set the 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.

In previous exemptions, the FAA required that the UA be returned to a pre-determined location within the private or controlled area of operation if the UAS loses communication or GPS signal. The FAA has re-examined the situation where the GPS signal is lost or the PIC loses communications with the UA and determined that these two situations employ unique functions and incur different failure modes. Therefore, the FAA has included two separate conditions and limitations addressing each situation. In the situation where the UAS uses GPS navigation and the GPS signal is necessary to safely operate the UA, the PIC is required to immediately recover or land the UA. However, if the UA can be operated safely without a GPS signal, the operation may continue. If the PIC loses command or control link with the UA, the UA must follow a pre-determined route to either reestablish link or immediately land. The modified conditions and limitations preserve the same intent and level of safety, while also adding clarity and reducing restrictiveness for the operator.

The petitioner has requested relief from 14 CFR § 91.151(a), *Fuel requirements for flight in VFR conditions*, for the electrically powered UAS only. Prior UAS specific relief has been granted in Exemption Nos. 8811, 10808, and 10673 for daytime, Visual Flight Rules (VFR) conditions. The conditions and limitations below prohibit the PIC from beginning a UAS flight unless (considering wind and forecast weather conditions) there is enough available power for UAS to operate for the intended operational time and to operate after that for at least five minutes or with the reserve power recommended by the manufacturer if greater. The FAA finds that this provides sufficient reason to grant relief from 14 CFR § 91.151(a)(1) to the extent necessary and in accordance with the conditions and limitations below for all UAS listed in this exemption.

The FAA Air Traffic Organization (ATO) reviews all proposed UAS operations and evaluates the safety of these operations relative to the requested airspace through the existing COA process. The majority of current UAS operations occurring in the NAS are being coordinated through air traffic control (ATC) by the issuance of a COA. This process 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 FAA has issued a COA to this operator, which is attached to this exemption. The COA sets the requirements 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 follow the terms of a COA. If the petitioner intends to conduct operations outside of the parameters of what is permitted under the attached COA it may apply to the ATO for a new or amended COA.

In previous exemptions, the FAA limited UAS operations to outside 5 nautical miles of an airport reference point (ARP) as denoted in the current FAA Airport/Facility Directory (AFD) or, for airports not denoted with an ARP, the center of the airport symbol as denoted on the current FAA-published aeronautical chart unless a letter of agreement (LOA) with that airport's management is obtained or otherwise permitted by a COA issued to the exemption holder. In order to maintain operational safety in the vicinity of airports, particularly as it affects Class B, C, or D airspace, instead of contacting the airport management, the petitioner must apply to the ATO for a new or amended COA. The ATO will coordinate an LOA with local air traffic management via the COA process. The FAA finds that this approach facilitates consistency between the exemption and the COA.

Public Interest

The FAA finds that a grant of exemption is in the public interest. Professional training programs for UAS operators will positively affect unmanned aviation activities by providing future UAS operators with a safe environment to gain proficiency and experience. This gives the FAA good cause to find that the UAS operation enabled by this exemption is in the public interest.

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

Relief considered (14 CFR)	**FAA determination (14 CFR)**
21	Relief not necessary
45.23(b)	Relief not necessary
61.23(a) and (c)	Relief granted with conditions and limitations
61.101(e)(4) and (5)	Relief granted with conditions and limitations
61.113(a)	Relief granted with conditions and limitations
61.133	Relief not necessary
61.3(d)(2)(iii)	Relief not necessary
61.315(a)	Relief granted with conditions and limitations
91.7(a)	Relief granted with conditions and limitations
91.7(b)	Relief not necessary
91.9(b)(2)	Relief not necessary

Relief considered (14 CFR)	FAA determination (14 CFR)
91.9(c)	Relief not granted
91.103	Relief not granted
91.109(a)	Relief granted with conditions and limitations
91.119(a)	Relief not granted
91.119(b)	Relief not granted
91.119(c)	Relief granted with conditions and limitations
91.119(d)	Relief not necessary
91.121	Relief granted with conditions and limitations
91.151(a)(1)	Relief granted with conditions and limitations
91.203(a) and (b)	Relief not necessary
91.405(a)	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, Kansas State University is granted an exemption from 14 CFR §§ 61.23(a) and (c), 61.101(e)(4) and (5), 61.113(a), 61.315(a), 91.7(a), 91.109(a), 91.119(c), 91.121, 91.151(a)(1), 91.405(a), 91.407(a)(1), 91.409(a)(1) and (2), and 91.417(a) and (b), to the extent necessary to allow the petitioner to conduct UAS operations according to the conditions and limitations listed below.

