October 9, 2014

U.S. Department of Transportation
Docket Management System
1200 New Jersey Avenue, S.E.
Washington, D.C. 20590

Re: Petition of Southern Company Services, Inc. for an Exemption Pursuant to Section 333 of the FAA Modernization and Reform Act of 2012

Dear Sir or Madam:

Pursuant to section 333 of the FAA Modernization and Reform Act of 2012 (the "FMRA"), 49 U.S.C. § 44701 and 14 C.F.R. Part 11, Southern Company Services, Inc. ("Southern Company Services" or "Petitioner"), a subsidiary of The Southern Company ("Southern"), hereby requests an exemption to permit limited small unmanned aircraft system ("sUAS") operations as described herein. Southern Company Services requests the exemption in order to conduct research on the applicability of sUAS when assessing damage to power lines due to storm events and performing routine power line inspection.

sUAS operations have the potential to assist utilities in providing safer and faster alternatives to manned ground and aerial inspections, and to increase customer benefits. Petitioner requests an exemption in order to conduct research on the application of sUAS in the power industry and to investigate the benefits of such technology compared to manned ground and aerial inspections. Petitioner will investigate benefits for various sUAS applications and evaluate the extent to which its customers could benefit through better service. Through its research, Petitioner will be in a position to establish best practices for using and operating sUAS within the power industry and share that information with the Department of Transportation (the "Department"), the Federal Aviation Administration ("FAA") and other industry members.

As described in detail below, Petitioner's proposed sUAS operations are in accordance with the principles and the requirements set forth at section 333 of the FMRA. They will also help implement the Department's and the FAA's policy to leverage authority granted under Section 333 for authorizing safe, civil operations of sUAS in the national airspace system ("NAS").

Southern Company Services' proposed operations will also meet strict safety requirements. They will only take place in a privately owned, remote location, involve trained

THOMPSON HINE LLP
ATTORNEYS AT LAW
1919 M Street, N.W.
Suite 700
Washington, D.C. 20036-3537
www.ThompsonHine.com
Phone: 202.331.8800
Fax: 202.331.8330

pilots, occur at low altitudes, last for limited time periods and use sUAS weighing less than 10 pounds, far less than the FMRA's cut-off weight of 55 pounds to qualify as sUAS.[1] Reliance on sUAS would vastly reduce risks to crews responsible for power line inspections and significantly hasten power restoration in the event of storms, hurricanes, tornadoes and other weather events occurring in the southeast region of the United States. Southern Company Services' proposed operations will not have an impact on any citizen's privacy rights and will be in compliance with all privacy laws. In this regard, granting Southern Company Services' exemption request would be in the public interest.

[1] *See* FMRA, Pub. L. No. 112-95, § 331(6), 126 Stat. 11, 72. (2012) (stating that "[t]he term 'small unmanned aircraft' means an unmanned aircraft weighing less than 55 pounds").

Contents

I. Description of The Southern Company and Southern Company Services, Inc.

A. The Southern Company

Southern is a leading U.S. producer of clean, safe, reliable and affordable electricity. It owns electric utilities in four states (Alabama Power, Georgia Power, Gulf Power, and Mississippi Power), as well as a competitive generation company, Southern Power. Southern also owns a licensed operator of three nuclear generating plants, Southern Nuclear, as well as fiber optics and wireless communications entities—Southern Telecom and SouthernLINC Wireless. Southern brands are known for energy innovation, excellent customer service, high reliability and retail electric prices that are below the national average. With 4.4 million customers, over 100,000 miles of medium voltage power lines and nearly 46,000 megawatts of generating capacity, Southern is the premier energy company serving the Southeast.

Southern has been recognized by the U.S. Department of Defense and G.I. Jobs magazine as a top military employer and listed by DiversityInc as a top company for Blacks. The company received the 2012 Edison Award from the Edison Electric Institute for its leadership in new nuclear development, was named Platts' 2011 Power Company of the Year and is continually ranked among the top utilities in Fortune's annual World's Most Admired Electric and Gas Utility rankings.

B. Southern Company Services, Inc.

Southern Company Services, with offices in Birmingham, Alabama, is a shared services organization of Southern. As such, Southern Company Services provides administrative and operational services and support to Southern subsidiaries. Southern Company Services also provides engineering services to Southern subsidiaries.

One of Southern Company Services' areas of support is research and development. It is through its Research and Technology Management ("R&TM") office that Southern Company Services provides research and development services to Southern subsidiaries. Southern Company Services' R&TM will manage, coordinate and execute all sUAS activities for the other Southern subsidiaries in the geographic area designated in section III.C. of this petition. Southern Company Services, therefore, is the Petitioner requesting a section 333 exemption for limited sUAS operations as set forth herein.

The Petitioner's name and mailing address are:

Southern Company Services, Inc.
Attn: Dexter Lewis
600 North 18th Street, 14 N-8195,
Birmingham, AL 35203
Tel.: (205) 257-6854
Email: dlewis@southernco.com

All communications in connection with this petition should be sent to the undersigned and to the address listed above, to the attention of Mr. Dexter Lewis, who will be the point of contact at Southern Company Services.

II. Statutory and Regulatory Authority for Granting Petitioner's Request for an Exemption

A. Section 333 of the FMRA

Section 333 of the FMRA provides that

> The Secretary of Transportation *shall* determine if certain unmanned aircraft systems may operate safely in the national airspace system before completion of the plan and rulemaking required by section 332 of this Act or the guidance required by section 334 of this Act.[2]

Section 333 also states:

> If the Secretary determines under this section that certain unmanned aircraft systems may operate safely in the national airspace system, the Secretary *shall* establish requirements for the safe operation of such aircraft systems in the national airspace system.[3]

Based on the plain language of the statute, the Secretary is required to determine whether certain UAS operations should be permitted before issuance of the sUAS regulations required under section 332 of the FMRA. If the Secretary determines that the operations are safe, the Secretary must decide what the requirements will be for such operations. In other words, the

[2] FMRA § 333(a) (emphasis added).

[3] FMRA § 333(c) (emphasis added).

Secretary is required to apply conditions for the safe operation of the sUAS in instances where the Secretary has determined that the system may operate safely in the NAS. The FAA has interpreted section 333, as a grant of limited statutory flexibility to expedite requirements for the safe operation of certain aircraft systems in the NAS.[4]

Section 333 further states that when the Secretary of Transportation makes a determination under subsection (a), the Secretary must consider which types of UAS would not create a hazard to others using the NAS or the public or pose a threat to national security. The Secretary is required to consider the following UAS specifications and operational factors:

- Size.
- Weight.
- Speed.
- Operational capability.
- Proximity to airports and populated areas.
- Operation with visual line of sight.[5]

If, upon consideration of the factors enumerated above, the proposed sUAS operations do not pose a threat to others using the NAS or to national security, the Secretary, acting through the FAA, may approve the proposed operations. As shown below, Southern Company Service's proposed sUAS operations will in no way create a hazard to the NAS or pose a threat to national security based on the factors set forth at section 333.

B. 49 U.S.C. Sections 40109 and 44701

Section 44701 requires the FAA Administrator to promote safe flight of civil aircraft by prescribing standards for aircraft and aircraft parts, inspecting, servicing and overhauling aircraft, maximum hours for airmen, and other practices or procedures necessary for safety and national security.[6] However, subsection (f) states that the FAA Administrator "may grant an exemption

[4] *See* FAA, Section 333, https://www.faa.gov/uas/legislative_programs/section_333/ (last visited Oct. 2, 2014).

[5] FMRA § 333(b)(1).

[6] 49 U.S.C. § 44701(a)-(b) (2014).

from a requirement of a regulation prescribed under subsection (a) or (b) of this section or any of sections 44702-44716 of this title, if the Administrator finds the exemption is in the public interest."[7] In addition, Section 40109 authorizes the Administrator to "grant an exemption from a [safety] regulation prescribed in carrying out sections 40103(b)(1) and (2), 40119, 44901, 44903, 44906, and 44935-44937 of [49 U.S.C.] when the Administrator decides the exemption is in the public interest."[8] Consequently, under the plain language of pertinent U.S. aviation law, the Administrator is expressly authorized to grant exemptions from the FAA's safety regulations where it would be in the public interest. As set forth in further detail below, granting Southern Company Services' petition for an exemption would be in the public interest.[9]

C. 14 C.F.R. Part 11

The FAA's regulations state that, using a petition for exemption, an entity may ask FAA to grant it relief from current regulations in title 14 of the Code of Federal Regulations.[10] 14 C.F.R. Part 11 provides the bases for requesting exemptions. The petitioner is required to state (1) the specific sections of Title 14 from which it seeks an exemption, (2) the extent of relief it seeks and (3) the reasons why granting the request would be in the public interest and would not adversely affect safety (or how the exemption would provide a level of safety at least equal to that provided by the rule from which the petition seeks an exemption).[11] As set forth below, Petitioner has fulfilled each of these criteria by demonstrating that granting its exemption will serve the public interest and not adversely affect safety.

