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January 21, 2015

Petition for Exemption under §333 of the FAA Modernization and Reform Act of 2012
Soar Environmental Consulting, Inc.

The Honorable Mr. Anthony Foxx
United States Secretary of Transportation
1200 New Jersey Ave, SE
Washington DC, 20590

Re: Exemption Request under §333 of the FAA Modernization and Reform Act of 2012 (Public Law 112-95) from 14 CFR 21; 14 CFR 36, 45.23; 45.27, 45.29; 61.113; 91.9(b)(2); 91.103(b); 119(c); 91.151(a); 91.203(a)&(b); 91.405(a); 91.407(a) (1); 91.409(a) (2); 91.417(a)&(b)

Dear Mr. Secretary,

In accordance with §333(c) of the Federal Aviation Administration Modernization and Reform Act of 2012, Soar Environmental Consulting, Inc. is requesting permission to use its Rotomotion SR-15 Unmanned Aircraft System (UAS) to perform inspections of hydroelectric system assets, specifically remote penstocks, flow lines, dams, and reservoirs; remote or impassable sections of natural gas and/or oil pipelines; and bridges supporting gas and/oil pipelines. This letter contains an explanation of how these exemptions are in the public interest and maintain at least an equal level of safety to existing regulations, as well as documentation pertaining to the waiver requests as per 14 CFR Part 11. Additionally, this letter includes an attachment with the UAS Operations Guide delineating the operations, procedures, and operating system of the SR-15 UAS.

Soar Environmental Consulting, Inc. is focused on public safety while supporting companies in meeting extant and forthcoming regulatory compliance measures associated with the operation and maintenance of hydroelectric and natural gas pipeline projects. Soar Environmental Consulting personnel have over 20 years of direct field and management experience with penstock and pipeline inspections, regulatory requirements, and compliance management. Not only does our company provide solutions through the use of environmental consulting, auditing and management services, but we also have the distinct advantage of having a working knowledge within the utility industries, understand endemic inspection requirements, and know the requirements for conducting work in remote locations.

Soar Environmental Consulting would like incorporate UAS technology coupled with qualified pilots into our commercial portfolio. Our proposal to meet inspection requirements of the hydroelectric and natural gas pipeline industry through UAS operation is directly correlated to the remote locale, the complex regulatory structure, and the safety risks associated with the current practice of operating and maintaining these assets. Our UAS inspection operations will be in the best interest of the public, providing a safer alternative to the extant potentially dangerous task of inspecting in remote or inaccessible areas. Soar will be responsible for

ensuring compliance with applicable Federal Aviation Administration (FAA) and International Civil Aviation Organization (ICAO) regulations in relation to this operation and Best Management Practices will be implemented for regulations that are not applicable to this operation.

Performing aerial inspections utilizing an unmanned system is a benefit to the public interest in multiple ways:

1. Personnel Safety

    a. Capital assets, such as penstocks, dams, pipelines, and bridges often times span over areas where terrain is unstable, vertical, or simply too dangerous for foot travel. Field inspections leave employees vulnerable to environmental hazards such as snow and ice accumulation, stream crossing, seasonal water runoff, felled trees and blocked paths; biological hazards, such as poison ivy, snakes, and natural predators; and extreme temperature changes which may cause altitude sickness, heat stroke or frost bite. The utilization of our UAV will ensure access to these areas while minimizing risk of serious injury or issue to personnel assigned to conduct these inspections.

2. Access to remote or impassable areas

    a. Segments of penstocks, dams, pipelines, and bridges may currently be or become unreachable, partially obscured, or impracticable for inspection by conventional means, such as physically walking the line, or utilizing airplane or helicopters for inspections. Access to assets can also be partially or completely blocked by environmental singularities, such as storm events, snow loading, felled trees, or vegetation growth, or blocked by mechanical means such as vehicle accidents, new construction, or road maintenance. The use of our UAV will ensure access to remote or impassable areas on an as-needed basis as well as during or after uncontrolled singular events.

3. Ensure regulatory requirements are actualized

    a. Regulatory requirements, including but not limited to those enforced by the Federal Energy Regulatory Commission, Department of Transportation's Office of Pipeline Safety, the California Public Utilities Commission and/or other federal, state and county agencies in general mandate that public entities and private corporations maintain and inspect the aforementioned assets on a periodic basis to ensure public safety and proper operation. As discussed, some of these assets are currently unreachable, partially obscured, or impracticable for inspection by conventional means, such as physically walking the line, or utilizing airplane or helicopters for inspections. The use of a UAV to conduct these inspections will supplement extensive, comprehensive maintenance programs where needed and will ensure regulatory compliance measures are fully actualized, which in turn reinforces public safety standards and adherence to extant and forthcoming regulatory requirements.

