DigiCORA III Sounding System with Radiotheodolite and GPS Windfinding

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Utilizing state-of-the-art processing technology, the DigiCORA III upper air sounding system, integrated with a radiotheodolite and GPS windfinding, is ideal for field use in tactical and test range applications.

Tilted RT20A radiotheodolite in a test.

Vaisala's upper air equipment, comprising the DigiCORA III sounding system, radiotheodolite and GPS windfinding, is ideal for both tactical field conditions and test range applications.

The requirement for independent and passive windfinding is fulfilled by using a radiotheodolite, which also enables use of cheaper radiosondes, i.e. sondes without GPS modules. The GPS windfinding capability is an easy-to-use and very accurate alternative for soundings in situations in which GPS is acceptable, such as test range applications.

User-friendly features of the system

The DigiCORA III sounding system is based on a PC platform, i.e. a sounding workstation, connected to subsystems which receive telemetry and navigation signals and preprocess these signals. The PC-based solution ensures ease of use, low costs for training and maintenance, and a wide range of connectivity options.

The new graphical user interface, known from the PC world, utilizes user-proven terms and functions and offers vastly improved system control and management.

The sounding software itself, which includes data processing algorithms that have proven themselves in field use totaling nearly 10,000 years, incorporates new functions and operating options that reach into the future of radiosounding, making DigiCORA III the perfect long-term solution for a sounding system.

Thanks to the excellent storage capabilities of current PCs, all the sounding data collected can be stored and archived for later analysis and possible simulation with different parameter settings.

DigiCORA III's ability to store sounding data from different weather situations and to simulate soundings with this data opens up excellent opportunities to train and drill operators to use the system. It is also a valuable feature in defense applications where there is a need to maintain operator skills even though the system is not operated daily.

All upper air WMO and STANAG messages – automatically or manually triggered – can be easily sent through the standard PC-based interfaces.

Vaisala's policy of maintaining a seamless upgrade path for new features will guarantee smooth operation through new generations of equipment.

Main system components

A meteorological system for defense applications, based on the DigiCORA III concept, can be built from the following main modules (see block diagram):

- Windows NT workstation (PC) running DigiCORA III software
- MPA 201 ARCNET interface and SPT11A calibration data reader
- SPS220 sounding processing subsystem (AC or DC operated)
- UHF telemetry and local GPS antenna, CG25, with cables
- RT20A radiotheodolite for RDF windfinding with cable
- Cable connecting the NT workstation and the SPS220
- RP20 power supply
- Radiosondes

The processing boards of the radiotheodolite transmit pressure, temperature and humidity (PTU) data, as well as antenna angle data, through the sounding processing subsystem to the workstation. Consequently, the processors in the sounding processing subsystem transmit PTU and GPS wind data from the GPS sounding.

In the workstation, the DigiCORA III software performs data collection, presentation, analysis and storage automatically and under the control of the operator. The workstation also creates and relays meteorological messages to customer-appointed locations using serial connections, telephone services or various network protocols.

The DigiCORA III is compatible with all Vaisala radiosonde types. The RS80 and RS90 families of radiosondes are equally suitable. The most suitable type depends on the windfinding solution used.

The FB16A balloon filling system and RP20 power supply are optional accessories.

Functions of the main components

The DigiCORA III can be applied in a variety of environments – including mobile defense applications – to meet the diverse requirements of upper air sounding. Special measurements (ozone and radioactivity, for example) can also be incorporated and will be available in the near future.

Radiotheodolite with a tilt sensor

The RT20A radiotheodolite antenna tracks the flight of the radiosonde, converts the radiosonde signal to PTU data and measures the azimuth and elevation angles of the pointing direction. The altitude of the radiosonde is calculated by the DigiCORA III software by using radiosonde PTU data. Using pointing angles and altitude data, the computer can calculate the wind data.

Vaisala's RT20A radiotheodolite is the only radiotheodolite in the market that has a tilt sensor to eliminate unintentional tilting of the antenna due to soft ground or other reason. If the attitude of the antenna changes, the sounding data is unusable without a tilt sensor.