III. Southern Company Services' Proposed Operations

A. Proposed sUAS Platform

1. Southern Company Services will use a safe, proven sUAS platform

Petitioner seeks an exemption permitting operations of an Aeryon SkyRanger sUAS rotorcraft that weighs 6 pounds, including its imaging payload, to perform power line inspections

[7] 49 U.S.C. § 44701(f).

[8] 49 U.S.C. § 40109(b).

[9] *See* § V., *infra*.

[10] 14 C.F.R. § 11.61.

[11] 14 C.F.R. § 11.81. Additional, non-substantive content is required.

that consist of still photographs, video, and other data taken by onboard sensors. The SkyRanger produces high quality imagery and data that can be used independently—or in the case of surveying and modeling—can be combined to produce precision digital point clouds, triangle models, and contour maps of the surveyed area. Applications for these sUASs include inspection of sensitive infrastructure, including oil and gas pipelines and flare stacks, power lines and towers, wind turbines, and surveying tasks such as precision agriculture, mining, transportation, and forestry. Use of the SkyRanger for these inspection and surveying applications reduces the need to operate conventional aircraft, providing data more quickly, accurately, economically, and safely, with reduced environmental impact.

The SkyRanger is a safe, proven sUAS platform used by multiple governmental agencies. A critical element of this petition for an exemption is evidence of the Aeryon SkyRanger's airworthiness. Aeryon has demonstrated airworthiness of the SkyRanger through a history of authorized flight operations and successful flights, including many operations with public agencies. The list of authorized SkyRanger operators includes: Michigan State Police, US Navy Spawar, Mass Development (Joint Base Cape Cod), Unmanned Experts (NIJ Partnership), Western Washington University, Aetos (via Northwest Michigan College), University of Alaska Fairbanks, University of New Mexico, Kansas State University, and Virginia Tech University. The SkyRanger also successfully completed the Department of Homeland Security RAPS Trial in 2013.

In Canada, Aeryon has obtained 19 Special Flight Operations Certificates (SFOCs) from Transport Canada over 5 years and its customers have received multiple certificates to perform demonstration, research and development, and public and commercial operations. The SFOCs and the operations by numerous public entities in the United States demonstrate the SkyRanger's safety and fitness for operations proposed in this petition. The criteria set forth in the certificates demonstrate the device's safety and fitness for operation and ensure that the FAA has sufficient basis to evaluate the aircraft's safety.

The SkyRanger also has a significant set of automated features to ensure safe takeoff, flight, and landing in many conditions. Details on such features are set forth at Attachment 1 hereto and discussed below in this section III.A and section IV. (pertaining to an exemption from 14 C.F.R. §61.113). This information provides the FAA with more than a sufficient basis for concluding that this particular sUAS does not present a hazard to the NAS or persons or property on the ground.

2. Aircraft design and operational characteristics

The Aeryon SkyRanger is a 6-pound rotorcraft sUAS characterized by a high degree of pre-programmed control and various built-in technical capabilities that limit the potential for operation outside of the operating conditions set forth in section III.C. It has the capability to hover and move in the vertical and horizontal plane simultaneously, and it provides many other built-in functional and safety features to assist the operator with safe and reliable operations.

The flight control system of the Aeryon SkyRanger contains two semi-autonomous flight modes that use a point-and-click map and video interface and a manual override mode. Under semi-autonomous modes, which are the primary modes for flight control, the operator exercises control by clicking the on a map the points to which the aircraft should fly or programming a flight plan comprising a series of waypoints or a grid-based area into the flight control system and executing it. The flight control system relies upon the GPS for navigation and employs a variety of sensors, including sonar, barometric pressure, temperature, wind speed, and others to ensure high aircraft stability and flight control accuracy. Landing zones and flight areas may be designated to ensure that the SkyRanger operates only within user-specified flight parameters. At all times during flight, the operator can cancel the semi-autonomous flight modes and take immediate control of the aircraft.

The SkyRanger employs a robust slate of automated safety functions and safety enhancing features, including the following:

- Automated pre-flight system performance checks.
- Automated condition or fault detection, warnings, and pre-defined responses to a number of flight and system conditions, including:
    - High winds with system and user defined safety thresholds.
    - Low battery with system and user defined safety thresholds.
    - High temperature or other system safety thresholds.
    - Lost-link communication.
- Pre-defined response behavior including attempting to re-establish radio communication, return to home position and hover, return to home position and land, and land in current position.
- In the case of lost GPS capability, a manual user flight mode that allows the operator to provide manual navigation inputs to assist in landing the vehicle.

Attachment 1 contains additional specifications and information concerning the Aeryon SkyRanger. A confidential aircraft manual will be submitted as soon as possible under separate cover and with a request for confidential treatment.

3. Aircraft inspection and maintenance

Attachment 1 provides information on SkyRanger inspection and maintenance requirements and procedures. The SkyRanger is nearly maintenance free, is capable of evaluating its health and functionality, and requires inspection before flight and after contact with other objects.

B. Pilot and Observer Qualifications

The pilot in command ("PIC") of the SkyRanger will be an FAA licensed airman with at least a private pilot's certificate and current third-class medical certificate. Prior to flying the SkyRanger, a PIC must complete Aeryon's authorized training program for operation and maintenance of the SkyRanger sUAS.

The pilot and the visual observer will have been trained in general sUAS operations and received up-to-date information on the sUAS to be operated.

C. Scope of Operations

This section III.C identifies the standards under which Southern Company Services will operate the SkyRanger sUAS. At a minimum, Southern Company Services will operate the sUAS in conformance with the Model Aircraft Operating Standards set forth in Advisory Circular 91-57. The robust set of operating parameters described in this section ensures that Southern Company Services' proposed operation will "not create a hazard to users of the national airspace system or the public or pose a threat to national security."[12]

1. Geographic Location

Southern Company Services requests an exemption for sUAS operations and proposes training and research and development activities in a very limited geographical area. Petitioner initially proposes conducting sUAS operations within an existing power system training facility,

[12] *See* FMRA, Pub. L. No. 112-95, § 333(b), 126 Stat. 11, 72. (2012).

the Klondike Training Facility ("Training Facility"), which is located in Lithonia, Georgia.[13] The Training Facility is situated on private property owned by Georgia Power Company, a Southern subsidiary, is surrounded by a secure chain link fence, and remains closed to the public at all times. The Training Facility is also greater than five miles from any airport and located in class G Airspace. (*See* Figures 1 and 2, below.) Thus, the Training Facility meets the Class G airspace and 5 statute-mile airport-distance requirements that Congress adopted for sUAS operations by public safety agencies.[14]

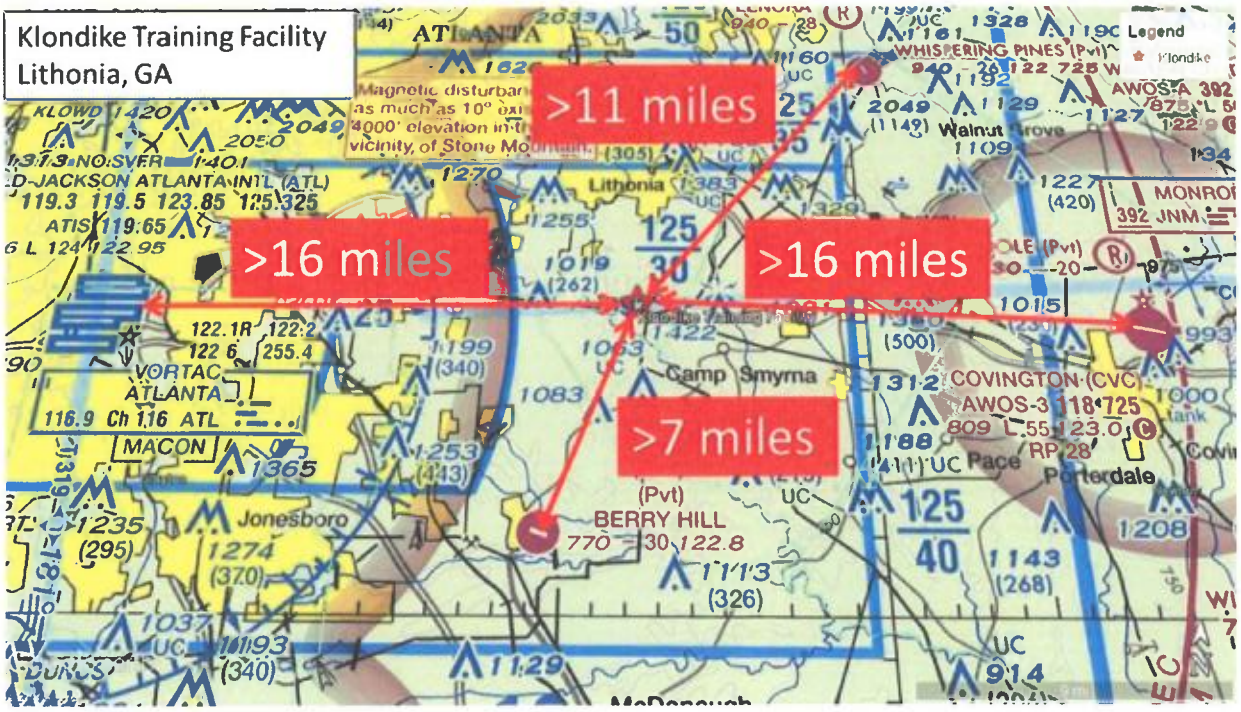

Figure 1. The Training Facility is greater than 5 miles from any airport. This figure is difficult to read, but the distances are as follows: greater than 16 miles from ATL, greater than 7 miles from Berry Hill, greater than 16 miles from Covington, and greater than 11 miles from Whispering Pines.