4. Cost Effectiveness

a. Currently, multiple personnel consisting of agency officials, employees and/or contractors are often required to conduct field inspections on large projects over vast amounts of terrain in order to ensure public safety and meet regulatory requirements. Inspections can require a substantial amount of person-hours and persist for days or weeks at a time due to terrain and accessibility issues. Factoring in engineering, planning & scheduling, safety meetings, mileage, recovered man-hours, potential down time due to injury, potential worker's compensation savings, and the intangible consideration of keeping employees injury-free, the current system of inspecting these assets becomes cost-prohibitive. UAV inspections are timelier, safer and more efficient than the conventional methods for conducting these inspections. Our UAV inspections will free up otherwise occupied employees, and provide a more economic approach to the traditional inspection, thus lowering operational costs.

As a prior Air Traffic Controller, I value the importance of understanding and complying with the FAA Regulations – the 7110.65 was my best friend for many years. It is with this knowledge and respect for our current airspace operations that I request this exemption to provide inspection services on hydroelectric system assets, specifically remote penstocks, flow lines, dams, and reservoirs; remote or impassable sections of natural gas and/or oil pipelines; and bridges supporting gas and/oil pipelines. I am optimistic that you find this request acceptable and in accordance with Section 333(c) of the FAA Modernization and Reform Act of 2012. If you have any questions or need additional information, please feel free to contact me at 559.547.8884 or email me at mjmurphy@soarhere.com.

Respectfully,

Michael J. Murphy
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Petition for Exemption under §333 of the FAA Modernization and Reform Act of 2012
Soar Environmental Consulting, Inc.

Soar Environmental Consulting, Inc. requests an exemption under Section 333 of the FAA Modernization and Reform Act of 2012 for commercial flight of its Rotomotion SR-15 UAS. Soar Environmental Consulting, Inc. is a Disabled Veteran Business Enterprise (DVBE) small business located in Clovis, California. Soar Environmental Consulting provides environmental consulting, regulatory compliance management solutions, and inspection services to commercial and government operations. With approval of this petition, Soar Environmental Consulting will utilize our UAS to perform inspections of hydroelectric system assets, specifically remote penstocks, flow lines, dams, and reservoirs; remote or impassable sections of natural gas and/or oil pipelines; and bridges supporting gas and/oil pipelines. Proposed operations will be performed in full compliance with aviation safety regulations, maintained at or below 400 feet AGL and in Line-of-sight with the Pilot-in-Command (PIC). As per 14 CFR §11.81, this petition for exemption is prepared and filed in accordance with regulation to request exemptions from the Federal Aviation Regulations pertaining to operation of a UAS so that operations can be commercially completed in accordance to all applicable FARs that would pertain to a small UAS. Specifically, 14 CFR §11.81 states:

> *"You must include the following information in your petition for an exemption and submit it to FAA as soon as you know you need an exemption.*
>
> *(a) Your name and mailing address and, if you wish, other contact information such as a fax number, telephone number, or e-mail address;*
> *(b) The specific section or sections of 14 CFR from which you seek an exemption;*
> *(c) The extent of relief you seek, and the reason you seek the relief;*
> *(d) The reasons why granting your request would be in the public interest; that is, how it would benefit the public as a whole;*
> *(e) The reasons why granting the exemption 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 you seek the exemption;*
> *(f) A summary we can publish in the FEDERAL REGISTER, stating:*
> *(1) The rule from which you seek the exemption; and*
> *(2) A brief description of the nature of the exemption you seek;*
> *(g) Any additional information, views or arguments available to support your request; and*
> *(h) If you want to exercise the privileges of your exemption outside the United States, the reason why you need to do so."*

IAW 14 CFR §11.81, Soar Environmental Consulting, Inc. submits the following information:

(a) Name and mailing address

I. Michael J. Murphy
1802 N Magnolia Ave
Clovis, Ca 93619
559.547.8884
mjmurphy@soarhere.com

(b) The specific section or sections of 14 CFR from which exemption is sought

I. 14 CFR 21
II. 14 CFR 36
III. 14 CFR 45.23, 45.27
IV. 14 CFR 45.29
V. 14 CFR 61.113
VI. 14 CFR 91.9
VII. 14 CFR 91.103
VIII. 14 CFR 91.119
IX. 14 CFR 91.151
X. 14 CFR 91.203
XI. 14 CFR 91.405, 91.407, 91.409, 91.417

(c) The extent of relief sought is for the duration of the Grant of Exemption, unless otherwise specified. The reason to seek the relief is as follows:

I. 14 CFR 21

i. Soar Environmental Consulting, Inc. requests relief from 14 CFR part 21. The UAV is a small rotorcraft weighing less than 25 pounds during operation. The UAV maximum speed is 25mph and the operating area will be limited to remote or impassable locations where vehicular traffic is non-existent or controlled. The PIC will maintain VFR Rules and operate the UAV during the day, at or below 400 feet AGL and in line-of-sight so as not to create a hazard to users of the National Airspace System or the Public or pose a threat to national security.

II. 14 CFR 36

i. Soar Environmental Consulting requests relief from any associated noise certification and testing requirements of part 36. As a note, according to the manufacturer's specifications, the UAV operates below 40db within 50 meters.