Conditions and Limitations

The conditions and limitations within Grant of Exemption No. 13465 have been superseded, and are amended as follows.

In this grant of exemption**,** Kansas State University is hereafter referred to as the operator.

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

1. Operations authorized by this exemption are limited to the 3D Robotics X8, 3D Robotics X8-M, 3D Robotics Aero, and 3D Robotics Aero-M[4] when weighing less than 55 pounds including payload and the equipment used to secure the payload. Proposed operations of any other aircraft will require a new petition or a petition to amend this grant.

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

3. The UA must be operated at an altitude of no more than 400 feet above ground level (AGL). Altitude must be reported in feet AGL. This limitation is in addition to any altitude restrictions that may be included in the applicable COA.

4. *Air Traffic Organization (ATO) Certificate of Waiver or Authorization (COA).* All operations must be conducted in accordance with an ATO-issued COA. The exemption holder must apply for a new or amended COA if it intends to conduct operations that cannot be conducted under the terms of the attached COA.

5. The PIC and any student manipulating the flight controls must have the capability to maintain visual line of sight (VLOS) at all times. This requires the PIC and any student manipulating the flight controls to be able to use human vision unaided by any device other than corrective lenses, as specified on that individual's FAA-issued airman medical certificate or valid U.S. driver's license issued by a state, the District of Columbia, Puerto Rico, a territory, a possession, or the Federal Government, to see the UA.

6. All operations must utilize a visual observer (VO). The UA must be operated within the visual line of sight (VLOS) of the VO at all times. The VO must use human vision unaided by any device other than corrective lenses to see the UA. The VO, the person

[4] The petitioner also proposed to operate the KSU Crow UAS and the UAV Factory Penguin B UAS. The FAA must conduct an assessment on these aircraft, which also includes a finding that the proposed UAS meet the conditions in Section 333 of Public Law 112−95. The analysis on the UAV Factory Penguin B UAS remains valid, pending FAA approval of the aircraft. When the FAA completes its review, we will proceed accordingly and no further action will be required by the petitioner.

manipulating the flight controls of the small UAS, and the PIC must be able to communicate verbally at all times. Electronic messaging or texting is not permitted during flight operations. The PIC must be designated before the flight and cannot transfer his or her designation for the duration of the flight. The PIC must ensure that the VO can perform the duties required of the VO. Students receiving instruction or observing an operation as part of their instruction may not serve as visual observers.

7. This exemption and all documents needed to operate the UAS and conduct its operations in accordance with the conditions and limitations stated in this exemption, are hereinafter referred to as the operating documents. The operating documents must be accessible during UAS operations and made available to the Administrator upon request. If a discrepancy exists between the conditions and limitations in this exemption, the applicable ATO-issued COA, and the procedures outlined in the operating documents, the most restrictive conditions, limitations, or procedures apply and must be followed. The operator may update or revise its operating documents as necessary. The operator is responsible for tracking revisions and presenting updated and revised documents to the Administrator or any law enforcement official upon request. The operator must also present updated and revised documents if it petitions for extension or amendment to this exemption. If the operator determines that any update or revision would affect the basis upon which the FAA granted this exemption, then the operator must petition for an amendment to its exemption. The FAA's UAS Integration Office may be contacted if questions arise regarding updates or revisions to the operating documents.

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

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

10. Prior to each flight, the PIC must conduct a pre-flight inspection and determine the UAS is in a condition for safe flight. The pre-flight inspection must account for all potential discrepancies, e.g. inoperable components, items, or equipment. If the

inspection reveals a condition that affects the safe operation of the UAS, the aircraft is prohibited from operating until the necessary maintenance has been performed and the UAS is found to be in a condition for safe flight.