[13] Southern Company Services may request COAs for additional locations in the future.

[14] FMRA § 334(c)(2)(C).

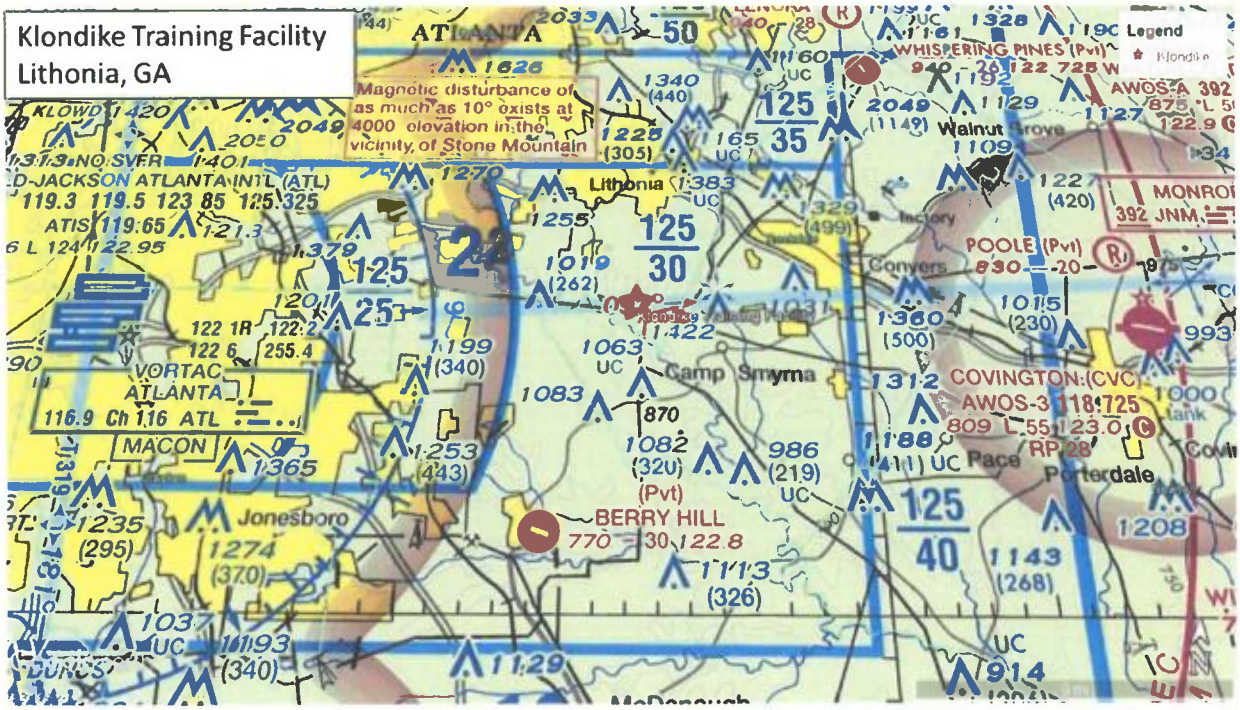

Figure 2. The Training Facility, as shown by the red star, is below ATL Class B airspace, which starts at 3,000 feet AGL, far above the altitude of Southern Company Services' proposed operations. Class G is from the surface to 1200 feet AGL. Operations below 400 feet AGL will be in class G airspace.

The Training Facility has multiple "training yards" with non-energized poles and wires that will be used to train field crew personnel. This infrastructure will serve as the perfect training facility for pilots learning to assess pole and line damage. Specific location details of the Klondike Training Site are shown in Figure 3 below.

Figure 3. Training Facility site in Lithonia, GA. The different colors represent different training yards for the Training Facility. There are two Distribution training areas, two Transmission training areas, and one pole yard.

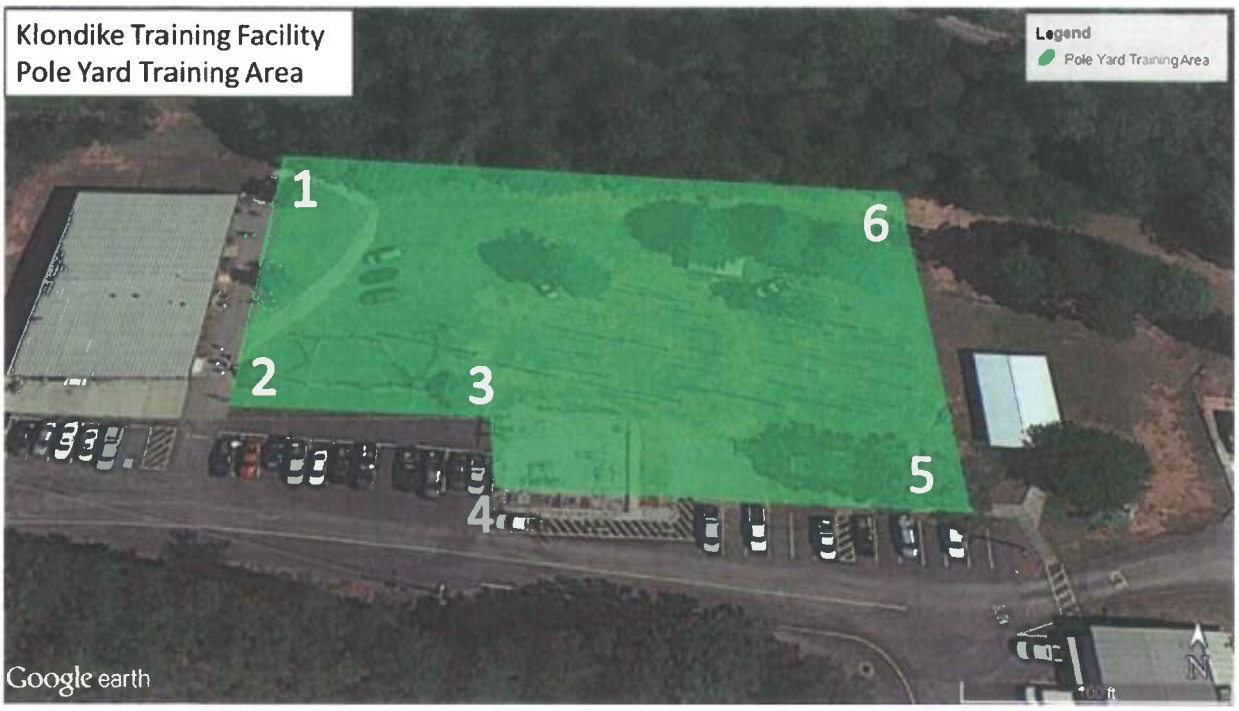

Figure 4. Pole Yard Training Area

As shown in Figure 4, above, the Training Facility comprises an open area with multiple power poles. This section of the Training Facility is known as the Pole Yard Training Area. This area would serve as the first training area for the Aeryon SkyRanger. The poles represent vertical infrastructure that a pilot must avoid. Flights will not occur over the adjacent parking lot.

Table 1. Location specific information on the Pole Yard Training Area.

Point	GPS Coords	Length Segment	Length (feet)
1	33.639582,-84.126115	1-2	136
2	33.639222,-84.126111	2-3	107
3	33.639221,-84.125756	3-4	30
4	33.639096,-84.125749	4-5	189
5	33.639099,-84.125091	5-6	170
6	33.639559,-84.125195	6-1	300

Further, in Figure 5, below, is the area within the Training Facility known as Transmission Training Area 1. This area consists of large de-energized equipment used for training. This area will be used for applications training required for transmission line structures.

Figure 5. Transmission Training Area 1

Table 2. Location specific information on Transmission Training Area 1.

