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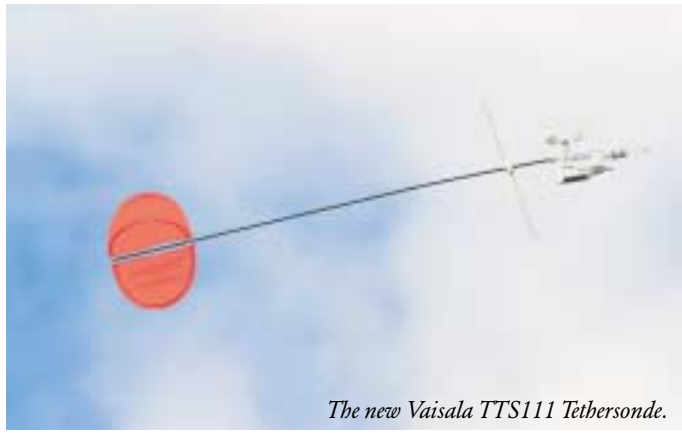
Improved boundary layer observations

Vaisala Launches the DigiCORA

Vaisala has launched a new DigiCORA Tethersonde System for boundary layer observations. The new design integrates proven Vaisala sensors in a field inter-changeable sensor transducer version, validated for tethered sounding applications. New Tethersondes also include an ASIC-based transmitter, a digital solid state compass, and an external battery pack option. Boundary layer researchers worldwide will appreciate the system's new features and improved performance.



The new Vaisala TTS111 Tethersonde.

Tethered meteorological sounding systems have been used in boundary layer research for many years. Due to the scarcity of equipment designed specifically for this type of experimentation, systems have been configured from a wide range of available components. Sensors used in these systems, in many cases, are not subjected to validation of accuracy, measurement repeatability, or level of performance in the tethered sounding application. Examples of unanticipated problems associated with this type of custom integration include out-gassing effects of various materials on thin film sensors, neglect of sensor ventilation requirements, solar radiation effects and micro-environments created by the mechanical housings and deployment devices.

Limitations of custom instruments

Sensors used in custom instrument packages have commonly been designed for industrial applications, surface weather measurements or synoptic sounding applications. Those meteorological sensors used in the few commercial tethered instruments offered in the past have been integrated and subsequently calibrated as a complete instrument. Unlike radiosondes that are consumable instruments, tethersondes are reusable devices and require periodic re-calibration of the sensors. Unfortunately, this means calibrating the complete instrument, a point of frustration when they must be returned to the production facility for this procedure. Users are typically unable to calibrate sensors in the field because of highly proprietary techniques and data formats.

Low power consumption, sensor output formats, lightweight materials and data transmission media have also been difficult issues to deal with in designing custom configurations. Receiving and data processing systems and methods of deployment for tethered measurements are no less problematic.

Technical advances in personal computers, data processing, meteorological sensors, and ASIC circuitry have made significant improvements in tethered

Ronald Shellhorn performing a sounding at Jokioinen, Finland

Up to six tethersondes can be attached to the tethered line for a sounding.

Tethersonde System

balloon sounding solutions possible. At the same time modern quality processes can ensure that systems are designed and tested to meet the specific requirements of boundary layer tethered measurements.

Versatile new features

Vaisala has incorporated many technological advances into the new DigiCORA Tethersonde System. The new design integrates proven Vaisala HUMICAP®, THERMOCAP®, and BAROCAP® sensors, used in Vaisala radiosondes worldwide, into a sensor transducer version validated for tethered sounding applications. The sensors are calibrated with systems traceable to MSL standards and calibration coefficients are stored in serial EPROM. Coefficients are transmitted to a DigiCORA Sounding Processor along with the meteorological data, which eliminates the need for paper tape readers. An even greater benefit to the user is the interchangeability of the sensor transducer/modules. These economical, consumable components are simply unplugged and replaced with fresh modules when sensors are contaminated or their accuracy degrades. In other words, no more expensive instrument re-calibration is needed.

New transmitters benefit from an ASIC design that provides easier programming of data transmission frequencies, narrower transmission bandwidths, and an obvious advantage, a lighter weight. A new digital, solid state compass introduces a level of accuracy unattainable in earlier versions that used electromechanical compasses. The compass can be simply calibrated in the field prior to a flight. This calibration accounts for magnetic inclination with magnetic declination accounted for in the user interface software. Validation testing of the new compass indicates a repeatability differential of less than 3°, a significant improvement on earlier versions, where accuracy could exceed +10°.

Results of wind tunnel testing also show improved wind speed accuracy from the new Tethersondes, the result of improvements in anemometer gear housings and wind speed software calculations. Another new feature in the Vaisala Tethersonde is the addition of six A/D channels. These channels, in addition to an optional Ozone sensor interface, allow for the addition of user supplied sensors with appropriate outputs.

Modularity brings added value

The cost of performing tethered soundings has always been a major concern for researchers with limited project budgets. A powerful feature of the Vaisala DigiCORA Tethersonde System adds considerable value. The new Tethersonde product has been designed around the same sounding processor used in the DigiCORA radiosonde system, which allows for the addition of a variety of modular, synoptic sounding options. Tethersonde system users can add GPS, Loran-C, and radiotheodolite synoptic sounding options, and, conversely, existing DigiCORA users can add tethered sounding capability to their systems. A wider range of functional capability is available at significantly less cost than from acquiring different systems for each application.

The DigiCORA Tethersonde system offers two modes of tethered atmospheric soundings. By raising and lowering a Tethersonde at constant ascent and descent rates, a boundary layer profile can be acquired. Or, by attaching up to six Tethersondes to the tetherline, meteorological data can be acquired over time at selected altitudes.

Vaisala's earlier generations of tethered sounding systems included PC DOS based application software. This out-dated operating system and software has now been replaced with a Windows® based user interface with new and useful features.

New software and external battery pack option

Two other constraints that have limited tethered research projects in the past are the ability to power tethered instruments over extended periods of time, and the ability to handle and archive large flight data files that would be the result of extended flights. Vaisala's new, optional external battery pack can now extend tethersonde flight time to over twenty hours. In addition, PC hard disk technology evolution has resolved the latter issue with seemingly exponential growth in data storage capacity. A tethered sounding up to five times longer than with previous systems can now be performed.

Enhanced system performance

Several validation tests of the new system have been completed, including flight duration testing at Vaisala Boulder site, comparison testing against NOAA's 300-meter Boulder Atmospheric Observatory (BAO) tower in Erie, Colorado, and wind tunnel testing at NCAR's ATD facility in Boulder. Results show significant enhancement in all performance areas. The new system will certainly benefit boundary layer researchers worldwide. ●