



By Hermann Strass

**CompactPCI & AdvancedTCA**

# Flying without turbulence

## CompactPCI powers weather research advances

Pod is a term that describes round, long things. An example is a container hanging under the wings of an airplane, housing a jet engine. A helipod is similar in shape but hangs underneath a helicopter and houses scientific instruments, electronic control equipment, and a computer system. The helipod was developed by the Institute for Air and Space Systems (ILR) at the Technical University (TU) Carolo-Wilhelmina of Braunschweig, Germany, which has a long history of scientific aerospace research.

The helipod is an autonomous system with its own battery power supply, navigation system (Global Positioning System), computer system (CompactPCI), and storage. Used for novel ways of weather research, the helipod has produced some new and interesting results.

The helipod is the most advanced airborne system to measure atmospheric turbulence. It has been used in the Arctic waters, in California, Germany, and other places. Turbulence measurements can be done on the ground or onboard aircraft. This area is of great importance to weather development in the Northern Hemisphere. This airborne method is very expensive and it falsifies the measurement by introducing its own turbulence into the measured values. The helipod is 5 m (approximately 16 feet) long, 60 cm (about 2 feet) in diameter and weighs 250 kg (about 550 pounds), and is carried by a helicopter using a rope approximately 15 m (50 feet) long. At a speed of more than 40 meters per second (144 kilometers per hour, about 90 mph), the helipod is outside the downwash area of the helicopter rotor blades. The helipod's position enables it to measure the natural air turbulence. When used with two measurement systems, coarse and fine, along with some sophisticated algorithms, helipod measurements are more accurate than those using any other method. Table 1 shows some accuracy parameters. In Figure 1 a helipod heads off for turbulence, temperature, moisture,

Parameter	Absolute	Relative (metric)	Relative (US approximate)
Temperature	0.2 K	0.01 K	0.018 °F
Humidity	1%	0.01 g/kg	0.00016 oz/lb.
Air velocity	0.3 ms <sup>-1</sup>	0.01 ... 0.1 ms <sup>-1</sup>	0.003 ... 0.03 ft/s
Height	0.7 m	0.3 m (radar) 0.01 m (barometric)	12 in. (radar) 4 in. (barometric)
CO2	2 x 10 <sup>-6</sup>	0.5 x 10 <sup>-6</sup>	0.5 PPM

Table 1



Figure 1



Figure 2

and CO2 measurements over the Arctic Sea. Figure 2 shows the rope being let out

of the way of the rotor blades. (Photos courtesy TU Braunschweig.)

Measurements are taken as close as every 8 cm (about every 3 inches) and on different height levels for a high-definition three-dimensional profile.

### Surprising results

The high degree of heterogeneity of the air up to high altitudes above ground proved surprising. So far scientists have assumed that at heights greater than 300 meters to 500 meters (approximately 950 feet to 1,590 feet) the air above different ground areas (such as forest, lake, ice, and grassland) should be completely mixed. The heliPod measurements revealed that the air above discrete ground environments also differs even at much higher altitudes. Computer models for local weather forecast computations had to be changed considerably.

The heliPod does not need approval by the authorities, (Federal Aviation Administration) because it is passive. It can be easily disassembled for transport, reassembled onboard a ship or at some other location, and then lifted by a helicopter for immediate measurement activities. The first versions were flown in 1994, which means the team at the ILR has more than ten years' of experience in high-precision atmospheric turbulence, temperature, and humidity measurements.

The operation of the heliPod is controlled by two CompactPCI cards, six M-Modules from MEN (Germany), and one ARINC M-Module from AcQ (The Netherlands). Important criteria included a wide operating temperature range from -40 °C (arctic) to +85 °C (desert), and low power consumption of 8 W using a PowerPC processor (MPC8245) on a 6U CompactPCI board. The M-Modules were:

- One M66 (32 DIOs)
- Four M36 (32 differential channels of 16-bit A/D)
- One M34 (16 SE channels of 12-bit A/D)
- One ARINC M-Module

The M-Modules were mounted on the D03 CPU board and on the D301 carrier board, both 6U CompactPCI boards from MEN.

The ILR chose the real-time Linux operating system ELINOS from Sysgo (Germany) supplied by MEN. A few modifications were required for this highly specialized application. Adapting the real-time operating system was no problem since ELINOS is an open source Linux system.

With only two CompactPCI cards, the ILR was able to build and operate a highly complex and accurate measurement system from standardized, cost-effective components, which is usable in harsh environments.