Point	GPS Coords	Length Segment	Length (feet)
1	33.636143,-84.126646	1-2	273
2	33.635645,-84.126086	2-3	380
3	33.635557,-84.124828	3-4	190
4	33.636121,-84.124814	4-1	577

Further, in Figure 6, below, is the area within the Training Facility known as Transmission Training Area 2. This includes a test line that contains multiple types of structures used for training. This area will be used for applications training required for transmission lines.

Figure 6. Transmission Training Area 2

Table 3. Location specific information on Transmission Training Area 2.

Point	GPS Coords	Length Segment	Length (feet)
1	33.635235,-84.122652	1-2	213
2	33.634857,-84.122548	2-3	1,083
3	33.636529,-84.120837	3-4	400
4	33.637013,-84.121665	4-5	394
5	33.636047,-84.121789	5-1	424

Figure 7, below, depicts the area within the Training Facility known as Distribution Training Area 1. This is a distribution test line that contains multiple, installed pieces of distribution equipment. This area will allow a pilot to perform visual inspection on specific distribution equipment.

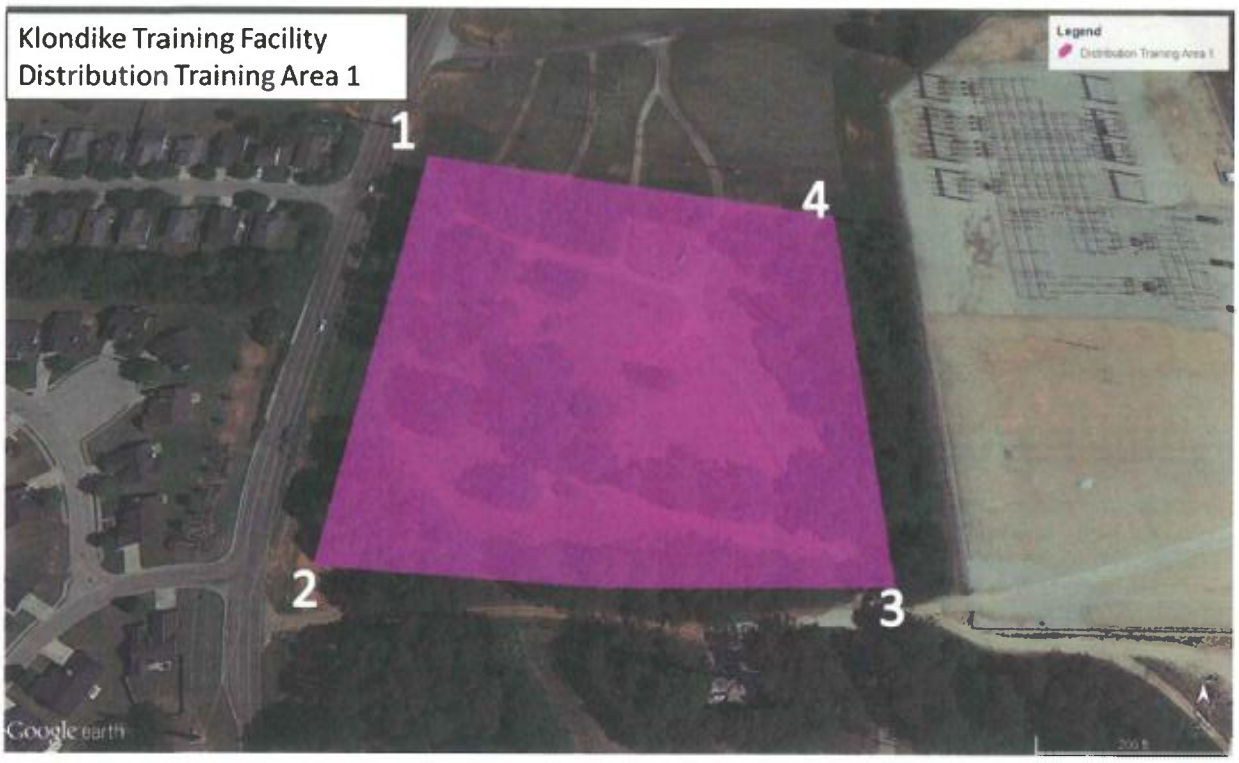

Figure 7. Distribution Training Area 1

Table 4. Location specific information on Distribution Training Area 1.

Point	GPS Coords	Length Segment	Length (feet)
1	33.637941,-84.129277	1-2	550
2	33.636295,-84.129449	2-3	623
3	33.636328,-84.127293	3-4	497
4	33.637757,-84.127266	4-5	540

Further, in Figure 8, below, is the area within the Training Facility known as Distribution Training Area 2. This test line crosses back and forth to represent a long distribution line. This area will be used for applications training required for distribution lines.

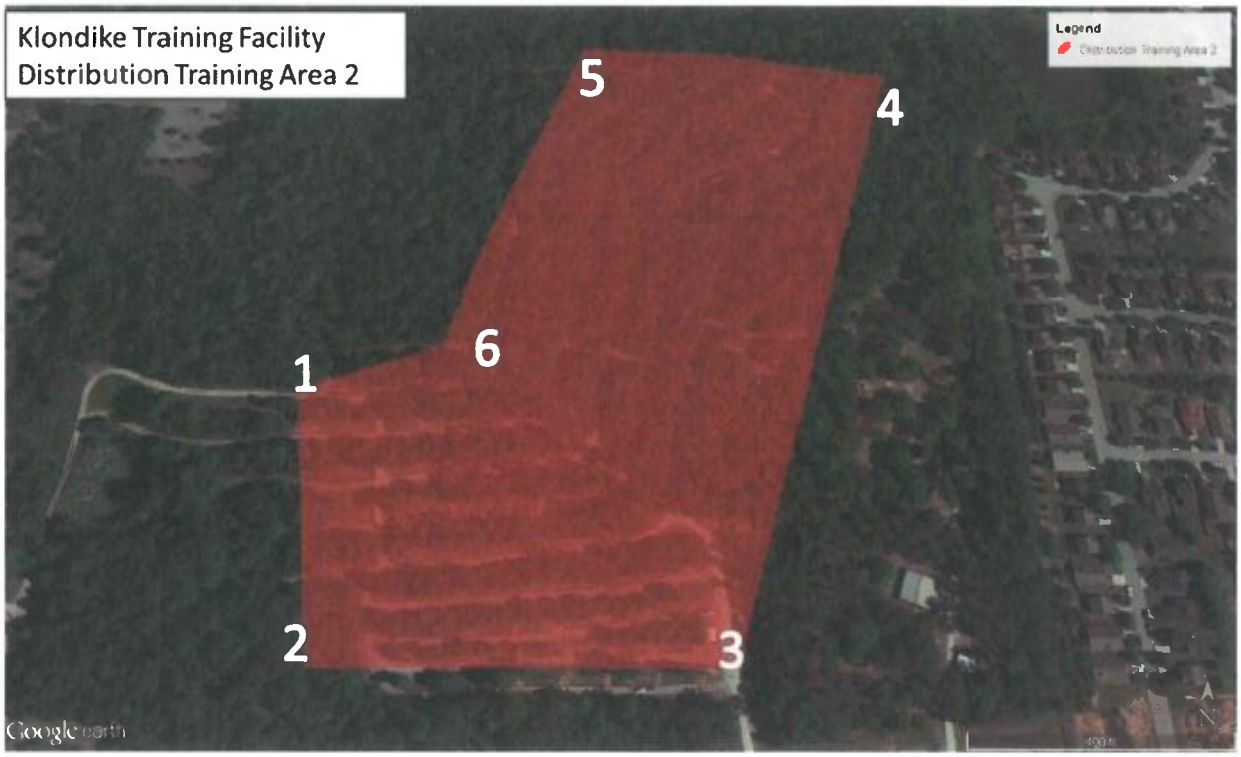

Figure 8. Distribution Training Area 2

Table 5. Location specific information on Distribution Training Area 2.

Point	GPS Coords	Length Segment	Length (feet)
1	33.641214,-84.125662	1-2	475
2	33.639955,-84.125512	2-3	650
3	33.640008,-84.123183	3-4	1,293
4	33.643322,-84.121875	4-5	640
5	33.643465,-84.124192	5-6	777
6	33.641607,-84.124739	6-1	250

As set forth in section 334(c) of the FMRA and shown above, the Training Facility's location meets the same statutory requirements that Congress adopted for sUAS operations to be conducted by public safety agencies. Specifically, it is within Class G airspace and outside of 5 statute miles from any airport.[15]

Further, as shown above, safe sUAS demonstrations can be coordinated at the Training Facility to research the use of sUAS for different applications within the power generation and transmission industry.

2. Flight Conditions

In addition to operations within a limited geographic location only, Southern Company Services proposes sUAS operations under the conditions described below. These conditions will ensure that such operations will not adversely affect safety in the NAS and will provide a level of safety at least equal to that provided by each rule from which Petitioner seeks an exemption:

(1) The sUAS will weigh less than 10 lbs.