III. 14 CFR 45.23, 45.27

i. The UAV does not currently display marks consisting of the Roman capital letter "N" followed by the registration number of the aircraft in compliance with 14 CFR 45.23 and 14 CFR 45.27. Soar Environmental Consulting will register the UAV with the FAA and ensure UAV is marked as appropriate before using the UAV in the NAS for commercial purposes.

IV. 14 CFR 45.29

i. Soar Environmental Consulting request relief from the size requirements under this section due to the size limitations of the UAV. We propose to use marks as large as possible on the UAV as well as keep registration information with the PIC during operation.

V. 14 CFR 61.113

i. Soar Environmental Consulting, Inc. currently does not have commercial pilot licenses and requests relief from 14 CFR part 61.113 for a period not to extend one year from Grant of Exemption to acquire the appropriate commercial pilot licenses for any and all PICs operating the UAV. Soar Environmental Consulting, Inc. will require that all PICs hold a minimum of a Private Pilot License with a third class airman medical certificate for the one year exemption period. This one-year exemption will give pilots enough time to acquire the necessary hours and skills to become commercial pilots. We hope the FAA considers this exemption noting that these operations will be in remote areas with controlled or no access, that private pilots have parallel aeronautical knowledge requirements to those of commercial requirements, and the additional manned airmanship experience of a commercially certificated pilot may not correlate to the airmanship skills necessary for operating a UAS.

VI. 14 CFR 91.9

i. Relevant materials shall be kept in a location accessible to the PIC in compliance with the regulations.

VII. 14 CFR 91.103

i. In regards to 91.103(b), the UAV will not be operated within any Class B, C, or D airspace; but, the PIC will follow all other applicable pre-flight actions including reviewing weather, flight battery requirements, landings, and takeoff distances and aircraft performance data before initiation of flight.

VIII. 14 CFR 91.119(c)

i. Soar Environmental Consulting requests relief from this section because the UAV will be operated below 400 feet AGL. The PIC will ensure the UAV is operated in controlled environments outside of populated areas away from public and traffic; avoiding of areas which are depicted in “yellow” on VFR charts, as well as obtaining and assessing information regarding congested areas from the local Flight Standards District Office (FSDO) and avoiding areas of congestion. The UAV will not be operated within 500 feet of vehicles or objects in open areas. Soar Environmental Consulting requests that if barriers or structures are present that can sufficiently protect nonparticipating persons from the UAV or debris in the event of an accident, the PIC may operate closer than 500 feet to persons afforded such protection. The operator will ensure that nonparticipating persons remain under such protection.

IX. 14 CFR 91.151

i. Soar Environmental Consulting requests exemption from this section due to the maximum flight time available from this UAV. The UAV total flight time is limited to 35 minutes and therefore the PIC would not be able to meet the minimum standards and still conduct the inspections. The UAS is equipped with a visual battery indicator that displays the battery levels at all time.

Additionally, the UAS has a visual alarm that indicates when the battery reaches a state of 20% battery life, or approximately 7 minutes of flight time. These indicators, coupled with pilot awareness and the emergency return-to-station setting will supply ample time to land the UAV safely in the event of low battery.

X. 14 CFR 91.203

i. Soar Environmental Consulting requests relief from 14 CFR 91.203 as the appropriate airworthiness certificate does not exist for this UAS. Additionally, the certificate cannot be displayed in the aircraft due to the size and physical structure of the UAV.

XI. 14 CFR 91.405, 407, 409, 417

i. Soar Environmental Consulting, Inc. requests relief from 14 CFR 91.405, 407, 409, and 417 The above-cited regulations require, in general, aircraft owners and operators to inspect the aircraft "…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." These regulations apply to aircraft with an Airworthiness Certificate. Therefore, these sections are not applicable to this UAS. Operators will adhere to requirements located within the operations manual.

(d) The reasons why granting this request would be in the public interest; that is, how it would benefit the public as a whole

I. Personnel Safety

i. Capital assets, such as penstocks, dams, pipelines, and bridges often times span over areas where terrain is unstable, vertical, or simply too dangerous for foot travel. Field inspections leave employees vulnerable to environmental hazards such as snow and ice accumulation, stream crossing, seasonal water runoff, felled trees and blocked paths; biological hazards, such as poison ivy, snakes, and natural predators; and extreme temperature changes which may cause altitude sickness, heat stroke or frost bite. The utilization of our UAV will ensure access to these areas while minimizing risk of serious injury or issue to personnel assigned to conduct these inspections.

II. Access to remote or impassable areas

i. Segments of penstocks, dams, pipelines, and bridges may currently be or become unreachable, partially obscured, or impracticable for inspection by conventional means, such as physically walking the line, or utilizing airplane or helicopters for inspections. Access to assets can also be partially or completely blocked by environmental singularities, such as storm events, snow loading, felled trees, or vegetation growth, or blocked by mechanical means such as vehicle accidents, new construction, or road maintenance. The use of our UAV will ensure access to remote or impassable areas on an as-needed basis as well as during or after uncontrolled singular events. Additionally, many of the areas with hydroelectric or natural gas pipelines

transect regions that contain environmental sensitive flora and fauna. The use of our UAV for inspecting in these remote areas will limit potential environmental damage to sensitive, protected, threatened or endangered flora and fauna from foot traffic and could reduce the current necessary vegetation maintenance required to access sensitive areas that are dispersed throughout the projects.

