Windlift, LLC
5905 Triangle Drive
Raleigh, North Carolina, 27617
February 6, 2012

Response to the Federal Aviation Authority (FAA)
Docket No.: FAA-2011-1279, Notice No. 11-07
Notification for Airborne Wind Energy Systems

Windlift Introduction

The Windlift team is fully committed to working with the FAA and NAS users to ensure aviation safety during development of the Windlift Airborne Wind Energy System (AWES).

Windlift is an Airborne Wind Energy (AWE) company developing an AWES for the US Department of Defense. The US Military faces a tremendous challenge delivering fuel to remote bases. Force protection for fuel convoys can drive the fully burdened cost of fuel past $12/gallon. When this $12/gallon fuel is consumed by tactical quiet generators (TQG), the cost of electricity exceeds $1.80/kWh.

The company is currently funded under a Small Business Innovative Research (SBIR) contract through the US Marine Corps Expeditionary Energy Office and will begin Phase II SBIR work in the summer of 2012. Windlift's AWES systems are designed to function as autonomous micro-grids with integrated TQG, battery, and power converter/inverter/solar controller. Windlift's AWES will lower fuel use by 75%, reducing the cost of electricity by half.

Airborne Wind Energy Advantages

Airborne Wind Energy offers unique advantages for mobile applications.

1. AWE foils can be fully supported by a bridling system across the span of the wing, reducing structural and material requirements.

Windlift uses flexible fabric wings that can be easily packed and transported in a backpack. Flexible wings are coupled with an intelligent line management system to reduce the risk of line entanglement injury to ground personnel in the event of an unscheduled landing.

2. AWE foils can reach a much larger swept area in comparison to tower based turbines. This increases the capacity factor by a significant margin.

3. AWE ground stations require no tower or foundation, greatly reducing mass.

   Windlift's engineering team has designed a next generation platform for a 10.3 kW system on a 7 foot trailer, weighing less than 4,100 lbs. An equivalent sized wind turbine would require 60,000 lbs. of rebar reinforced concrete foundation, and a 100 foot steel tower.

4. AWE systems can operate at higher altitudes, harnessing stronger winds.

   Windlift utilizes 3 tethers in a reel-in/reel-out power-stroke, steering the wings from ground based motors. Windlift's production systems will operate most efficiently between 500 and 1000 feet above ground level (AGL), utilizing a 1500 foot tether. During normal operation the airborne components should never exceed 1000 feet AGL, but a 1500 foot radius safety zone is preferred.

Response to FAA Concerns

1. Impact(s) to various surveillance systems (radars);

   Windlift uses fabric wings that are expected to be mostly transparent to radar. Metallic elements can be incorporated to create a radar signature if required.

2. Conspicuity to aircraft (marking and lighting);

   Windlift's flexible fabric wings can be brightly colored and embedded with reflective elements to maximize visibility for pilots operating under VFR. The dynamic movement of the wings flying crosswind creates a unique and easily identifiable visual signal.

   Windlift's tether is made of ultra-high molecular weight poly-ethylene (Dyneema, Spectra) and has no conductive elements. Tether marking creates challenges for AWE systems, and the increased drag will greatly reduce performance. Two or three reflective flags placed within 75 feet of the wing could provide a strong visual signal of the direction and angle of the tether for VFR pilots.

   Windlift's wing has no onboard electric power. All flight control motors are ground based, and the wing passively steers based on differential line tension. If

night time operation is required, a conductive cable will be run up the tether or a battery will be used to power lights. LED lights would be preferred. Any additional weight will have a severe negative impact on the efficiency and stability of the system.

3. Overall safety--safety to other airspace users, safety to persons and property on the ground, safety to the efficient and effective use of NAS facilities, safety to airports, safety to air commerce, and safety to the efficient operations and managing of the NAS;

   Windlift's machine uses a reel-in, reel-out method to generate power. The powerful ground based winch can reel-in the wing at a rate of 10 m/s (22 mph). When the airfoil is at the end of the tether it can be brought back to the base station in less than 50 seconds. The wing can also be flown toward the ground at 30 m/s (67 mph). A combination of strategies can be utilized to bring the wing and tethers from 1000 feet above ground level (AGL) to below 500 feet AGL in less than 6 seconds.

   Windlift's proposed final system will include a low-cost traffic collision avoidance system (TCAS). Windlift's engineers will be working closely with military air traffic controllers to identify the safest approach. When AWES systems become common on the battlefield an integrated "identification, friend or foe" coupled with a TCAS will be required for safe operation.

   Low-cost civilian portable collision avoidance systems (e.g. PCAS from Zaon Flight Systems) are becoming commonplace, with costs ranging from $500 - $1500. If TCAS systems continue to become cheap and ubiquitous, the future risk of AWE to flight operations will be further minimized.

4. AWES fly-away protection (mooring cable is severed);

   The Windlift system falls to the ground like a parachute.

5. AWES physical dimensions per unit and per farm;

   The wing will be 20-40 m^2, depending on local wind conditions. The final wing dimensions will shrink as operational efficiency is improved.

6. AWES operating dimensions per unit and per farm (amt. of airspace it may require);

   The proposed final system will have a tether length of 1500 feet, and during the power stroke will operate at a 30-45 degrees tether angle (500-1000 feet AGL). During the retract cycle it is possible for the wing to fly directly overhead so a 1500 foot safety zone is preferred.

7. AWES mobility (potential for AWES to relocate from physical ground location to a different ground location); and

   The Windlift system is designed to be mobile for military applications. During US testing the system will be stationary.

8. Wake turbulence or vortices of wind capturing component(s).

   Expected to be negligible.

Current Testing

Windlift will work closely with the FAA to promptly respond to any concerns raised by the aviation community. The company will also proactively maintain communication with flight organizations known to operate within 50 miles of the testing site such as Coast Guard, Navy, and crop dusters. The current testing site is located between 2 large radio towers (605', 1030'). In addition:

1. NOTAMs will be issued for all testing periods.
2. Flight testing of the MWES will only be conducted during daylight hours.
3. Testing altitude will not exceed 499 feet.
4. The ground station will be stationary.
5. Airborne operations will be only for data collection and testing purposes.
6. Only single AWES devices will be allowed.

Safe Travels,

Andy Stough, Vice-President of Engineering
Dr. Matthew Bennett, Vice-President of Research and Development
Robert Creighton, President
Windlift, LLC