(2) All flights will be operated within visual line of sight of the PIC and at least one observer.

(3) Flights will be operated within the Training Facility boundaries, as described in section III.C.1. Additional COAs will be requested for any training and research and development operations outside of the Training Facility.

(4) All flights will be operated at an altitude of 400 feet or less AGL and in Class G airspace.

(5) The sUAS will not be operated above 50 knots.

(6) All flights will be operated during daylight hours.

(7) All flights will be operated at least 5 miles away from any non-private airport.

(8) No sUAS activity will be conducted above any public passible roads, highways, interstates, or other public transportation rights of way unless traffic is restricted.

(9) The minimum crew for each flight will consist of the sUAS pilot and a visual observer.

(10) A safety briefing will be conducted before each flight, and it will identify adverse weather, the proposed flight path, the boundaries of the flight area, and any relevant hazards to the flight.

(11) The operator will obtain the consent of all persons involved in the research and ensure that only consenting persons will be allowed within 100 feet of the flight operation.

(12) The visual observer and the pilot will at all times be able to communicate by voice and/or radio.

(13) The maximum total flight time for each flight will only be 40 minutes or at such time as the sUAS reaches 20% battery power reserve, whichever is shorter.

(14) Southern Company Services will not perform sUAS services for any organizations other than Southern and its operating subsidiaries.

Southern Company Services notes that the FAA has found that safety factors permit sUAS flights by operators when the mandatory operating conditions specified above were present.[16]

IV. Regulations from which Exemption is Requested

Petitioner requests an exemption from relevant provisions governing aircraft operations within Title 14 of the Code of Federal Regulations in order to conduct research on the applicability of sUAS when assessing damage to power lines due to storm events and conducting routine power line inspection. Exemptions are requested from provisions within Parts 21, 45, 47, 49, 61 and 91 of Title 14. Petitioner addresses each relevant regulation below and provides a

[16] *See* Federal Aviation Administration, Notice N-8900.227, Unmanned Aircraft Systems (UAS) Operational Approval, at 20-21 (July 30, 2013).

basis for requesting an exemption. Petitioner also provides the basis for achieving a level of safety that is either equal to, or greater than, the level of safety provided by the regulation from which an exemption is requested. In this regard, Southern Company Services meets the requirements at Part 11 for exemptions, and, as set forth at section V., below, granting these exemptions are in the public interest as required under 49 U.S.C. section 44701(f).

14 C.F.R. Part 21 (Aircraft Certification).

14 C.F.R. Part 21, Subpart H sets forth requirements for airworthiness certificates as required by 14 C.F.R. § 91.203(a)(1). As explained above at section III.A, the SkyRanger's airworthiness has been proven. Further, given the size of the aircraft, relatively low speed for operation, proposed limited location for flights in the Training Facility, and the previous COAs issued, an exemption from Subpart H meets the equivalent level of safety under section 333 of the FMRA and 14 C.F.R. Part 11, especially in light of the restrictive conditions proposed in this petition. The operations proposed in this petition will be as safe as, if not more safe than, operations involving manned aircraft or rotorcraft operating with an airworthiness certificate and without the restrictions that Petitioner has proposed in this petition.

14 C.F.R. Part 45, subpart C and 14 C.F.R. 91.9 (Aircraft Marking).

Section 45.23 provides:

> (a) Each operator of an aircraft must display on that aircraft marks consisting of the Roman capital letter "N" (denoting United States registration) followed by the registration number of the aircraft. Each suffix letter used in the marks displayed must also be a Roman capital letter.
>
> (b) 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 91.9(c) provides:

> No person may operate a U.S.-registered civil aircraft unless that aircraft is identified in accordance with part 45 of this chapter.

The SkyRanger has no cabin, cockpit or pilot station, and, therefore, no entrance to any of these areas, on which the markings can be placed. Given the size of the sUAS, two-inch lettering will be impossible. The SkyRanger is currently marked with a fixed label stating "Aeryon Labs SkyRanger" that measures 1.5" x 0.5", as well as a serial number located under the removable camera payload. Southern Company Services is prepared to mark the sUAS with its name and location (or origin) and fulfill any other request by the FAA concerning this issue in accordance with section 45.29(f) where the pilot, observer, and others working with the sUAS will see its identification.

The FAA has previously issued exemptions to this regulation.[17]

14 C.F.R. Part 47 (Aircraft Registration) and Part 49 (Recordation of Aircraft Title and Security Documents).

14 C.F.R. Part 47 sets forth various aircraft registration requirements. For example, section 47.3(b) states that no person may operate an aircraft eligible for registration unless the aircraft has been registered by its owner. 14 C.F.R. Part 49 requires recordation of any conveyances affecting title to, or interest in, aircraft.

Petitioner seeks an exemption from the registration requirements at Part 47 and the title recordation requirements of Part 49 on the grounds that the Aeryon SkyRanger will only be operated within the confines of the Training Facility and pursuant to the conditions proposed in this petition. Due to the limited nature of the flights proposed hereunder, registration and recordation of title and any security interests are not necessary to achieve an equivalent level of safety.

14 C.F.R. § 61.3(d) (Requirement of Certificate for Flight Instruction).

This regulation generally states that only those holding a flight instructor certificate issued under the FAA's regulations can give training required to qualify a person for solo flights. Aside from general training on the fundamentals of instruction, a person that possesses a flight instructor certificate is not especially qualified to provide the limited training on small *unmanned*

[17] *See, e.g.*, Exemption Nos. 8738, 10167, 10167A and 10700.

aircraft that would be necessary to qualify existing private pilots to fly the SkyRanger. First, to qualify for the certificate, a person must demonstrate an ability to instruct a person to fly a *manned* aircraft.[18] The training needed to operate the SkyRanger, however, is less rigorous than that required for manned aircraft; because of the SkyRanger's automation, the skills necessary to safely operate a manned aircraft are unnecessary for operating the SkyRanger. Second, the training necessary to conduct the proposed sUAS operations would be given to private pilots who already possess adequate aeronautical knowledge to operate sUAS. Third, qualified instructors will provide only the highest level of flight instruction. This level of training is equivalent to that required under the instruction certification requirements at 14 C.F.R. § 61.3(d). An exemption from that provision is thus appropriate.

14 C.F.R. § 61.31(d)(2) (Aircraft category, class, and type ratings).

This provision requires the pilot in command of an aircraft to possess an appropriate category and class rating for the aircraft. In other words, it limits pilots to the aircraft types and operations for which they are licensed (*e.g.*, airplane single engine land; instrument airplane). sUAS, however, are dissimilar from other categories and classes of aircraft for which pilots are rated. Indeed, the FAA does not issue licenses for pilots to fly sUAS. Thus, the existing category and class limitations do not apply to sUAS operations and exempting the SkyRanger pilots from the category and class requirement at section 61.31(d)(2) would not adversely impact safety. Moreover, the special training that the pilots will obtain under Petitioner's proposed operation, as explained below regarding section 61.113, will be rigorous, thorough, and more than sufficient to reach a level of safety that is equivalent to that achieved pursuant to section 61.31(d)(2) for manned aircraft, especially given the restrictive conditions for operations proposed hereunder and the limited geographic location for such flights in the Training Facility only. It is on these grounds that Petitioner respectfully requests an exemption from this provision.

14 C.F.R. § 61.113(a) & (b) (Private Pilot Restrictions on Compensation).

Section 61.113(a) and (b) prohibit private pilots from operating an aircraft for compensation or hire, with a few exceptions. To avoid this prohibition, a person must possess a commercial pilot certificate, which requires additional aeronautical knowledge and airmanship competency.[19] This additional competency is unnecessary, however, to operate the SkyRanger

[18] *See, e.g.*, 14 C.F.R. § 61.187(b)(1)(iv) (requiring proficiency in providing a preflight lesson a maneuver "to be performed in flight"); 14 C.F.R. § 61.195(g) ("a flight instructor must perform all training from *in* an aircraft that meets the following requirements . . . .") (emphasis added).

[19] 14 C.F.R. §61.133(a).

in the proposed limited operations with the SkyRanger-specific training that each sUAS pilot will obtain.[20] Moreover, unlike a conventional aircraft that carries a pilot, passengers, and cargo, the SkyRanger in this case is remotely controlled with no passengers or property of others on board. Commercial pilot certification is also unnecessary because of the characteristics of the SkyRanger and the location for the proposed operations. Aeryon's SkyRanger has a high degree of pre-programmed control and various built-in technical capabilities that strictly limit the potential for operation outside of the operating conditions and geographic location proposed in this petition.

The SkyRanger has an all-digital software platform with advanced features previously restricted to full size unmanned aircraft. Automated features and advanced fly-safe controls enable safe, reliable operation, as well as advanced networking capabilities and system extensibility:

- Plan your flight or fly ad-hoc: The system can autonomously fly a programmed flight path or fly in manual mode

- Smart batteries and charger: Flight time and battery minutes are displayed at all times. The system will return home and land automatically if user-configurable limits are reached.