III. Ensure regulatory and public safety requirements are actualized

i. Regulatory requirements, including but not limited to those enforced by the Federal Energy Regulatory Commission, Department of Transportation's Office of Pipeline Safety, the California Public Utilities Commission and/or other federal, state and county agencies, mandate that public entities and private corporations maintain and inspect the aforementioned assets on a periodic basis to ensure public safety and proper operation. Some of these assets are currently unreachable, partially obscured, or impracticable for inspection by conventional means, such as physically walking the line, or utilizing airplane or helicopters for inspections. This UAV carries a Sony FCB-EX980 High Resolution video camera with 26x zoom which will allow viewing and recording of assets for critical infrastructure evaluation, such as rust accumulation, cracks, leaks, concrete damage, spalling, paint condition, etc. The recording can then be reviewed by technical experts at any time and archived for future condition comparison and filed to meet regulatory requirements. The use of a UAV to conduct these inspections will supplement extensive, comprehensive maintenance programs where needed and will ensure regulatory compliance measures are fully actualized, which in turn reinforces public safety standards, confirms structures are up to code, and ensures adherence to extant and forthcoming regulatory requirements.

IV. Cost Effectiveness

i. Currently, multiple personnel consisting of agency officials, employees and/or contractors are often required to conduct field inspections on large projects over vast amounts of terrain in order to ensure public safety and meet regulatory requirements. Inspections can require a substantial amount of person-hours and persist for days or weeks at a time due to terrain and accessibility issues. Factoring in engineering, planning & scheduling, safety meetings, mileage, recovered man-hours, potential down time due to injury, potential worker's compensation savings, and the intangible consideration of keeping employees injury-free, the current system of inspecting these assets becomes cost-prohibitive. UAV inspections in select areas are timelier, safer and more efficient than the conventional methods for conducting these inspections. Our UAV inspections will free up otherwise occupied employees, and provide a more economic approach to the traditional inspection, thus lowering operational costs. Lower overhead for corporations could lead to end-user savings such as decreased utility bills.

(e) The reasons why granting the exemption 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 exemption is sought

I. The UAV consists of a lightweight, battery powered rotocraft, a personal computer-based ground control station, and associated communications equipment. The rotocraft length is 47", width of 16.5" and a height of 20.5" which can operate at a maximum speed of about 22 knots. The UAS is equipped with a visual battery indicator that displays the battery levels at all time. Pilots are trained to monitor the battery indication lights during flights. Additionally, the UAS has a visual alarm that indicates when the battery reaches a state of 20% battery life, or approximately 7 minutes of flight time. The UAS consists of an autonomous flight mode with point-and-click waypoints overlaid on a GPS map as well as a hand-held Spektrum DX-8 controller. The PIC will primarily utilize the autonomous mode for flights; but, the Spektrum DX-8 controller will be at hand and available for emergency use. Also, the PIC can modify the flight plan of the UAV at any time using the flight management interface or by manual take-over via the Spektrum DX-8 controller. In autonomous mode, the PIC can instruct the UAV to hold position with the click of a button, or return to the Home waypoint, The UAV has an emergency return to Home waypoint in the event of signal loss.

II. The aircraft will be operated with both a PIC and a ground-based Visual Observer (VO) in accordance with FAA Policy N 8900.227 Section 14, Operational Requirements for UAS. All flights will occur at no more than 400 feet above ground level (AGL); operations will be conducted in remote or inaccessible regions with the permission of the land owner; and all required permits will be obtained from state and local government before operation. The UAV will not be operated within 500 feet of vehicles or objects in open areas, unless barriers or structures are present that can sufficiently protect nonparticipating persons from the UAV or debris in the event of an accident. The PIC will file a Notice to Airmen (NOTAM) providing location and a date/time for each operation and a VFR Flight Following, if necessary.

III. The aircraft will not be operated over urban or populated areas; at air shows or over an open-air assembly of people; over heavily trafficked roads; or within 5 nautical miles of an airport or heliport. Flight operations will be limited to day, visual meteorological conditions and the aircraft will remain within visual line of sight of the PIC at all times.