11. The operator must follow the UAS manufacturer's maintenance, overhaul, replacement, inspection, and life limit requirements for the aircraft and aircraft components. Each UAS operated under this exemption must comply with all manufacturer safety bulletins.

12. *PIC certification:* Under this exemption, a PIC must hold either an airline transport, commercial, private, recreational, or sport pilot certificate. The PIC must also hold a current FAA airman medical certificate or a valid U.S. driver's license issued by a state, the District of Columbia, Puerto Rico, a territory, a possession, or the Federal government. The PIC must also meet the flight review requirements specified in 14 CFR § 61.56 in an aircraft in which the PIC is rated on his or her pilot certificate.

13. *PIC qualifications:* The PIC must demonstrate the ability to safely operate the UAS in a manner consistent with how it will be operated under this exemption, including evasive and emergency maneuvers and maintaining appropriate distances from persons, vessels, vehicles and structures before operating non-training, proficiency, or experience-building flights under this exemption. PIC qualification flight hours and currency may be logged in a manner consistent with 14 CFR § 61.51(b), however UAS pilots must not log this time in the same columns or categories as time accrued during manned flight. UAS flight time must not be recorded as part of total time.

14. *Training:* The operator may conduct training operations when the trainer/instructor is qualified as a PIC under this exemption and designated as PIC for the entire duration of the flight operation. Students/trainees are considered direct participants in the flight operation when manipulating the flight controls of a small UAS and are not required to hold any airman certificate. The student/trainees may be the manipulators of the controls; however, the PIC must directly supervise their conduct and the PIC must also have sufficient override capability to immediately take direct control of the small UAS and safely abort the operation if necessary, including taking any action necessary to ensure safety of other aircraft as well as persons and property on the ground in the event of unsafe maneuvers and/or emergencies for example landing in an empty area away from people and property.

    Under all training situations, the PIC is responsible for the safety of the operation. The PIC is also responsible for meeting all applicable conditions and limitations as

prescribed in this exemption and ATO-issued COA, and operating in accordance with the operating documents. All training operations must be conducted during dedicated training sessions and may or may not be for compensation or hire. The operation must be conducted with a VO who is not a student and not the PIC. The VO must maintain visual sight of the aircraft at all times during flight operations without distraction in accordance with the conditions and limitations below. Furthermore, the PIC must operate the UA not closer than 500 feet to any nonparticipating person without exception.

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

16. The UA may not 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.

17. For UAS operations where GPS signal is necessary to safely operate the UA, the PIC must immediately recover/land the UA upon loss of GPS signal.

18. If the PIC loses command or control link with the UA, the UA must follow a pre-determined route to either reestablish link or immediately recover or land.

19. The PIC must abort the flight operation if unpredicted circumstances or emergencies that could potentially degrade the safety of persons or property arise. The PIC must terminate flight operations without causing undue hazard to persons or property in the air or on the ground.

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

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

22. Documents used by the operator to ensure the safe operation and flight of the UAS and any documents required under 14 CFR §§ 91.9 and 91.203 must be available to the

PIC at the Ground Control Station of the UAS any time the aircraft is operating. These documents must be made available to the Administrator or any law enforcement official upon request.