Flight safety is a priority, no matter the operating environment or project. The SkyRanger offers superior safety over manned aircraft by removing the need for people to be onboard in potentially dangerous situations. With multiple built-in safety features, the Aeryon platform leads other sUAS with respect to safety:

- Intelligent fault handling: The system automatically detects potential issues—with configurable automated response behavior such as a return-home-and-land routine

- Automatic pre-flight checks: The system self-calibrates all of its sensors and performs self-tests prior to takeoff to check for errors

- No-fly zones: The system has the ability to set up visual no-fly zones

[20] *See In re Astraeus Aerial*, FAA-2014-0352, slip op. at 15-18 (Sept 25, 2014) (granting an exemption from 14 C.F.R. §§61.113(a)&(b) for sUAS operations because private pilot aeronautical knowledge is sufficient and the additional airmanship skills of a commercial pilot do not necessarily provide an advantage in limited sUAS operations).

- Self-monitoring: Monitoring battery levels, in-flight wind speeds, and other system and environmental conditions are automatically handled by the system

- Battery communication: Battery minutes and flight time are displayed at all times. The system will return home and land automatically if user-configurable limits are reached.

Additional automated safety functions and safety enhancing features of the SkyRanger include the following:

- Auto detection of lost GPS warns the pilot and initiates an immediate landing.

- Low battery on the SkyRanger triggers a Non-Fatal Warning alarm to return home, land and replace the battery

- Very low battery on the SkyRanger triggers a Fatal Error alarm and initiates an emergency high speed descent landing.

- If the SkyRanger detects a lost-link to the base station the vehicle will perform its pre-defined Non-Fatal Condition Response.

Given Petitioner's proposed conditions and restrictions, and given the SkyRanger's safety features, an equivalent level of safety will be attained by allowing operation of the SkyRanger with a private pilot's certificate, not a commercial pilot's certificate, under the conditions set forth herein.

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

14 C.F.R. § 91.7(a) (Airworthiness Requirement).

This regulation states that no person may operate a civil aircraft unless it is in an airworthy condition. As explained above at section III.A, the SkyRanger's airworthiness has been proven. Further, given the size of the aircraft, proposed limited location for operations, and

the previous COAs issued, an equivalent level of safety will be achieved under the restrictive conditions proposed in this petition.

14 C.F.R. § 91.9(b)(2) (Flight Manual on Aircraft).

This regulation provides:

> No person may operate a U.S.-registered civil aircraft ...
>
> (2) For which an Airplane or Rotorcraft Flight Manual is not required by §21.5 of this chapter, unless there is available in the aircraft a current approved airplane or Rotorcraft Flight Manual, approved manual material, markings, and placards, or any combination thereof.

Given the size and configuration of the SkyRanger, it has no ability or place to carry such a flight manual on the aircraft. Nor is there any pilot on board. The equivalent level of safety will be achieved by keeping the flight manual at the ground control point where the pilot flying the sUAS will have immediate access to it. As mentioned above, the SkyRanger User Guide, or aircraft manual, will be provided under separate cover with a request for confidential treatment as soon as possible. The FAA has issued to others the following exemptions to this regulation: Exemption Nos. 8607, 8737, 8738, 9299, 9299A, 9565, 9565B, 10167, 10167A, 10602, and 10700.

14 C.F.R. § 91.105 (Crewmembers at Stations; Seatbelts).

Section 91.105 requires flight crew members to be at their stations with seatbelts fastened during landing and takeoff. The proposed operations do not involve flight crew members aboard the aircraft. An exemption from this provision is appropriate under the conditions proposed in this petition.

14 C.F.R. § 91.109 (Flight Instruction).

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

The SkyRanger is a remotely piloted aircraft, and, by design, does not have fully functional dual controls. Flight control is accomplished through the use of a control box that communicates with the aircraft via radio communications. The flight plan is either manually

controlled through point-and-click touchscreen navigation or pre-programmed as way points or an AutoGrid into the auto pilot before or during flight. Only in unusual circumstances will the pilot input control functions to alter the pre-programmed flight. Since instruction and training will be accomplished through a training program, an equivalent level of safety will be assured. Moreover, the instructor can easily assume control of the flight during training and instruction. The FAA has approved exemptions for flight training without fully functional dual controls for a number of aircraft and for flight instruction in experimental aircraft. (*See* Exemption Nos. 5778K and 9862A.) The equivalent level of safety will be achieved by the manufacturer providing the training and through the use of experienced and qualified pilots familiar with the SkyRanger.

14 C.F.R. § 91.119 (Minimum Safe Altitudes).

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

As set forth herein, the SkyRanger will never operate at higher than 400 feet AGL. Nor will flights occur outside the designated geographic locations. Thus, there will be no flights near persons, vehicles or vessels. Rather, flights will be conducted outside of congested or populated areas. However, because aerial survey and inspection work must be accomplished at relatively low altitudes and at altitudes less than 500 feet AGL and within 500 feet of structures, an exemption from Section 91.119(c) is needed.

An equivalent level of safety will be achieved given the size, weight, speed, and material with which the SkyRanger is built. It is also achieved through operations in the Training Facility, which is a very limited geographic area as described at Section III.C.1, above. Compared to current aerial survey operations conducted with aircraft or rotorcraft weighing far more than 6 lbs. and carrying flammable fuel, which are currently allowed at or below 500 feet AGL and within 500 feet of structures, the proposed SkyRanger operations will be far safer. Indeed, the low-altitude operations of the sUAS in the restricted geographic location will maintain separation between these sUAS operations and the operations of conventional aircraft that must comply with Section 91.119.

14 C.F.R. § 91.121 (Altimeter Settings).

14 C.F.R. § 91.121 requires persons operating aircraft to maintain certain cruising altitudes or flight levels by reference to an altimeter that is set "to the elevation of the departure

airport or an appropriate altimeter setting available before departure." Petitioner requests an exemption to this provision on the grounds that an equivalent level of safety, or greater, will be achieved by the Aeryon SkyRanger's use of a GPS system. The PIC will rely on the SkyRanger's GPS system in order to monitor the sUAS's altitude, thereby achieving an equivalent level of safety.

14 C.F.R. § 91.151 (Fuel Requirements).

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

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

An exemption from 14 C.F.R. § 91.151(a) would still result in safe operations and falls within the scope of a similar, prior exemption.[21] Operating the sUAS, without 30 minutes of reserve fuel does not engender the type of risks that Section 91.151(a) was meant to prevent given the size and speed at which the sUAS operates, and given the limited geographic location for operations proposed in this petition. The fact that it carries no pilot, passenger, or cargo also enhances its safety. Additionally, limiting SkyRanger flights to 20 minutes would greatly reduce their utility and require a greater length of time to accrue data and information from the research to be conducted. In the unlikely event that the SkyRanger should run out of fuel, it would simply land within the Training Facility. Given its weight and construction material, the risks are less than contemplated by the current regulation and an equivalent, if not greater, level of safety would be achieved under the conditions proposed in this petition.

An equivalent level of safety can be achieved by maintaining 10 minutes of reserve battery power, which would allow 40 minutes of flight time. The 10 minutes' worth of reserve battery power would be more than adequate to return the sUAS to its planned landing zone from anywhere in the Training Facility.

[21] *See* Exemption 10673 (allowing Lockheed Martin Corporation to operate without compliance with 91.151(a)).

The FAA has granted similar exemptions to others, including Exemptions 2689F, 5745, 10673 and 10808.

14 C.F.R. § 91.203(a) and (b) (Display of Certificates).

Sections 91.203(a) and (b)requires all civil aircraft to have within them airworthiness and registration certificates, which are displayed at the cabin or cockpit entrance. These requirements were designed for manned aircraft which have a cabin and cockpit. Given the size, of the SkyRanger and its lack of a cabin or cockpit, airworthiness and registration certificates cannot be contained in and displayed in the SkyRanger in accordance with section 91.203. Moreover, operation of the SkyRanger will be conducted pursuant to an exemption to the airworthiness and registration requirements. For these reasons, compliance with Sections 91.203(a) and (b) are unnecessary.

14 C.F.R. § 91.213 (Inoperative Instruments and Equipment).

This regulation prohibits taking off in an aircraft with inoperative instruments and equipment unless certain conditions are met. The SkyRanger operations proposed herein will be subject to restrictive conditions, occur within a restrictive area, and require extensive pre-flight checks and inspections. These conditions and requirements achieve the same, if not a greater, level of safety required under section 91.213.