IV. This exemption will provide a greater level of safety to that provided by the rule from which the exemption is sought due to the current nature of conducting inspections in remote regions. Because UAS flights are not currently authorized for commercial use, methods for inspecting remote assets are limited to pedestrian or helicopter operations. Where helicopter operations are not feasible due to environmental or mechanical obstructions, deep canyons, steep montane regions or closeness of objects, utilizing the UAV will provide a safe alternative to the inherent dangers of walking through these regions to conduct the required inspections. The small size, extreme maneuverability and zoom capabilities on the camera allow for a safe, unimpeded inspection of critical infrastructure assets. A universal example of application would be monitoring the downstream face of a large concrete dam for cracking or block movement. As one may envision, walking up the face of a concrete dam is extremely dangerous, if at all possible, and dropping a helicopter into a steep canyon is also an extreme risk. However, utilizing our UAV in this instance would keep everyone safe, meet regulatory requirements and provide a necessary, desirable and more accurate depiction of the dam condition. Conducting

inspections such as these are in the public interest, provide a safer alternative, and produce more accurate data for engineering evaluation.

(f) Summary to publish in the Federal Register

I. The rule from which exemption is sought

i. Soar Environmental Consulting, Inc. seeks exemption under §333 of the FAA Modernization and Reform Act of 2012 (Public Law 112-95) from 14 CFR 21; 14 CFR 36, 45.23; 45.27, 45.29; 61.113; 91.9(b) (2); 91.103(b); 119(c); 91.151(a); 91.203(a)&(b); 91.405(a); 91.407(a) (1); 91.409(a) (2); 91.417(a)&(b)

II. A brief description of the nature of the exemption sought

i. Soar Environmental Consulting, Inc. requests an exemption under Section 333 of the FAA Modernization and Reform Act of 2012 for commercial flight of its Rotomotion SR-15 UAS. Soar Environmental Consulting, Inc. is a Disabled Veteran Business Enterprise (DVBE) small business located in Clovis, California. Soar Environmental Consulting provides environmental consulting, regulatory compliance management solutions, and inspection services to commercial and government operations. With approval of this petition, Soar Environmental Consulting will utilize our UAS to perform inspections of hydroelectric system assets, specifically remote penstocks, flow lines, dams, and reservoirs; remote or impassable sections of natural gas and/or oil pipelines; and bridges supporting gas and/oil pipelines. Proposed operations will be performed in full compliance with aviation safety regulations, maintained at or below 400 feet AGL and in Line-of-sight with the Pilot-in-Command (PIC). As per 14 CFR §11.81, this petition for exemption is prepared and filed in accordance with regulation to request exemptions from the Federal Aviation Regulations pertaining to operation of a UAS so that operations can be commercially completed in accordance to all applicable FARs that would pertain to a small UAS.

(g) Any additional information, views or arguments available to support request

I. We here at Soar Environmental Consulting are requesting this exemption because we strongly believe in the continuous improvement of safety measures that offer to protect our field personnel from the inherent dangers of the work environment, while striving to exceed regulatory compliance standards set forth for the safe and practical operation and maintenance of our hydroelectric and natural gas pipelines. The use of Unmanned Aircraft Systems affords us a great opportunity to reach both of these goals. Through adopting and utilizing UAS technological advancements within these fields, we are unlocking the potential to create a safer workplace for our loved ones, ensure regulatory requirements are exceeded, and build inspection data with which we can improve and protect the infrastructure of these crucial industries. We look forward to working with the FAA in meeting and exceeding these goals in the near future.

(h) Request to exercise the privileges of this exemption outside the United States

I. We do not request to exercise the privileges of this exemption outside the United States.

Respectfully submitted,

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Soar Environmental Consulting
UAS Operations Manual

I. Purpose

a. This Department Order addresses the safe handling and operations of the Rotomotion SR-15 Unmanned Aircraft System (UAS) to perform flight operations during inspections of structures and other assets. This UAS Operations Manual contains instruction and explanation on correct and safe operating procedures within the National Airspace System as required by the Federal Aviation Administration.

II. Scope

a. The scope of this order applies to flight of the UAS utilized for the expressed purpose of inspecting specific hydroelectric system assets, specifically remote penstocks, flow lines, dams, and reservoirs; remote or impassable sections of natural gas and/or oil pipelines; and bridges supporting gas and/oil pipelines. Soar Environmental Consulting, Inc. will utilize the UAS to perform structure evaluations and asset compliance inspections on remote assets by qualified and trained personnel that carry current required pilot license and applicable medical certificate.

III. General Responsibility and Authority

a. Managers

i. Managers are responsible for purchase, maintenance, storage, security, and oversight related to the proper management and functional use of the UAS.

ii. Managers are responsible for UAS registration, ensuring training is completed by manufacturer or qualified trainers, and ensuring administrative records are maintaining for UAS operation in accordance with regulatory requirements.

b. Pilot in Charge (PIC)

i. The PIC is responsible for determining whether the UAS is in condition for safe flight. The PIC shall discontinue the flight when unairworthy mechanical, electrical, or structural conditions occur. The PIC is directly responsible for the operation of the UAS and the safety of the operation.

ii. The PIC is responsible for following the flight preparation checklists and ensuring the operation complies with applicable regulations and ensures application of Best Management Practices for other operations not covered by applicable regulations.

iii. The PIC conducts a detailed inspection of the UAV after every 10 hours of flight. The PIC can perform maintenance on the UAV limited to repairing small cracks and/ or replacing rotors. All other maintenance will be performed by the manufacturer or a designated qualified person.

c. Observer

i. The Observer is responsible for maintaining visual contact with the UAV and scanning the flight area for air traffic, pedestrians, vehicles, or other obstacles that may have an impact on flight safety.

ii. The Observer is responsible for relaying to the PIC information related to air traffic, pedestrians, vehicles or other objects that may have an impact on flight safety, in a timely manner.

iii. The Observer coordinates any required communication between the PIC and other individuals.