23. The UA must remain clear and give way to all manned aircraft at all times.

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

25. All flight operations must be conducted at least 500 feet from all persons, vessels, vehicles, and structures unless when operating:
    a. *Over or near people directly participating in the operation.* People directly participating in the operation include the PIC, VO, the student manipulating the flight controls of the small UAS, and other consenting personnel that are directly participating in the safe operation of the UA.
    b. *Near but not over students who are not manipulating the flight controls of the small UAS.* These students must be briefed on the potential risks and acknowledge and consent to those risks. Operators must notify the local Flight Standards District Office (FSDO) with a plan of activities at least 24 hours prior to flight operations.
    c. *Near nonparticipating persons:* Except as provided in subsections (a) and (b) of this section, a UA may only be operated closer than 500 feet to a person when barriers or structures are present that sufficiently protect that person from the UA and/or debris or hazardous materials such as fuel or chemicals in the event of an accident. Under these conditions, the operator must ensure that the person remains under such protection for the duration of the operation. If a situation arises where the person leaves such protection and is within 500 feet of the UA, flight operations must cease immediately in a manner that does not cause undue hazard to persons.
    d. *Near vessels, vehicles and structures.* Prior to conducting operations the operator must obtain permission from a person with the legal authority over any vessels, vehicles or structures that will be within 500 feet of the UA during operations. The PIC must make a safety assessment of the risk of operating closer to those objects and determined that it does not present an undue hazard.

26. All operations shall be conducted over private or controlled-access property with permission from a person with legal authority to grant access. Permission will be obtained for each flight to be conducted.

27. 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 within 24 hours. Accidents must be reported to

the National Transportation Safety Board (NTSB) in accordance with its UAS accident reporting requirements.

28. The operator must have an operations manual that contains at least the following items, although it is not restricted to these items.
    a. Operator name, address, and telephone number.
    b. Distribution and Revision. Procedures for revising and distributing the operations manual to ensure that it is kept current. Revisions must comply with the applicable conditions and limitations in this exemption.
    c. Persons Authorized. Specify criteria for designating individuals as essential personnel. The operations manual must include procedures to ensure that all operations are conducted at distances from persons in accordance with the conditions and limitations of the exemption.
    d. Plan of Activities. The operations manual must include procedures for the submission of a written plan of activities.
    e. Permission to Operate. The operations manual shall specify requirements and procedures that the operator will use to obtain permission to operate over property or near vessels, vehicles, and structures in accordance with this exemption.
    f. Security. The manual must specify the method of security that will be used to ensure the safety of nonparticipating persons. This should also include procedures that will be used to stop activities when unauthorized persons, vehicles, or aircraft enter the operations area, or for any other reason, in the interest of safety.
    g. Briefing of essential personnel and all other participating persons. Procedures must be included to brief personnel and participating persons on the risks involved, emergency procedures, and safeguards to be followed during the operation.
    h. Essential Flight Personnel Minimum Requirements. In accordance with this exemption, the operator must specify the minimum requirements for all essential flight personnel in the operating manual. The PIC at a minimum will be required to meet the certification standards specified in this exemption.
    i. Communications. The operations manual must contain procedures to provide communications capability with participants during the operation. The operator can use oral, visual, or radio communications as along as the participants are apprised of the current status of the operation.
    j. Accident Notification. The operations manual must contain procedures for notification and reporting of accidents in accordance with this exemption.

    In accordance with this exemption, the operating manual and all other operating documents must be accessible to the PIC during UAS operations.

29. At least 24 hours prior to operations, the operator must submit a written Plan of Activities to the local Flight Standards District Office having jurisdiction over the proposed operating area.

    The Plan of Activities must include at least the following:

    a. Dates and times for all flights. For seasonal or long-term operations, this can include the beginning and end dates of the timeframe, the approximate frequency (e.g. daily, every weekend, etc.), and what times of the day operations will occur. A new plan of activities must be submitted prior to each season or period of operations.
    b. Name and phone number of the on-site person responsible for the operation.
    c. Make, model, and serial or N-Number of each UAS to be used.
    d. Name and certificate number of each UAS PIC involved in the operations.
    e. A statement that the operator has obtained permission from property owners. Upon request, the operator will make available a list of those who gave permission.
    f. Signature of exemption holder or representative stating the plan is accurate.
    g. A description of the flight activity, including maps or diagrams of the area over which operations will be conducted and the altitudes essential to accomplish the operation.

    In accordance with this exemption, the Plan of Activities and all other operating documents must be accessible to the PIC during UAS operations. A new Plan of Activities must be submitted should there be any changes to items (a) through (g).

Unless otherwise specified in this 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 October 31, 2017, unless sooner superseded or rescinded.

Issued in Washington, DC, on November 20, 2015.

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

Enclosure