80Mbytes/sec Throughput Data-Acquisition System for Wind Tunnel Testing at AgustaWestland

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In today's world the Aerospace and industry faces high economical pressures for the development of their products. These pressures translate to short development cycles on one hand and the request for very high measurement accuracy to verify new designs on the other hand. These economic pressures change the world of data-acquisition and Test & Measurement. This translates to two major requirements, which your equipment needs to address. The first is real-time storage and online monitoring and the second is measurement accuracy. We will show that the VXIbus is the ideal environment for such applications.

Let's take for example the wind tunnel data-acquisition system provided by Bustec to AgustaWestland. AgustaWestland needed a solution, which could provide them with the possibility to acquire 128 channels simultaneously at a sampling rate of up 216 kHz and at the same time to acquire data from about 128 slower channels. The slower channels consist of a mixture of thermocouple, pressure and digital I/O channels with up to 1 kHz sampling rate. One of the major requirements was that the system had to be able to allow the real-time monitoring of all channels and simultaneously to store the data continuously onto a RAID system (see Figure 1).

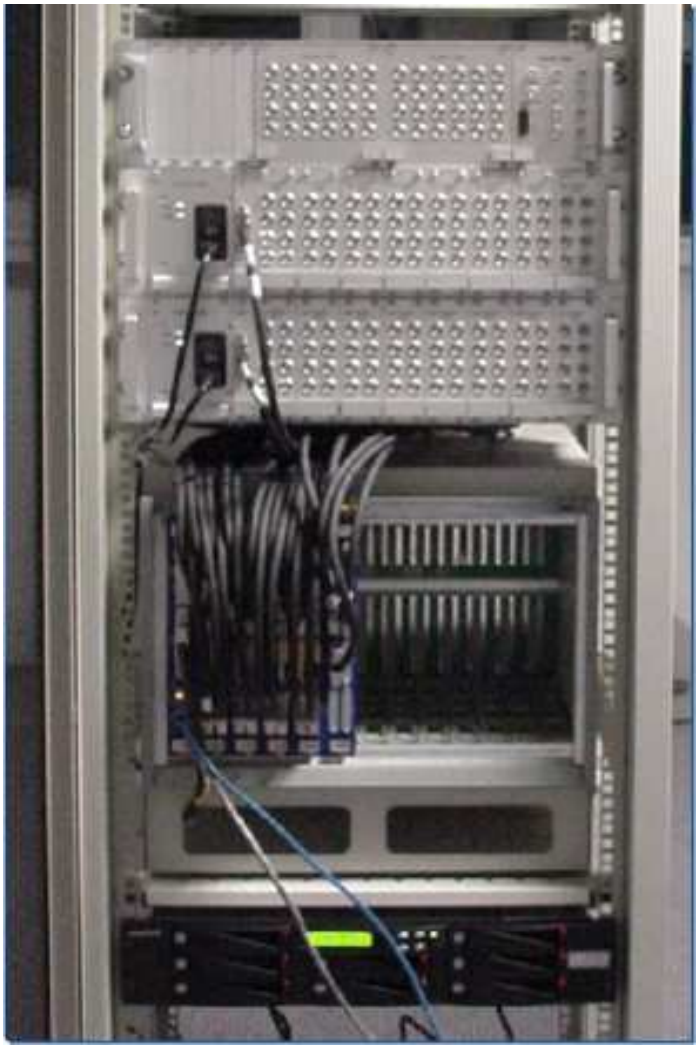

Figure 1: Wind Tunnel Data-Acquisition System

Therefore the bandwidth for data collection and concentration onto one or several different servers and workstations was a crucial aspect of the system design.

To achieve such goals the user needs a fast slot-0 and a slave module which can keep up with the speed of the slot-0. Bustecs 3044 Slot-0 Controller and the 3180 Motherboard are making full use of the VXIbus specification VXI-1 version 3.0 and provide the user with 80MB/sec sustained throughput, thus providing the user with the bandwidth needed for such large dynamic systems.

The ProDAQ 3044 PowerPC-based Slot-0 Controller features the MPC7457 PowerPC® processor running at 1.267 GHz, up to 2GB of on-board DDR ECC memory and 128MB of Flash, two 33/66/100 MHz PMC-X sites, dual Gigabit Ethernet interfaces and the new Tundra Tsi148® VXIbus interface chip. It is the first VXIbus slot-0 controller supporting the 2eVME protocol of the version 3.0 of the VXI specification.