IV. Description of UAS

a. The UAS is an autonomous Unmanned Aircraft System complete with automatic takeoff and a computer guided landing system. The system consists of the SR-15 rotocraft, a laptop-based ground control unit, and supporting telemetry.

b. No manual piloting is required during a mission cycle. The modes can be switched between semi and fully and autonomous flight control during flight, if necessary. Several modes are available, including teleop (joystick, fly-by-wire) and waypoint. The autonomous flight control system utilizes an advanced, stable-hover control system auto-takeoff and landing, unlimited number of programmable waypoints, “point and click” waypoints on map underlay, and joystick control. Pre-planned flight paths are created in autonomous mode by clicking on the map underlay on the UAS Ground Control Station (GCS) to create a preplanned flight path. To clear the flight plan, simply click the “x” button on the controller. Adjustments to speed and altitude can be made for each waypoint during the flight by highlighting the waypoint and inputting the change in speed or altitude in the coordinating boxes. Return-to-Home waypoints, Minimum Safe Altitude, and velocity are entered during preflight ensuring the UAV operates only within specified parameters.

V. Description of the GCS

a. The UAS GCS allows the operator simultaneous control over aircraft and camera functions. The touch screen control allows for quick navigation and data entry while the display screen provides all essential flight data to the PIC. Telemetry data is transmitted to the command station at least once per second.

b. The GCS displays the following information:

i. Video camera view
ii. GPS Map underlay with asset delineation as necessary

iii. UAV Latitude and Longitude
iv. UAV position, altitude and heading
v. Return-to-Home location
vi. North seeking arrow
vii. Date/time
viii. Altitude AGL
ix. Relative horizontal position
x. UAV HZ, RSSI, AFCS Voltage, Servo Voltage, GPS Satellite availability, GPS VDOP, Battery Voltage and RSSI reading and conditions

VI. Description of the UAV

a. The UAV can fly with a maximum takeoff wind of up to 15 mph and maximum sustained wind of up to 19.88 mph. The UAV automatically compensates for wind during all phases of flight and will remain steady in the air even when winds are reaching the maximum threshold.

b. The UAV has a maximum operational range of up to 20km (10.77nm).

c. All flight operations are controlled with GPS waypoints, making the system extremely easy to command and control. The UAV holds position and altitude if no commands are given by the PIC.

d. Camera positioning is manually controlled with left-hand buttons of the controller, but will automatically “lock” onto a target during slow turns or altitude adjustments. The camera will remain fixed on the target, which allows for better inspection capabilities, until the camera is manually moved from the target, or the target is no longer in the camera’s field of vision.

e. The UAV contains several safety features to ensure a safe flight. Onboard system error handling allows the UAV to detect system errors while in flight and return to the preset home waypoint automatically. System error handling includes loss of communication and low battery levels.

f. The UAV can be operated entirely with the GCS map based interface. The PIC only needs to click a location on the map, and the system will create a waypoint and command the UAV to fly to that waypoint on the map. All flights are recorded with map information and flight plans for archiving or future review.

g. Two high-duration, self-contained Lithium polymer batteries operate the UAV. The GCS laptop has its own battery and the telemetry require standard 110v electricity for operation. Charging the batteries is completed with a battery charger in 45 minutes and can be accomplished via standard outlet or vehicle.

h. The UAV is equipped with an Inertial Navigation System consisting of a 3-axis gyroscope, a 3-axis magnetometer, GPS receiver, and a static pressure sensor.

i. The UAV is equipped with vertical lift autonomous takeoff and assisted recovery. A Return-to-Home waypoint is designated by the operators and identified in the

GCS software. During launch initiation, the rotocraft will takeoff and hover 3 meters directly above the takeoff area and await further instruction.