14 C.F.R. §§ 91.405(a), (d); 91.407(a)(1); 91.409(a)(2); 91.417(a) and (b) (Maintenance Inspections and Placarding).

These regulations set forth various maintenance and inspection requirements and reference 14 C.F.R. Part 43. For example, section 91.405(a) requires that an aircraft operator or owner "shall have that aircraft inspected as prescribed in subpart E of this part and shall between required inspections, except as provided in paragraph (c) of this section, have discrepancies repaired as prescribed in part 43 of this chapter ...." Section 19.405(d) requires placards to be installed when discrepancies include inoperative instruments or equipment. Section 91.407 similarly makes reference to requirements in Part 43; Section 91.409(a)(2) requires an annual inspection for the issuance of an airworthiness certificate. Section 91.417(a) requires the owner or operator to keep records showing certain maintenance work that has been accomplished by certificated mechanics, under Part 43, or licensed pilots and records of approval of the aircraft for return to service.

The SkyRanger is nearly maintenance free. It performs automatic pre-flight checks and the failure of any check will prevent take-off. Pre-flight checks which cannot be performed by

the system will be performed by a qualified person prior to each flight and at predefined intervals as part of the Maintenance Schedule in the User Guide.

The pre-flight checklist includes:

1. Visual inspection of the airframe
2. Visual inspection of rotor integrity
3. Checking the charge of all batteries (aerial vehicle, command station, radio repeater station)

An equivalent level of safety will be achieved because the sUAS is small in size, will carry no external payload, will operate only in the Training Facility and is not a complex mechanical device. As provided in the Aeryon User Guide (System Maintenance section), the SkyRanger operator will ensure that the sUAS is in working order prior to initiating flight, perform required maintenance, and keep a log of any maintenance that is performed. Moreover, the operator is the person most familiar with the aircraft and is best suited to maintain the aircraft in an airworthy condition and to ensure an equivalent level of safety.

The SkyRanger's Maintenance guidelines ensure a level of safety equivalent to these maintenance and inspection requirements in Part 91. In addition, any component failure detectable by the system will be reported to the control station and will cause the sUAS to perform a Fatal Condition Response (FCR) or Non-Fatal Condition Response (NFCR), depending on the type of failure.

V. Granting Southern Company Services' Petition is in the Public Interest

Southern Company Services' proposed sUAS operations will accord significant benefits to the public, Southern Company customers, its employees, and to the industry. Through its proposed research and development operations, Petitioner will generate best practices that can be applied across the industry and throughout the United States. Southern Company Services' operations will help devise ways to restore power for consumers more quickly after storm events. The best practices developed from Petitioner's research will result in lower restoration and maintenance costs and help provide safer, more affordable and more reliable power to all consumers in the United States. Petitioner is willing to share information gathered from its research and development efforts with others for this purpose, including the FAA.

Southern Company Services' proposed sUAS operations will also enhance safety and reduce risk. Traditional inspections are conducted with helicopters and bucket trucks. Helicopters are noisy, consume expensive energy resources in the form of fuel and can be dangerous in that there is a risk of accidents which can result in significant damages to property as well as injuries and fatalities for the crew. Bucket trucks are large, invasive and not always helpful in attaining hard-to-reach areas, and, thus, can be dangerous for inspection crews as well.

In contrast, Petitioner's proposed operations would involve sUAS weighing less than 10 pounds, operated at a very low altitude—*i.e.* under 400 feet AGL—and at relatively low speeds. Petitioner's proposed operations do not involve the carriage of passengers or crew, and, thus, avoid risks involved with manned aircraft flights. Moreover, since Petitioner's sUAS will operate on battery power, the carriage and consumption of flammable fuels will not occur. Nor will fuel emissions. Petitioner's proposed operations will be significantly safer and more efficient than helicopters and bucket trucks.

Petitioner's proposed sUAS operations also fulfill Congress' objective in adopting section 333 of the FMRA, and FAA's policy, to expedite the integration of sUAS into the NAS and allow such operations where the FAA can determine that they will be accomplished without endangering others using the NAS or posing a risk to national security. As set forth above, Southern Company Services' operations will be conducted in accordance with strict conditions that ensure safety of the NAS and pose no threat to national security whatsoever.

VI. Privacy

Petitioner's proposed sUAS operations do not implicate any privacy concerns. All proposed sUAS training flights will be confined to the Training Facility, which is located on private property owned by Georgia Power Company, a Southern Company operating subsidiary. As shown in section III. C, above, the Training Facility is located far from residential areas and business centers. Moreover, the public is restricted from accessing the Training Facility. To the extent that Petitioner would seek additional COAs for training and research and development flights outside the Training Facility, the geographic area would be limited and public access will be restricted, thereby eliminating privacy concerns. In addition, Petitioner will remain in compliance with all applicable local, state and federal privacy laws.

VII. Federal Register Notice

Pursuant to 14 C.F.R. Part 11, Petitioner provides the following Federal Register notice in the event that the FAA determines that publication of such a notice will be required:

> Southern Company, through its subsidiary, Southern Company Services, Inc. (Southern Company Services) has filed a petition with the Federal Aviation Administration requesting an exemption from the following provisions in connection with operating a small unmanned aircraft system (sUAS) weighing 6 pounds: 14 CFR Part 21; 14 CFR Part 45, subpart C; 14 CFR Part 47; 14 CFR Part 49; 14 CFR § 61.3(d); 14 CFR § 61.31(d)(2); 14 CFR § 61.113(a), (b); 14 CFR § 91.7(a); 14 CFR § 91.9(b)(2);4 14 CFR § 91.105; 14 CFR § 91.109; 14 CFR § 91.119; 14 CFR § 91.121; 14 CFR § 91.151; 14 CFR § 91.203(a), (b); 14 CFR § 91.213; 14 CFR § 91.405(a), (d); 14 CFR § 91.407(a)(1); 14 CFR § 91.409; and 14 CFR § 91.417(a), (b).
>
> Southern Company Services' proposed sUAS operations will occur less than 400 feet above ground level, over five miles from any airport, and in areas where public access will be restricted. The purpose of the operations is to conduct research on the use of sUAS when inspecting power lines for damage, especially after storm events. Southern Company Services requests that its sUAS operations be subject to the conditions and safety standards that are as set forth in its petition in order to ensure a level of safety that is equivalent to, or higher than, the level attained through regulations listed above.

VIII. Summary

In accordance with the factors to be considered under section 333 of the FMRA, Petitioner's proposed operations will not endanger others using the NAS or pose a threat to national security. The SkyRanger's size and weight are quite small at only 6 pounds, and its speed is relatively low at 50 knots. The SkyRanger's operational capabilities are quite sophisticated with numerous safeguards. Since it is currently widely used under public Certificates of Authorization, the SkyRanger's airworthiness has been proven. At all times, the flights will be operated within the pilot's and the visual observer's lines of sight. Flights will also occur in a remote area far from any airport and populated areas. Since equivalent levels of

safety will be accomplished through the proposed conditions in this petition, exemptions from the regulatory provisions discussed above are appropriate.

IX. Request for Relief

Based on the foregoing, Petitioner hereby requests an exemption from the provisions discussed herein and such further relief that the Department deems appropriate for the operations proposed herein.

Respectfully submitted,

G. Brent Connor
Jason D. Tutrone
Thompson Hine LLP
Counsel for Southern Company Services, Inc.

Attachment

cc: James Williams
Robert Pappas

Petition of Southern Company Services, Inc.

ATTACHMENT 1

SMALL UNMANNED AERIAL SYSTEM DESCRIPTION

Aeryon Corporate Overview: Aeryon Labs, Inc. is a Canadian company located in Waterloo Ontario. Aeryon is focused on providing micro unmanned aerial systems and is globally recognized as the market and technology leader in this space. Key customers range from military organizations such as Canadian Special Operations and US Special Operations; key government agencies such as NOAA, Environment Canada and the US Coast Guard; world leading universities in the unmanned space such as University of Alaska Fairbanks and Kansas State University; police agencies such as the RCMP and OPP; and global enterprises such as BP, UK Power Networks and Fortune 500 companies in the chemical, oil/gas and security markets. Aeryon systems have accumulated over 5000 hours in global flight operations. This number does not include military flight hours which increase the numbers further.

Aeryon systems have a been approved by the FAA for research COAs and have a demonstrated safety track record. The Aeryon sUAS platforms were the first to officially fly at one of the FAA's UAS Test Sites (UAF Alaska). Many customers from military, to education to police and even commercial operations have been given approval to fly in US, Canada, UK, Australia, Japan, and others airspaces.

SkyRanger Overview: Aeryon unmanned systems have been used to fight terrorism in Iraq, Afghanistan and Nigeria, monitor hostile borders between Saudi Arabia and Yemen, ensure the safety of world leaders at the G50 Nuclear Summit in Seoul, escort a fuel tanker and ice breaker into a remote Alaskan community, monitor wildlife on the Aleutian Islands, map remote communities in South America, keep our highways clear and safe; and provide volumetric analysis for open pit mines.

