Before the
Federal Aviation Administration
Washington, D.C. 20591

In the Matter of	)	
	)	
Notification for Airborne Wind Energy Systems (AWES)	)	**FAA Docket No. FAA-2011-1279; Notice No. 11-07**
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To the Federal Aviation Administration:

Formal Comments of Nickolaus E. Leggett

The following are formal comments by Nickolaus E. Leggett. I am a licensed pilot for hot-air balloons, gliders, and single-engine airplanes. I am also a certified electronics technician (ISCET and iNARTE) and an Extra Class amateur radio operator (call sign N3NL). I have a Master of Arts degree in Political Science from the Johns Hopkins University (May 1970). I am also an inventor holding three U.S. Patents. My latest patent is a wireless data bus for digital devices (U.S. Patent # 6,771,935). I also hold patents on hovercraft (air cushion vehicles)

Airborne Wind Energy Systems (AWES)

The Federal Aviation Administration (FAA) should take all reasonable steps to encourage the development and deployment of airborne wind energy systems (AWES) within the United States National Airspace System (NAS). Each AWES is a kite or balloon supported system that provides electrical energy from the wind. Since each type of AWES reaches up to higher altitudes than conventional terrestrial wind farms, the AWES has the potential to capture much more energy than a conventional wind farm on the surface of the Earth.

This occurs because the winds at greater heights are generally much stronger than they are close to the surface of the Earth. Pilots are very familiar with this situation and balloon pilots are especially aware of it.

The AWES family of technologies may be very valuable in the future when foreign sources of energy have very high prices or are unavailable for various reasons. In such an energy-short and high-priced future all of the renewable energy options will be essential for America's energy security and economic health.

Avoiding Long-Term Conflicts between AWES and Aircraft Traffic

While AWES systems will be valuable, they must not seriously conflict with aircraft traffic. Since operational AWES airborne systems and their anchor cables can tower up to 2000 feet above ground level (AGL) and even higher conflicts can be serious.

My main concept is that an AWES should have a similar maximum height profile to that of hills or mountain foothills that are located in the geographic vicinity of the AWES . This would be a distance of approximately 10 miles radius from the AWES. Thus if an AWES is located near to some 1500 foot hills, its permitted altitude would be approximately 1500 feet AGL. This would provide a basic rule of thumb for pilots. AWES systems will be the same height as the local hills. In flat country, the AWES would be operated up to 1000 feet AGL, similar in height to tall broadcast towers.

In highly-mountainous areas, the operational AWES would be similar to the average height of mountain foothills. The AWES would not reach up to the peak heights of the main mountains themselves except in very unusual circumstances. As result of these basic AWES altitude rules, the AWES deployments would blend in to a certain degree with the existing terrain in a given locality.

Over time, an increasing fraction of NAS aircraft usage may migrate to higher and higher altitudes reducing potential conflicts with AWES installations at lower altitudes. Eventually much airborne traffic may be above 50,000 feet operating at fairly high cruising speeds in a semi-spacecraft operating mode. This will be encouraged if electrohydrodynamic (EHD) aircraft of an enhanced "ionocraft" type are developed for the aviation marketplace. Reference One. Full-scale aircraft would use multiple stages of electrified grids to accelerate entrained air for the purposes of propulsion and suspension of the aircraft. These are expected to work well at extreme altitudes. An alternative high-altitude aircraft would be the Light Craft invented by the Professor Leik Myrabo of the Rensselaer Polytechnic Institute. Reference Two. These aircraft are propelled by energy transmitted to them from the ground (beamed energy propulsion).

All operational AWES installations would be equipped with electronic systems that would make them visible on the Automatic Dependent Surveillance Broadcast (ADS-B) displays of the manned aircraft operating in the NAS. In addition, these ADS-B notifications would be available for unmanned aircraft operated in the NAS.

Near-Term Experimental Operation of AWES Prototypes

The first AWES prototypes should be operated in large but restricted airspace currently used for military practice work and/or for unmanned aircraft operations. The use of these areas is quite structured and disciplined which would be a useful starting point for learning to live with AWES installations.

The proposed limit of testing to 499 feet AGL is totally inadequate for research and development. This low height can be easily reached with a child's classical hand-held kite. I have done it myself as a child. Such a low altitude does not represent the full

physical situation of a commercial AWES installation. At this low altitude, the wind will often be too low to support a kite-type AWES installation.

A limit of near 2000 feet AGL is more appropriate for tests of actual deployed AWES installations. This would allow industrial-sized AWES to be tested in a realistic manner where a heavy structure is supported by the air and is exposed to the weather changes.

Limiting AWES tests to daylight hours is also inadequate for realistic testing. An important part of any testing program is to expose the AWES to the variations of the weather over long periods of time (at least months). Any commercial AWES will have to survive and produce power continuously for long periods of time just as commercial terrestrial wind farms do. They will not be deploying these rather complex devices every morning. Think of an AWES as being more like a suspension bridge. You set it up and you leave it for long periods of time.

Some mobile AWES installations will be used in the future. For example, specifically designed AWES could be used to provide electric power to ships at sea while they are in motion. This type of power could be used to recharge navy ships that are equipped with electric rail gun systems. Other mobile AWES could be used to resupply energy to fuel-cell propelled ships at sea via the electrolysis of water. Some mobile AWES will be used over land for large open-pit mining operations, prospecting efforts, and large agricultural properties. As a result of this, some controlled testing of mobile and portable AWES prototypes should be allowed by the FAA.

Some testing of multiple-unit AWES is also needed to understand the aerodynamics of operating several units in close proximity to each other in various

weather conditions and climates. It is important to realize that a whole new family of devices is being developed here and so a fairly liberal testing environment is needed.

Respectfully submitted,

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Reference One Wikipedia Ionocraft

http://en.wikipedia.org/wiki/Electrohydrodynamic_thruster

Reference Two Contact page for Professor Myrabo

http://www.eng.rpi.edu/soe/index.php/faculty/154?soeid=myrabl