

US National Weather Service Chooses Vaisala's Modified Version of the Vaisala WINDCAP® Ultrasonic Wind Sensor WS425 as Part of Its Nationwide Surface Observation System

Vaisala Ultrasonic Wind Sensors will be integrated into the Automated Surface Observing System (ASOS), which serves as the primary surface weather observing network in the United States.

The ASOS is jointly administered and used by the National Weather Service (NWS), the Federal Aviation Administration (FAA), and the Department of Defense. The network is designed to support weather forecasting activities, aviation operations, and the needs of the meteorological, hydrological, and climatological research communities and private sector communities.

NWS design goals

According to Program Manager Rick Ahlberg, the main objectives of the new ASOS wind

sensor modernization were: increased reliability, reduced need for maintenance (particularly in winter), ice free operation and the sensors' ability to incorporate the WMO Gust Standard.

The wind sensor modernization is a part of an overall ASOS Product Improvement Program. Mr. Ahlberg says that the improvements include better observing capability, reporting accuracy, and consistency.

The overall program objective was to acquire a commercial off-the-shelf (COTS) sensor that could be modified to meet the requirements of the NWS and

FAA. The wind instrument needed to be ice-free, and contain no moving parts which would wear down or be contaminated by sand, salt or dust.

After a rigorous evaluation, Handar Inc's COTS sonic sensor was chosen. The sensor was modified to meet the NWS specifications. In 1999, Vaisala Oyj acquired Handar Inc. The sensor is now known as the special ice-free model of the Vaisala Ultrasonic Wind Sensor WS425, that is, the so-called D-model. The sensor incorporates Vaisala's proprietary equilateral triangle design, which always has one redundant measurement path and therefore solves the known turbulence problem.

The Vaisala Ultrasonic Wind Sensor WS425 is an array of three equally spaced transducers which radiate and receive ultrasonic pulses in a horizontal plane. The sensor measures transit times in both directions for each of the three transducer pairs. The wind speed and direction are then derived from these six transit time measurements. The Ice Free Wind Sensor for the NWS is capable of providing the WMO standard 3-second average gust, whereas the existing cup anemometer provided a 5-second average gust. This capability improves responsiveness and reflects the gusts more accurately.

Meeting the NWS requirements

As mentioned before, the fundamental design of the ASOS Ice Free Wind (IFW) relies on the standard Vaisala Ultrasonic Wind Sensor WS425. However, a few improvements and ASOS specific modifications have been made.

In order to guarantee operation even in the most difficult conditions, the sensor has an enhanced heating feature. There are heater foils inside the ceramic transducers, the transducer arms, and the birdspike. The power consumption is divided as fol-

lows: three transducers total 24 W, three transducer arms total 76 W, and 1 birdspike 15W. The total heating power is 150W.

To ensure the sensor's ASOS compatibility, it has a 10m long sensor cable, power supply with heating control circuitry, and power relays to control the heating current. Additionally, in order to guarantee trouble-free and safe communications, there is an optical modem that isolates the sensor from the rest of the ASOS infrastructure. An installation kit is included in the delivery to make the sensor mechanically compatible with the ASOS system.

Rigorous testing

During the course of the project, the sensor was subjected to extensive electrical, environmental, field, and functional testing.

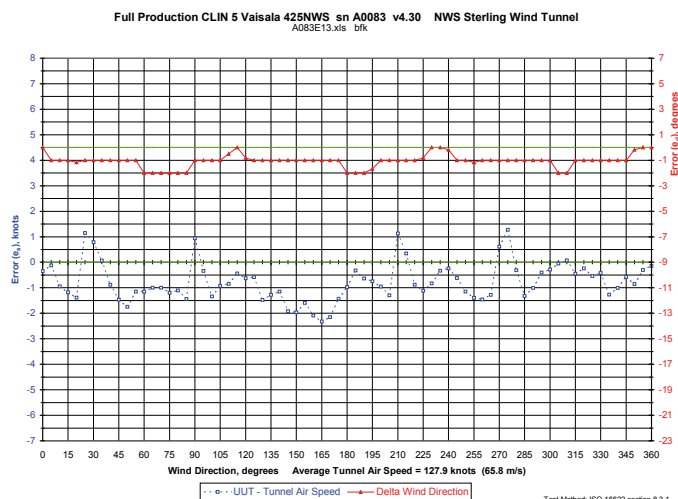
Test Manager Michael Sturgeon has been responsible for the tests on the NWS' side. Although the sensors' functional accuracy requirement for wind speed is +/-2 knots, or 3% up to 125 knots, Michael has also tested the sensor performance beyond its limits. The sensor has shown good performance with wind speeds up to 157 knots. The following graphs show some of the test results. ●

References

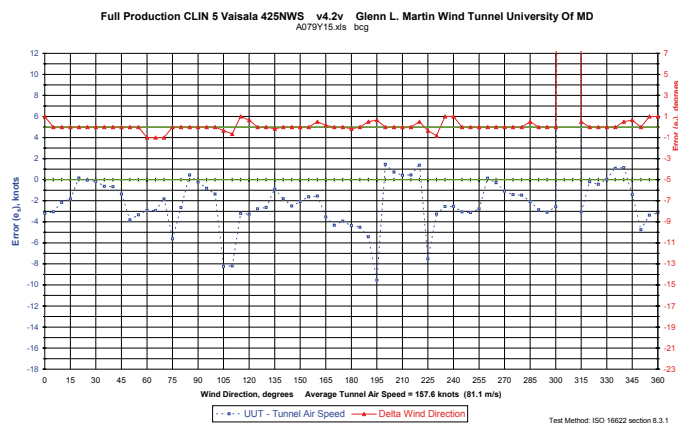
Rick Ablberg, Program Manager; Michael Sturgeon, Test Manager:
ASOS Product Improvement Implementation Plan (Addendum III) For Ice Free Wind, May 15, 2003. U.S. DEPARTMENT OF COMMERCE, National Oceanic and Atmospheric Administration, National Weather Service/Office of Operational Systems
Field Systems Operations Center/Observing Systems Branch



Complete Vaisala Ice Free Wind Sensor for the NWS.



Wind tunnel test results at 65.8 m/s. Sensor is rotated full 360 degrees, 30 second average wind speed and direction has been recorded.



Wind tunnel test results at 81.1 m/s. Sensor is rotated full 360 degrees, 30 second average wind speed and direction has been recorded.