The Aeryon SkyRanger can carry payloads of up to 600 g. The SkyRanger flies with a maximum wind threshold of 40 M.P.H. for sustained winds and wind gusts up to 55 M.P.H. What is unique about the Aeryon SkyRanger is the system automatically compensates for wind versus relying on the operator's 'sense of feel' for what the impact of the wind is at the altitude the system is flying. The end result is a system capable of gathering high quality aerial intelligence at much higher wind thresholds. A trait that is imperative for many aerial inspection operations.

The SkyRanger has an operational range of up to 3 km (1.6 NM) with the standard offering and up to 5 km (2.7 NM).

THOMPSON HINE LLP
ATTORNEYS AT LAW
1919 M Street, N.W.
Suite 700
Washington, D.C. 20036-3537
www.ThompsonHine.com
Phone: 202.331.8800
Fax: 202.331.8330

All flight operations are GPS controlled making the system extremely easy to navigate. At any point if the operator is not explicitly commanding the system to move, the system automatically holds its GPS position (*i.e.* GPS hold for reliable location hover). Camera positioning is also GPS controlled allowing for the most sophisticated camera targeting available. The flight control system employs not only GPS positioning but a variety of sensors including sonar, barometric pressure, temperature, wind speed and others to ensure the most stability of any system in its class-regardless of the wind.

The Aeryon SkyRanger can be operated in both semi and fully autonomous flight modes. Creating preplanned flight paths to fly in autonomous mode is as simple as clicking on the map to create a preplanned flight path. In semi-autonomous mode, the operator clicks on the map and the Aeryon SkyRanger automatically flies to the point on the map where the operator is pointing. Pre-mission waypoints, Landing zone points and flight area dimensions can all be entered during preflight ensuring the SkyRanger operates only within specified parameters.

The Aeryon SkyRanger includes many advanced safety features that make the SkyRanger the safest choice for both urban and non-urban environments. Built-in intelligent fault handling allows the SkyRanger to detect a system fault while in the air, and to automatically fly back to its take-off location and land. Faults that can be detected include: loss of communication; pre-set wind thresholds exceeded; and low battery levels. In addition, the operator can create no fly zones or maximum flight ranges and altitudes so the system cannot enter areas deemed unsafe or unnecessary to fly over. And before every take-off automated flight checks ensure the system is flight ready before it takes off.

The Aeryon SkyRanger can be operated entirely by a touch-screen, map based interface. This means The operator only needs to command the system where to go, and the system does all the flying for the operator. Maps can be saved and flight plans can be made or recalled with no internet connection required.

SkyRanger Operating Manual - System user manual available upon request.

Physical Characteristics

Measurements – 40" diameter deployed, 20x10" folded

Weight (without payload) – 2.4kg (5.3 lbs.)

Fuel – Lithium polymer batteries are self-contained high duration systems with "SMART" intelligence on-board. This includes cycle charge times, locations, GPS antenna, chemical management, and real-time data feeds to ensure maximum flight duration and sub-system safety processes. Charging is done in the included Aeryon Battery charger and can be charged via standard wall outlet, or via a vehicle.

Landing style/type – Autonomous vertical lift

Propulsion System

- Engines – The SkyRanger is powered by 4 electric brushless DC motors.
- Batteries – Lithium polymer batteries are self-contained high duration systems with SMART intelligence on-board. This includes cycle charge times, locations, GPS antenna, chemical management, and real-time data feeds to ensure maximum flight duration and sub-system safety processes. Charging is done in the included Aeryon Battery charger and can be charged via standard wall outlet, or via a vehicle.

Performance Characteristics

- Maximum Altitude – 1500 ft.
- Maximum Endurance – 50 minutes
- Maximum Range – 3 km
- Weather Minimums -
- Winds Maximum – 40 MPH sustained, 55 mph gusts
- Minimum ceiling: 500 ft.
- Minimum visibility: 1 SM
- Icing conditions – no icing conditions
- Precipitation – no visible moisture

Maintenance – The UAS is nearly maintenance free, it performs automatic pre-flight checks and the failure of any check will prevent take-off. Checks which cannot be done by the system will be performed by a qualified person prior to each flight.

Pre-flight checklist includes:

- Visual inspection of the airframe
- Visual inspections of rotor integrity
- Check charge of all batteries (aerial vehicle, command station, radio repeater station)

Reliability – The system is designed for maximum reliability and to maintain performance over its life. The only components that experience routine wear are rotors, batteries, motors, and legs. Battery and motor conditions are monitored by the system with deviations reported to the operator.

Contact with other objects during flight may cause other components, particularly rotors, and motor arms, to become damaged. Damaged components are likely to be detected during the full visual inspection of the airframe performed before each flight. Structural damage affecting flight characteristics will be detected by on-board sensors.

The UAV system detects numerous conditions which may make flying unsafe, such as reduced GPS accuracy, magnetic anomalies, low battery charge, battery cell imbalances, temperature fluctuations. Automatic pre-flight checks prevent the UAV from taking off if such conditions are present; or, if the condition is detected during flight, the system will trigger a Fatal Conditioned Response.

Fault Tolerance - The key feature of the UAV fault tolerance is its mechanical simplicity. It uses four fixed pitched rotors, each mounted on a separate motor. No control surfaces or other actuators are required for the UAS to fly. Any component failure detectable by the system will be reported to the control station and will cause the UAV to perform a Fatal Condition Response (FCR) or Non-Fatal Conditioned Response (NFCR), depending on the type of failure.

Command and Control Systems
The SkyRanger Ground Control station allows the operator simultaneous control over aircraft and payloads. The touch screen control allows for quick navigation and data entry while the display screen provides all essential flight data to the operator. Telemetry data is transmitted to the command station at least once per second.

Displayed on GCS:

- UAS Position
- Navigation Route
- UAS Tail Number
- UAS Position
- UAS Altitude
- UAS Heading
- North Seeking Arrow
- Range to Target
- Calculated target position

- Date/time
- Sensor heading and orientation relative to UAS

On-board Flight Instruments – The UAV is equipped with an Inertial Navigation System (3-axis gyroscope, 3-axis magnetometer, GPS receiver, and static pressure sensor) and a sonar sensor for precision AGL altitude measurement.

On–board computer systems – The UAS is equipped on-board computer systems to monitor (sensors, battery, etc.), control (speeds, altitude, position, etc.), and communicate (control, telemetry, etc.).

On-board guidance and navigation equipment – The UAS can operate autonomously; it does not require any input from ground-based equipment, or from the pilot to hover in place.

Frequency Allocations – 900 MHz, 2.4 GHz, 5.8 GHz, custom

Flight termination link – to prevent a "fly away" or other potentially dangerous situation a flight termination link is available to the operator at the GCS.

Takeoff and Landing – The SkyRanger has vertical lift autonomous launch and recovery. A Landing Zone "LZ" is designated by the operators and identified in the GCS software. For launch procedures the aircraft will takeoff and hover 3 meters directly above the LZ and hold until further operator instruction is given. The aircraft will automatically adjust for wind during this period.

Navigation System – Specific maps can be downloaded to the display screen (such as air sectional and geographic maps) which are overlaid with GPS positional data. Waypoints can be created before and during flight operation creating specific locations and sequences for the aircraft.

Redundant Systems – The UAS combines the input from a multitude of sensors. Even though the data from all sensors is required for optimal system performance, a single sensor malfunction is likely to result in degraded performance rather than leading to a catastrophic failure.

Emergency Procedures and System Failures
Failure Handling – The UAS has extensive failure detection and handling capabilities. All failures are deeded to be either fatal or non-fatal. Failures classified as fatal result in a Fatal

Condition Response (FCR); and failures classified as non-fatal result in a Non-Fatal Condition Response (NFCR).

Sensor Failure – Failure of on-board flight instruments/sensors will degrade the UAS performance and will result in either a FCR or a NFCR, depending on their severity. If the UAS becomes unstable due to sensor failure, it will stop all four motors and free fall to avoid a fly away condition.

Motor Failure – The UAS flight performance will degrade significantly if one or more motors fails.

Airframe Failure – If airframe is damaged in ways that impacts flight characteristics, the UAS will behave similar to if an on-board flight instrument failed.

Navigation System Failure – In a navigation system failure, degraded GPS will result in FCR or NFCR 's depending on failures.

Power Failure – A complete battery failure which results in power loss to the UAS will result in degraded flight performance.

Low Battery Condition – Operator will be alerted of a low battery condition and will land the aircraft as soon as able.

Low Battery Condition – Operator will be alerted of a low battery condition and will land the aircraft as soon as able.

Line-of-Sight Loss – All flight operations will be conducted with the UAS within visual sight of the pilot. If the pilot's view becomes obstructed and line-of-sight is lost, the pilot may instruct the UAS to hover in place until line-of-sight is reestablished, to return to the take-off position, or to land at the current position.

Security
The system and communication links are encrypted by the manufacturers proprietary software.