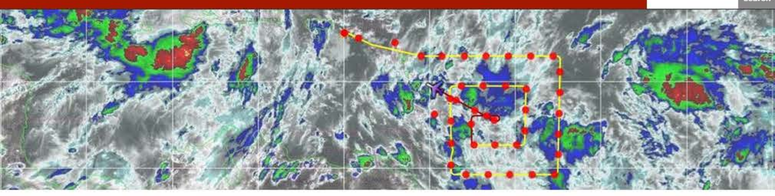

AVAPS Dropsonde System

Files and Brochures

AVAPS Dropsonde System

The Sounding Group in ISF operates the AVAPS™ (Airborne Vertical Atmospheric Profiling System) also known as the AVAPS™ Dropsonde System.

The AVAPS Dropsonde system, has dramatically extended the envelope of atmospheric profiling capabilities. Since its debut in 1997, it has flown on numerous missions in support of operational weather forecasting and atmospheric research, with impressive results.

The AVAPS Dropsonde System is a key atmospheric instrument that measures high resolution vertical profiles of ambient temperature, pressure, humidity, wind speed and wind direction. Measurements are taken by a parachuted GPS dropsonde that is launched from the aircraft and descend to the surface. In-situ data collected from the sonde's sensors are transmitted back in real time to an onboard aircraft data system via radio link.

Atmospheric soundings from dropsondes provide the ability for targeted observations over remote areas such as the oceans, Polar Regions and land masses; they also provide a means to obtain soundings in and around severe weather systems, such as hurricanes. Atmospheric soundings obtained from dropsondes during hurricane reconnaissance flights have improved the accuracy of forecasts of hurricane landfall by about 20 percent over the decade of the 1990's. The use of aircraft released dropsondes have had a dramatic impact on the forecast track of hurricanes.

OVERVIEW

The sonde is a small electronic device which contains atmospheric sensors: pressure, temperature, humidity and a GPS receiver to derive winds. The sonde is launched from an aircraft where a parachute is deployed. As the sonde descends to the Earth's surface it continuously measures the state of the atmosphere and telemetries this information to the research aircraft. The aircraft is equipped with dedicated hardware and software to process the signal from the sonde in real-time to display and archive the data. Once the sonde has reached the surface, all data collected during the descent is sent via satellite to atmospheric research centers or the National Hurricane Center or the World Meteorological Organization. The mini Sonde and aircraft is the equivalent of a standard radiosonde or weather balloon launched by the National Weather Service launched twice a day from over 100 locations in the U.S.

DROPSONDE DESCRIPTION

The Dropsonde is composed of a small electronic circuit board, sensors and a battery housed in a cardboard tube with a parachute. The total weight of the sonde is less than 6 ounces with dimensions of a 1.75" diameter tube 12 inches long. The inner electronic components of the dropsonde consist of precision temperature, pressure and humidity sensors, low powered telemetry transmitter, GPS receiver and a microprocessor. As the sonde descends it continuously measures the atmosphere from the release altitude to the Earth's surface. Measurements are made every half second which provides a precise detailed profile of the atmosphere. The parachute deploys from the top of the sonde within seconds of being released from the aircraft. The parachute is a specially designed for high reliability and a very stable descent. As the sonde descends the GPS receiver tracks the position and velocity of the sondes, this change in motion corresponds to the atmospheric winds. The sensor data, GPS receiver 3D position and 3D velocity along with engineering health of the sonde is all wirelessly sent via radio waves to the aircraft with a low powered transmitter operating in the 400-406 MHz Meteorological band.

The dropsonde incorporates a pressure, temperature, humidity sensor module (RSS903) designed by Vaisala, Inc., for their RS92 radiosonde and a GPS receiver module. The sensor specifications are shown in the following table.

