UNIVERSITY of HAWAI'I MĀNOA

Department of Atmospheric Sciences Seminar Announcement

SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY

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A Decision Support System for Station Keeping Stratospheric Balloons

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Date: **Monday, March 2, 2015**
Seminar Time: **3:30pm**
Location: **Marine Sciences Building, MSB 100**

Abstract:

As the Google Loon project has recently demonstrated, stratospheric ballooning is drawing increasing interest. Using high-altitude balloons to provide communications for internet denied areas is of particular interest. However, there may be other applications including emergency management over communications denied disaster areas as well as human commercial flights.

For some applications, it may be important to station keep a balloon over a target for long periods of time. This may or may not be possible depending on atmospheric winds and other constraints. Understanding the feasibility of station keeping is therefore critical for system designers.

A station keeping optimization capability has been developed to maximize the duration of stratospheric flights and to assess potential performance. The capability uses a historical 3D numerical reanalysis of winds over a 30-year period along with an algorithm that seeks to maximize flight duration by taking advantage of favorable winds at different altitudes. Constraints on the optimization include user configurable parameters such as ascent and descent speeds, depth of flight layer, power consumption, and onboard propulsion. Trade studies are performed with different configurations to study sensitivity of performance. Over 44,000 flight simulations per trade study are produced and statistics of performance are aggregated and evaluated.

Results indicate that performance varies greatly by location and time of year. For example, the worst performance is observed for low-latitude locations during the summer months, while the performance of mid-latitude locations can be greatly enhanced during the Spring and Fall months.

In addition an operational decision support system has been developed to provide forecast flight durations and trajectories based on high resolution WRF modeling as well as ensemble forecasts from the GFS ensemble forecast system.