### European events

Hannover Fair held in Germany chose Russia as the partner country. Russian industry presented itself in Hall 13 at the fairground. The Russian economy indicated a healthy growth rate of 7.1 percent in 2004. Multibillion-EURO European contracts were inked at the Hannover Fair, which was opened by German Chancellor Gerhard Schroeder and Russian President Vladimir Putin. For more information on Hannover Fair 2005, see the June 2005 issue of *VMEbus Systems*, VMEbus Technology in Europe column (available online at [www.vmebus-systems.com](http://www.vmebus-systems.com)).

Voxbit (Germany) organized the RapidIO Developer Summit at the Siemens Conference Center in Munich, Germany on May 31, 2005. Hosted by the RapidIO Trade Association, the Developer Summit took place as a one day seminar similar to events in the USA. A big emphasis was given to High Availability (HA) issues as defined by the Service Availability Forum (SA Forum). AdvancedTCA and ideas for the SA Forum started at Siemens in response to their requirement for carrier grade, open standard telecom products and systems. Werner Kammerer, formerly at Siemens and now CEO of Voxbit, and Iain Scott, Executive Director of the RapidIO Trade Association, opened the conference, which included application, technology, product, and vendor presentations. RapidIO is an international standard (ISO/IEC 18372).

### European products

ESO Technologies (France) offers HA computing platform design integration

services for OEMs as defined by the SA Forum. AdvancedTCA hardware from partners and Carrier Grade Linux (CGL) are offered as integrated solutions (preconfigured HA systems) according to customer requirements. ESO Technologies also offers an automated AdvancedTCA testing software suite called AdvancedTCA-Tester.

Fastwel (Russia) is ISO9001 certified by TUV Rheinland. They offer 3U and 6U CompactPCI CPU cards, optionally for extended temperature range (-40 °C to +85 °C) with 1.6 GHz Pentium. Fastwel is a contract manufacturer, system integrator (for example, industrial automation and space applications), and they do custom design.

Fujitsu Siemens Computers (FSC) (Germany) signed a worldwide agreement with IBM, allowing IBM the use of the SAFE4CS software infrastructure from FSC for telecom services. Both companies will now work together to offer server and middleware solutions to Telecom Equipment Manufacturers (TEMs). IBM integrates SAFE4CS from FSC into their Integrated Platform-Telecom (IP-T), including Blade CenterT, to make it into a turnkey system offering for their telecom customers and service providers. FSC demonstrated SAFE4CS at SUPERC0MM 2005 held in Chicago.

### PICMG Europe news

The PCI Industrial Computer Manufacturers Group (PICMG) released new protocol encapsulation specifications for AdvancedTCA systems. Specifications SFP.0 and SFP.1 enable legacy protocols on PICMG 3.1 Ethernet and other transports over AdvancedTCA backplanes.

The PICMG executive membership approved two new protocol specifications that will allow applications that use legacy transport protocols to be easily ported to AdvancedTCA systems. By encapsulating these protocols on AdvancedTCA interconnects, they appear to be running over a direct connection.

SFP.0 is a protocol specification for low-overhead, high-speed generic

encapsulation targeted at PICMG 3.1 Ethernet-based modular systems, but also applies to other PICMG 3.x and 2.16 fabric-based systems and all kinds of packet- and cell-based traffic, for example, TDM and ATM for transport on a switched fabric.

SFP.1, also known as Internal TDM (I-TDM), is a companion protocol specification to SFP.0 that is optimized for TDM traffic over high-speed fabrics such as 1 and 10 Gigabit Ethernet (PICMG 3.1), Advanced Switching (PICMG 3.4), and InfiniBand (PICMG 3.2).

SFP.1 and SFP.0 together provide a complete encapsulation for TDM over Ethernet. This provides a functional replacement to the hardware-based H.110 and H.100 buses that existed in older telephony systems.

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### Websites of interest:

[www.acq.nl](http://www.acq.nl)

[www.eso-tech.com](http://www.eso-tech.com)

[www.fastwel.com](http://www.fastwel.com)

[www.fujitsu-siemens.de](http://www.fujitsu-siemens.de)

[www.helipod.de](http://www.helipod.de)

[www.menmicro.com](http://www.menmicro.com)

[www.picmg.org](http://www.picmg.org)

[www.rapidio.org](http://www.rapidio.org)

[www.saforum.org](http://www.saforum.org)