ABSTRACT FORM (for new projects only)

Project Title: 901401 Aerostat Hotspot

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(Indicate individuals appropriate for your project. Not all projects need all four positions filled in.)

Project Description: Aerostat tethered to ship extends wireless network coverage many miles

MBARI experiments are increasingly reliant on interactions among semi-autonomous platforms, with scientists stationed on one or more nearby MBARI vessels to coordinate and operate shipboard instruments. Over time, we have observed that the characteristics of terrestrial radio are such that the practical range for direct communication from a small ship to typical, low-profile drifters and vehicles is limited to less than 1 kilometer. Historically, this has lead to the use of satellites to communicate between platforms only a few miles apart. However, the slowness and expense of satellite based communications impede real-time data gathering and machine interaction. In practice, it also constrains ship's movements, as there is a need to stay within a 1km radius of platforms at times when they may require operator attention.

We propose to dramatically increase the range of wireless communications between a ship and surrounding assets by flying a radio relay on an aerostat moored to the ship's stern. FAA regulations generally allow for the operation of "Moored Balloons and Kites" up to 150ft above the earth without notification. Operation up to 500ft would require FAA notification. Operation from 500ft to 1500ft would require a waiver, which, when working at sea more than 5 miles from any airport, should be readily attainable.

Allsopp Helikites, Ltd. manufactures an aerostat design that combines aspects of a kite and a balloon. In still air, Helikites function like a balloon, but, unlike any balloon, they also generate significant lift in windy conditions – flying stably in wind velocities from 0 to 35mph. Various military and commercial organizations have successfully deployed Helikites from ships. During a recent visit to MBARI, Maritime Robotics presented the results of very successful sea-trials of their new remote surveillance product employing a shipborne Helikite to image oil slicks. They claimed to have evaluated many other aerostat designs before settling on the Helikite.

This project is intended be a one year effort with very specific goals:

1. Buy a lightweight radio package, including battery pack and antenna.
2. Buy an appropriately sized helikite and tether management system to fly that package.
3. Develop a mounting and deployment scheme.
4. Test deploy from the Paragon (or similar vessel) in the Monterey Bay

The helikite and associated deployment gear should cost < $7,000.
The radio package should cost <$2,000.

Helium for each deployment will cost roughly $200.

Testing will evaluate ease of deployment and recovery as well as workable radio range as a function of Helikite height. The initial radio package will likely be a 0.1 kilogram long-range WiFi router manufactured by Ubiquiti Networks -- the PicoStation2HP. This has the advantage of inter-operating with standard WiFi networks. However, we may also fly a package based on a 900Mhz Freewave radio to increase range at the expense of convenience. Either of these radios can directly network with MBARI AUVs, WaveGlider and ESP platforms.

The Aerostat Hotspot would also help address the requirement of the CANON initiative for multiple assets communicating between each other and the shore. By extending the reach of the network with such an aerial relay, CANON will be better positioned to return larger data sets in near real-time for dynamic decision making in field experiments.

It is important to emphasize that the Aerostat Hotspot is not a "store-and-forward" device or a "data mule". Its goal is to provide "always on" connectivity over the roughly 25 to 100 square miles surrounding the ship from which it is deployed. Weather permitting, the Helikite would be lowered only once every day for just the few minutes necessary to exchange battery packs. Some helium would need to be replenished about once every week.

The recently developed Waveglider Hotspot directly complements this proposal for an Aerostat Hotspot. The aerostat would allow the waveglider to patrol a wider area while maintaining a high bandwidth, interactive connection to the scientists coordinating experiments, providing them real-time, unabridged access to waveglider sensor data. When the waveglider wanders outside the coverage of the aerostat, it could still function in its store-and-forward configuration to ferry bulk data from peripheral assets back to the ship more quickly, without requiring a near rendezvous with it.