Sounding processing subsystem

The following units, housed in the SPS220 sounding processing subsystem, are used for GPS windfinding:

- URR20 UHF telemetry receiver
- UPP210A receiver processor (PTU processor on the card)
- MWG203 GPS processor

The local GPS antenna connects to the GPS processor and provides the system with calendar and orbit information on the satellites. The UHF telemetry antenna connects to the UHF receiver, which detects the radiosonde signal for processing into PTU data in the receiver processor. The sounding processing subsystem is remotely controlled by the DigiCORA III software.

There can be up to four SPS220 subsystems connected to a single DigiCORA III workstation. Each SPS220 can house two wind processing cards.

NT-based workstation

A PC runs the DigiCORA III software and acts as a collector and repository for meteorological data from the soundings. The data itself is received and preprocessed by a sounding processing subsystem.

A block diagram of Vaisala's MW21 DigiCORA III sounding system with an RT20 radiotheodolite and GPS wind finding.

Operating system

Data and message creation and relaying are based on DigiCORA III's integration with Windows NT or Windows 2000. The software has a number of predefined, editable message formats. The users can also define their own message formats with a built-in message editor. The messages can be triggered manually or automatically at predefined stages during or after sounding.

These can then be relayed forward using Windows NT's networking capabilities, including serial connection, dial-up networking and all LAN protocols

supported by NT. In other words, a network of DigiCORA III-based stations can form a scalable and automatic data and meteorological message relaying infrastructure for local, national and international needs.

Sounding software

The sounding software utilizes the advanced multi-tasking properties of Windows NT. This allows the software to run multiple sounding sessions concurrently, each of which can access a common data source. The soundings can be either live or sounding simulations using previously saved sounding data. At present only one of these can be a live sounding, but the architecture allows for operating multiple simultaneous live soundings from a single workstation, once the hardware capability becomes available.

DigiCORA III provides the user with a very rich collection of data from each sounding, as all received data can be saved and stored for later analysis. The database for storing soundings uses the Microsoft access format. Customers can therefore query the database with standard Microsoft Office 97 tools, like Excel 97. Separate API data access will be available in the future, allowing customers to make and use custom data processing and analysis tools to suit their specific requirements.

Meteorological messages

Several meteorological messages are available: the WMO standard messages, as well as BUFR and CREX. The NATO STANAG module extends the use of DigiCORA III to customers with tactical weather observation needs.

The available messages, parameters and message formats are specified in the DigiCORA III database. The user can predefine which messages should be generated at what time during or after the sounding. The user is also able to configure where the messages should be sent and whether a header or footer section should be appended. Real-time message generation is invoked utilizing the triggering server. ■

Orders for Upper Air Systems from North America

During September and October 2000, Vaisala received several substantial new orders from North America for its upper air observation system products. Deliveries will take place over the next three to five years.

"The orders include new upper air observation solutions for our customers, as well as additional orders for existing solutions. These new observation solutions have recently been introduced in North America, and the new orders confirm the market acceptance of the solutions. The North American market represents about one third of Vaisala's annual sales and is an area of considerable potential for Vaisala in the future," says Pekka Ketonen, President and CEO of Vaisala Group.

The US Department of Defense has placed an order for new upper air observation systems through Vaisala's cooperation partner in the United States. These new Vaisala systems will measure upper air meteorological data. The order incorporates an initial engineering and manufacturing development phase for four systems. Production options are estimated to cover 82 additional systems. Furthermore, the Department of Defense has placed orders both for their annual radiosondes for the next five years and for 17 observation systems.

The US National Weather Service placed an order for radiosondes to be delivered in 2001 and 2002. According to the agreement Vaisala will deliver some 50,000 radiosondes annually, which represents about two third of the US national requirements for upper air weather observations.

Additionally, the Mexican Meteorological Office ordered radiosondes for use at all 14 of the national synoptic upper air stations in Mexico. ■

Aurora's payload system was developed for high altitude dropsonde missions, for use on low speed platforms such as Pathfinder, Altus and Perseus B. Due to funding cuts, the dropsonde payload was not permitted to be deployed and operated from Pathfinder. Nevertheless, Aurora tested and qualified the payload for flight, using its high altitude test chambers. Vaisala's dropsondes were an integral part of this scientific experiment. Researchers are using dropsondes to get a more accurate picture of hurricanes.