The ProDAQ 3180 Ultra-performance Motherboard is a single-slot C-size VXIbus module able to accommodate up to eight ProDAQ function cards, a DSP plug-in, a memory module and a voltage reference plug-in (see Figure 2).

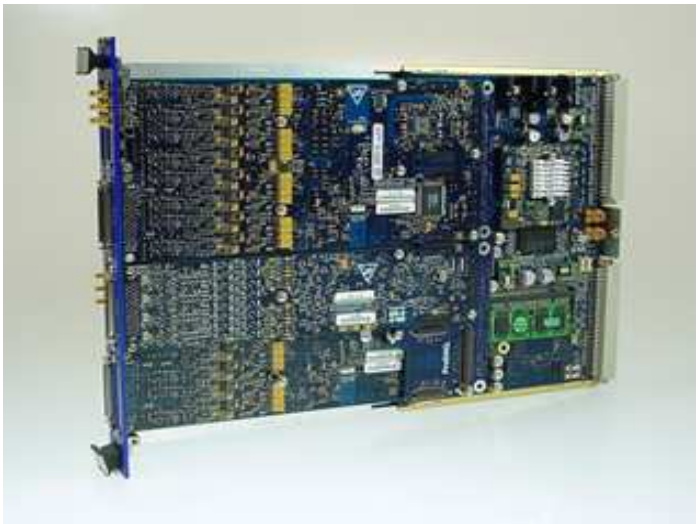

Figure 2: ProDAQ 3180 Ultra-performance Motherboard

ProDAQ functions cards occupy either one or two of the eight available positions in a ProDAQ motherboard providing any data acquisition and test I/O functionality necessary for the application. The internal data throughput rate of the ProDAQ 3180 motherboard of up to 320MB/sec between the function cards and the internal memory or DSP together with the unmatched 4800 MMACs of 16-bit performance and 3600 MFLOPS of floating-point performance of the TigerSHARC DSP provides the customer with enough resources for even the most demanding jobs.

Utilizing the power and flexibility of this base system, Bustecs ProDAQ 3424 24-bit Sigma/Delta ADC function card addresses the second requirement mentioned above, the high measurement accuracy. It provides eight channels of differential input, ICP and TEDS, gain up to 1000 and sample rates of up to 216 kHz with a Signal to Noise ratio of 114dB.

Figure 1 shows the complete data acquisition system as provided to AgustaWestland. On top you can see three signal conditioning units with cards for bridge, pressure and thermocouple signal conditioning as well as direct counter and digital I/O. Below the signal conditioning units you will find the VXIbus mainframe with the ProDAQ 3044 Embedded Slot-0 Controller, and the ProDAQ motherboards. Four ProDAQ 3180 Motherboards are populated with four ProDAQ 3424 Sigma/Delta ADC function cards each, providing a total of 128 fast input channels. One ProDAQ motherboard is equipped with four ProDAQ 3411 function cards providing 96 differential slow analog input channels for temperature and pressure measurement, one ProDAQ 3610 function card for the 48 digital input/output channels and one ProDAQ 3808 function card for the 8 channels of 100MHz counter channels. At the bottom the RAID system provides up to several Terabytes of data storage and a sustained throughput able to continuously record the data acquired by the system.

With the accuracy of their systems and the large data-bandwidth, Bustec can address the economic request to shorten test cycles and deliver results, which let you achieve your design goals.

About Bustec: Bustec is a leading supplier of high-performance data-acquisition and test products. The products are all based on computer independent and open platform standards. They offer the highest density available in the market and brought modularity to a new level. In addition Bustec provides the

highest data throughput available in the VXIbus market today together with an unmatched analog accuracy.

About the author: Dr. Fred Blönnigen has a Ph.D. in physics. After he made his Ph.D. in France, he worked in the University of Berkeley in California as Nuclear and Elementary particle Physicist. Back in Europe, he worked for a large American data acquisition and test company for several years. In 1997 he founded Bustec in Ireland and opened a branch in 2000 in the USA. He is still working as CEO of Bustec.