VII. UAS Specification Sheet

Item	Specification
Length	1,195 mm, 47”
Width	410 mm, 16.5”
Height	520 mm, 20.5”
Main Rotor (M/R) Diameter	1,390 mm, 54.7”
Tail Rotor (M/R) Diameter	260 mm, 10.2”
Transmission	Direct Drive
Tail Rotor	Shaft Drive
Dry Weight	8.2 Lbs, 3.72 Kg
Engine	2,200W Electric Motor (25V)
Energy Capacity	32V Battery 11,200 mAh (battery charge rate 45 minutes)
Climb Rate	122 mpm, 400 fpm (AFCS regulated)
Maximum Speed	11 mps, 36 fps [40 kph, 25 mph] (AFCS regulated)
Endurance	~ 30 Minutes
Maximum Range	20 Kilometers
Operating Ceiling	500 Meters
Payload	With Battery and Pan & Tilt Sensor Platform Installed: 1.5 Lbs or .7 Kg, sufficient to carry Sony FCB-EX980 day video camera, FLIR TAU 2 Series I/R Camera, multi- spectral camera, or small SLR digital camera.
Operating Temperatures	-20C to 50C
Stealth	Yes (40 db at 50 m)
Can Be Weatherized	No
Maximum Takeoff Wind	24km/h
Maximum Sustained Winds	32km/h
Minimum Takeoff/Landing Area	5m x 5m
Time to Deployment	5 Minutes
Time to Refuel and Redeploy	3 Minutes
Telemetry	802.11-based, LOS Long-range option up to 5 Kilometer range
Flight Control Software	Fully autonomous flight with auto-takeoff and landing, unlimited number of programmable waypoints, “point and click” waypoints on map overlay, joystick control
Ground Control Software	Included with system and provides command and control and sensor data on screen with audible warning system
Safety Controller	a) GHz DSM2, 800 yards, LOS range

VIII. Flight Preparation Checklists – Flight Operations Area

a. Prior to starting operations, The PIC will ensure the UAS is operated in controlled environments, outside of populated areas, away from public and traffic; avoiding of areas which are depicted in “yellow” on VFR charts, as well as obtaining and assessing information regarding congested areas from the local Flight Standards District Office (FSDO) and avoiding areas of congestion.

b. The PIC will file a Notice to Airmen (NOTAM) providing location and a date/time for each operation and request a VFR Flight Following, if necessary.

c. The PIC will check the current ATIS with the jurisdictional Air Traffic Control Center on the day of the flight prior to setting up the UAS.

d. The PIC will adhere to the following:

    i. Ensure launch and recovery zone is free and clear of debris.

    ii. Ensure launch and recovery zone is clearly marked for safety.

    iii. Conduct a safety and flight tailboard with all involved personnel on hazards in the area, flight mission, and flight operations area.

    iv. Ensure control of area, vehicular and pedestrian traffic is in place.

    v. Check ATIS report within 30 minutes of flight to ensure weather minimums are met for operation.

        1. VFR conditions; clear-of-clouds

        2. IFR conditions are not authorized at any time

IX. Flight Preparation Checklists – Preflight Airframe Check

a. Remove cab and inspect main gears for wear or damage

b. Visually inspect airframe

c. Visually inspect landing gear

d. Visually inspect rotor integrity

    i. Check tension on rotors and ensure rotors are straightened

    ii. Check for debris on rotors

e. Check charge of all batteries (aerial vehicle, command station) including backup batteries and ensure all telemetry is connected to energy supply source and the energy source is in working condition

f. Visibility >1 statute mile

g. Cloud Clearance >500 feet

h. Wind is no greater than 10kts with gusts no greater than 15kts

X. Flight Preparation Checklists – Preflight Systems Check

Turn on Computer and open GCS	
Attach Telemetry Ethernet to Computer	
Double click on black bar in the GCS Window	
Turn on and plug Joystick in and open Tab and press Rescan twice	Confirm movements from Joystick in the GCS
Turn on Manual Transmitter and make sure the throttle stick is down, hold switch is on and all switches away from pilot	
Battery Voltage > 4.7 on Transmitter	
Plug both batteries in on UAV and let sit for at least 30 seconds without moving.	
Confirm the V light on gyro is a solid red light	If red V light is blinking unplug batteries and plug back in
Press on Network Tab and select UAV	
Start Log File	
Minimize Network Tab	
Open Map Tab and load map	
Select Fail Safe and set ALT, Timeout, Speed to 4 m/s and highlight Rotate button	
Minimize tab and click on map to set Fail Safe Point to desired location	
Press the ROT and PSH button and make sure they are highlighted in yellow	
UAV HZ	> 5
RSSI	> 100
AFCS Voltage (fully charged)	> 11.5
Servo Voltage	> 5
GPS Satellites	> 7

GPS VDOP	< 100
Battery Voltage is	>58
AHRS is stable and correct according to UAV	
Move UAV to Takeoff position with transmitter	
Once UAV is in position make sure all blades are straight	
Recheck all UAV numbers	
Make sure camera in forward position	
Open Telemetry Tab and press the Reset Tangent button	
Minimize Telemetry Tab	

XI. Takeoff

a. Takeoff will take place at pre-determined location. The location will be clearly marked as such to ensure safety with ground personnel.

b. The system cannot be launched without approval from Observer. After the PIC has received clearance from the Observer, the PIC will have authority to proceed with takeoff.