Dropsonde Sensor Specifications

	Range	Repeatability	Resolution
Pressure	1080-100 hPa	± 0.5 hPa	0.1 hPa
Temperature	-90 to +60 C	± 0.2 C	0.1 C
Humidity	0-100%	± 5%	1.0%
Horiz Wind	0-200 m/s	± 0.5 m/s	0.1 m/s

In addition to the RSS903 sensor module and the GPS receiver module, the dropsonde electronics board includes a microprocessor for measuring and controlling the sensor module and sending the measured data to the 100 milliwatt 400 MHz telemetry transmitter, and an 8-volt lithium battery pack for power. Surface mount technology is used on the electronics board to reduce size and increase the ease of manufacture. In addition, the electronics board contains a connector that serves as an RS-232 link with the aircraft data system for test and checkout and for setting the telemetry transmitter frequency prior to deployment. The transmitter can be set anywhere in the 400-406 MHz meteorological band in 20 kHz steps, creating about 300 separate channels.

A unique square-cone parachute is used to reduce the initial shock load and slow and stabilize the sonde. The parachute is immediately deployed on exit from the launch chute and streamers for about five seconds until filled by ram-air. The stability of the square cone parachute is very good during the sonde's descent and reduces or eliminates any pendulum motion of the sonde.

UCAR/Intellectual Property and NCAR/SSSF have licensed Vaisala Inc. of Woburn, Massachusetts to build the NCAR GPS Dropsonde, as Vaisala model RD93.

USERS OF THE NCAR GPS DROPSONDE SYSTEM (AVAPS)

NOAA
SSSF has built a "double" 8-channel AVAPS system plus spares for the NOAA G-IV and two additional data systems plus spares for the two NOAA P-3's. These systems were delivered to NOAA in August 1996 for testing and use, and have since been used in numerous research programs as well as operational forecasting of tropical and winter storms.

DLR
An AVAPS system has also been built for DLR in their Falcon research aircraft.

USAF Reserve Hurricane Hunters
ISF has also built 10 AVAPS systems plus spares for the 53rd Weather Reconnaissance Squadron (aka Hurricane Hunters) at Keesler Air Force Base in Biloxi, Mississippi. These systems are operational in their WC-130J aircraft. During a typical hurricane season, the 53rd deploys 1000 to 1500 sondes on training and storm missions.

AES Canada
SSSF has also built and installed an AVAPS system in Atmospheric Environmental Services (AES) Canada-s Convair 580 research aircraft.

The Met. Office (UK)
UCAR/Intellectual property and EOL/SSSF has also licensed Vaisala to sell the AVAPS system to their customers worldwide. One such system has been installed in the United Kingdom Meteorological Office's BAE-146, operated by the Meteorological Research Flight (MRF) division.

NIPR (Japan)
Vaisala has sold another system to the National Institute for Polar Research (NIPR) in Japan.

NCAR
NCAR has one AVAPS system, which can be used in NSF/NCAR's C-130 or G-V, or by the scientific research community in other aircraft, such as the NASA DC-8.

SEE ALSO

http://www.nasa.gov/content/goddard/what-the-heck-is-a-dropsonde
https://www.eol.ucar.edu/content/what-dropsonde

FUTURE DEVELOPMENTS

TBD
For more information contact Terry Hock

AVAPS

- AVAPS Aircraft Data System
- AVAPS Data Workflow
- AVAPS Dropsondes
- AVAPS History
- AVAPS Launchers
- AVAPS Software
- Contact Information
- Documentation
- EOL Sounding File Format
- Gallery
- Papers using AVAPS Data

ORGANIZATIONAL FACILITIES

- In-Situ Sensing Facility (ISF)
- Research Aviation Facility (RAF)

DEPLOYMENTS

- PREDICT
- T-PARC
- HS3 2011
- HS3 2012
- HS3 2013
- CONCORDIASI

CITATION

When referencing the NCAR Airborne Vertical Atmospheric Profiling System (AVAPS) in publications or proposals, please use the identifier **10.5065/D66W9848** -- for example as a citation:

> UCAR/NCAR - Earth Observing Laboratory. (1993). NCAR Airborne Vertical Atmospheric Profiling System (AVAPS). UCAR/NCAR - Earth Observing Laboratory. https://doi.org/10.5065/D66W9848 Retrieved March 22, 2017

Please be careful of linebreaks when cutting and pasting the above text, and feel free to reformat to fit your document. Additional citation styles are avilable at DataCite or CrossCite.

Additionally, please cite the First Use paper associated with this Facility/Instrument:

> Hock, T. F., Franklin, J. L. 1999: The NCAR GPS Dropwindsonde. Bull. Amer. Meteor. Soc., 80, 407-420.