Air Resources Laboratory
Low Altitude Balloon Measurement Platforms

What They Are

The Field Research Division (FRD) designs, builds, and operates low altitude balloons to track air movement and to make atmospheric and meteorological measurements while drifting along with the wind in the lower atmosphere. FRD has been developing these balloons since the late 1960s.

Smart Balloon

The smart balloon is a constant volume, variable density, 11-foot diameter balloon. On-board instruments include temperature and relative humidity sensors housed in an aspirated radiation shield to increase accuracy. A rain gauge on top of the balloon provides precipitation rate as the smart balloon moves through areas of rain. An infrared temperature sensor provides remotely-sensed, sea-surface temperature data. Satellite communications allow continuous monitoring of the balloon position and sensor data without requiring an aircraft to be in close proximity to the smart balloon. The shell is designed to house the sensors and associated equipment inside the balloon to help protect them from turbulence and rain. The exterior of the balloon fabric is covered with a plastic rain shell to keep the shell from becoming saturated with precipitation or condensation.

ARL staff, Eric Egan (L) and Shane Beard (R), holding a Smart balloon (photo: NOAA)

WHISSP balloon (photo: NOAA)

Weather/Hurricane In-situ Sea Surface Probe (WHISSP)

The WHISSP (Weather/Hurricane In-situ Sea Surface Probe) project is a part of the NOAA Weather In-Situ Deployment Optimization Method (WISDOM) program's hurricane intensity research effort. For the WHISSP program, ARL designed and is continuing to develop low altitude, low cost, and durable balloons that are capable of carrying a barometric pressure sensor for up to fourteen days.

What They Are Used For

Smart Balloon

The smart balloon is capable of operating at a constant or operator-adjusted altitude to track the evolution of an air mass. As the balloon moves with the air, it continuously reports position, altitude, and a variety of environmental sensor data. The environmental data differ according to the specific application but can include basic meteorological measurements such as temperature or more targeted measurements such as pollutant concentrations.

WHISSP Balloon

The idea of making very low altitude barometric pressure measurements is patterned after the French Aeroclipper experiments conducted in the Indian Ocean. However, the Aeroclipper is expensive and difficult to launch. The ARL balloons are capable of very low altitude measurements by using a buoyant ballast line attached at the end of a 50 meter cord. The buoyant ballast weight is greater than the net lift of the balloon which ensures the balloon never rises above 50 meters. The cost is kept low by using commercially-available polyurethane balloons and making a simple modification to place the sensor enclosure inside the balloon.

Why They Are Important

Smart Balloon

When deployed as a part of a Lagrangian experiment, smart balloons help to better characterize the in situ chemical evolution of pollutants in the atmosphere over a period of several days. This capability to operate for an extended period of time helps scientists locate pollution sources and determine their affect on the atmosphere and environment. When deployed for hurricane research, smart balloons help characterize the energy content of the marine boundary-layer inflow to a hurricane and its relationship with hurricane intensity changes. The smart balloon is capable of providing critical in situ data on the thermodynamic history and trajectories of air parcels in the inflow layer.

WHISSP Balloon

Hurricanes in populated areas can cause billions of dollars in damage. NOAA's success in improving hurricane track predictions lies in its ability to acquire data from areas where data has traditionally not been gathered. WHISSP balloons are designed to fill this data void by providing a low cost and safe way to collect continuous measurements from within or near the eye of a hurricane for days at a time. Additional real-time data, such as central pressure in the eye of a hurricane, will improve current hurricane forecast model accuracy.

Payload being placed into a WHISSP balloon (photo: NOAA)

For More Information:

Field Research Division
www.noaa.inel.gov/
FRD Smart Balloon Technology
www.noaa.inel.gov/capabilities/smartballoon/smartballoon.htm
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