XII. Reliability

a. The UAS is designed for maximum reliability and to maintain performance; however, due to normal motor operations, certain components will experience wear and tear and shall be checked before and after each flight to ensure proper working order. Check rotors, batteries, motors, and landing gear before and after flight.

b. Motor conditions and battery are monitored by the system with deviations reported on screen.

c. Contact with other objects during flight may cause other components, particularly rotors, servos and motor arms to become damaged. Land the rotocraft as soon as safely possible to do so, record any contact with objects, check airframe, rotors, batteries, motors, landing gear, motor arms and servos and report the contact to CEO before initiating additional preflight checklists or flights.

d. The UAS continuously detects and displays system functions on screen which may make flying unsafe. These conditions are UAV HZ, RSSI, AFCS Voltage, Servo Voltage, GPS Satellite availability, GPS VDOP, Battery Voltage and RSSI. If any of these systems are not functioning properly, the UAS will report the anomaly with visual and aural alarms. Land rotocraft as soon as safely possible to do so, and check conditions. Do not fly until the system is functioning within the normal parameters as listed on flight checklist.

XIII. Emergency Procedures and System Failures

a. Sensor Failure – Failure of on-board flight instruments/sensors will degrade the UAS performance.

    i. If sensor failure occurs, utilize the Return-to-Home feature on the display. If this does not work, utilize the Spektrum DX-8 remote controller to return the UAV to the landing point or a safe area for landing.

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

    i. If motor failure occurs, utilize the Return-to-Home feature on the display if able. If this does not work, utilize the Spektrum DX-8 remote controller to land the UAV in a safe area closest to the current position of the UAV.

c. Airframe Failure – If airframe becomes damaged to the point that it affects flight operation, the UAS will behave similarly to an on-board flight instrument failure.

    i. Utilize the Return-to-Home feature on the display. If this does not work, utilize the Spektrum DX-8 remote controller to return the UAV to the landing point or a safe area for landing.

d. Navigation System Failure – In a navigation system failure, degraded GPS will result in unstable flight, depending on failures.

    i. Utilize the Spektrum DX-8 remote controller to return the UAV to the landing point or a safe area for landing.

e. Power Failure – A complete battery failure will result in total power loss to the UAV and the UAV will land with the assistance of gravity. Check landing site, assist in any safety issues, clean up the area and report the incident to the CEO.

f. Low Battery Condition – Operator will be alerted of a low battery condition.

    i. Utilize the Return-to-Home feature on the display.

g. Visual Line-of-Sight (VLOS) Loss

    i. PIC will conduct all flight operations with VLOS. If the pilot's view becomes obstructed and VLOS is lost, the pilot may instruct the UAS to hover in place until VLOS is reestablished, or to return to the Return-to-Home waypoint. If VLOS is not reestablished in a timely fashion, have the observer establish VLOS and relay information to the PIC. Based upon the information, the PIC may opt to land the rotocraft at the current position or wait until VLOS is restored.

XIV. Security

a. The system and communication links are encrypted by manufacturer proprietary software.

XV. Crew Requirements

a. Soar Environmental Consulting, Inc. requires the PIC to hold the proper Pilot License as required by the FAA.

b. The PIC will maintain flight currency as well hold a current Class II FAA Medical Certificate.

XVI. Safety

a. Safety is priority for every flight. The PIC is responsible for adhering to applicable FAR & ICAO Regulations.

b. Soar Environmental Consulting will utilize Best Management Practices during field operations and for any instances not covered by regulation.

c. Personnel will abide by all company safety practices at all times.

d. Any personnel may stop work at any time if a safety concern is raised without retribution

e. To assure safe operation within close proximity of structures, the PIC will operate the UAV in autonomous mode at all times, unless manual operation is necessitated, such as in the event of an emergency.

f. PIC and Observer will make all efforts possible to ensure that an emergency UAV landing will not result in injury to persons or property.

g. Operation support must adhere to PIC instructions, unless that instruction would result in an unsafe situation.

h. UAV flights will occur with VLOS.

i. The PIC will adhere as close as possible to the prescribed flight plan and will not deviate or fly in unnecessary areas. No joy-flying.

j. The UAS PIC will give way to any manned aircraft.

k. Flight operations will occur under VFR Conditions only. No night flights.

l. A fire extinguisher will be brought onsite for use in emergency situations.

XVII. Landing and Retrieval

a. Landing area will be pre-determined prior to flight. A secondary landing area will also be determined prior to the flight.

b. Landing will occur at the pre-determined area, or in the event that area is not available, landing will occur at the secondary landing area.

c. The system can be recovered after the PIC deems the flight complete and the UAV rotors have stopped moving.

d. If VFR Flight Following was used during the flight, the PIC must contact the controller and cancel the flight following before recovery.

XVIII. Flight Debrief

a. The PIC will create a report summarizing details of the flight.

i. Detailed report will include preflight tailboard, preflight inspection sheets, personnel present, location of inspection, structure or asset being inspected, map of inspection area, departure time, weather information, mission summary, results of inspection, areas of concern during inspection and any unexpected or unusual conditions.

If you have questions or concerns regarding this UAS Operations Manual, please contact Soar Environmental Consulting, Inc's CEO, Michael J. Murphy via cell phone at 559.547.8884 or email at mjmurphy@soarhere.com.

This order is hereby approved.

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