

Industrial PC upgrade promotes offshore surveying success

After nearly twenty years' presence in rugged environments, industrial rackmount PCs are well accepted and understood workhorses for real world data processing. However, innovative industrial PC manufacturers are equipping these familiar machines with newer, more compact and more powerful hardware. Upgrading to these more recent platforms can bring performance and reliability benefits of real commercial significance. An offshore equipment project recently completed by CodaOctopus Products Ltd using a Eurotech industrial PC clearly illustrates how hardware, software and support factors can all contribute to the success of such upgrades.

Based in Scotland, with offices in the US and Europe, CodaOctopus Products Ltd specialises in marine technologies for imaging, positioning, defence and surveying, and delivers complete geosurvey solutions. Their Coda DA Series of sonar acquisition systems is widely used in surveying, pipeline inspection and similar subsea operations. After several years' field experience, CodaOctopus has upgraded their original industrial PC implementation of the DA Series with newly available technology to gain some very tangible benefits. These become clear with a closer look at the application and its issues, and how the new solution is optimised to solve them.

Underwater surveying and related activities are typically performed using a sidescan sonar, a sub-bottom profiler, or both. The sidescan sonar maps large areas of the seabed and related factors such as the presence of debris or the status of pipelines or cables. The sub-bottom profiler uses acoustic (known as seismic) pulses to investigate the depth, position and slope of sub floor sedimentary layers, and to obtain some information about their composition. It can also detect buried objects such as pipelines, ancient artefacts and lost ship's anchors.

Sidescan sonar and sub-bottom profiler units, which are available from a number of well established manufacturers, are towed along a predetermined path by the survey vessel. The towing cables also carry communications traffic between the subsea units and the vessel. These are two-way links carrying triggering information to the subsea units, and measured data in analogue or digital format from them.

On board the vessel, the communications links connect to a data acquisition system providing the real-time data control and acquisition interface. As the data is acquired, it can be displayed on screens connected to the system, with hard copy available from printers. The data is also logged onto a hard drive locally or onto a networked server to be available for post-processing and interpretation software either within or external to the data acquisition unit. Different applications such as interactive interpretation, automated pipeline inspection and mosaicing can be fulfilled. Finally, the processed software can be integrated into a packaged presentation that conveys essential information to the intended recipients in an easily understood form.

Vessel operators face a number of pressures as they work to deliver this subsea surveying service. Although these arise for different reasons, they can all be mitigated by the quality and specification of the data acquisition unit.

Firstly, the operating environment is physically challenging, especially in terms of shock and vibration problems. The implications of a hardware failure are particularly severe during the course of a deep sea survey with no immediate access to a repair or parts centre. The second issue is partly related to the first, and concerns available space within the vessel. It is not unusual for survey vessels to carry two or

three acquisition systems, as well as another couple of units held either as hot spares or as a source of spare parts. This can add up to nearly 1½ metres of vertical racking space – a non trivial requirement on most survey ships.

Finally, there is pressure to obtain useful results, fast. A survey vessel typically costs £20 – 30,000 a day to charter, and will typically utilise two man teams working 12 hour shifts to make the most of the available time. Representatives from the end client, often present during surveys, are usually intent on obtaining results and making decisions as fast as possible. The best solution would be to perform all tasks from acquisition through to interpretation and even presentation on the data acquisition system, remaining focused on one machine for the surveying session. This would allow the group to discuss results and if appropriate initiate further surveys as fast and efficiently as possible. However this has often been difficult to achieve with the legacy Coda DA Series because analogue subsea sensors need a Linux environment, whereas many interpretation software packages from different suppliers run only under MS Windows.

CodaOctopus has responded by designing newly available technology into a solution far more effective than previously possible. The result is their revised Coda DA rackmount data acquisition series. This uses the Eurotech Apollo ICE industrial computer which is only 1u or 45mm high and features a Pentium M processor on a horizontally mounted industrial single board computer. It also contains two PCI data acquisition cards on an internal 1U riser and drives two VGA screens, and two printers. It can connect to analogue and digital sidescan sonars and sub-bottom profilers from many different manufacturers and link in to the onboard network. Raw and processed data is stored on an internal hard drive or directly to a networked server, with back up to DVD, CD or external drive devices possible. The software environment, unique to the Apollo, allows users to start either Fedora Linux or Windows XP at power on.

The DA series now comprises a number of variants (DA500Seismic, DA500SSS, DA1000 & DA2000) with capabilities and features which are determined by the requirements of the survey. For example the DA500 can be used to interface to a single sonar sensor whereas the feature rich DA2000 is capable of simultaneous asynchronous acquisition from dual sonar sensors. All units are based on the Eurotech Apollo industrial PC and use the same technology.

The Apollo's dual boot capability gives the Coda DA series a critical advantage over earlier single operating system machines. A Linux machine would allow users to handle analogue inputs from subsea sensors but not to run many third party interpretation packages available only under Windows. Conversely a Windows machine would not support analogue sensor inputs. By contrast, the DA series can provide a 'one stop' solution to all combinations by switching between Linux and Windows as required.

The dual screen output is a further boost to efficiency. Sidescan sonar and sub-bottom profiler data can be displayed simultaneously without loss of resolution, allowing immediate visual correlation of the two related images. Alternatively, incoming raw data and processed data can be displayed simultaneously for easy comparison. Users also appreciate the richness of hard copy information yielded from the twin printer outputs.

The Coda DA series' 1U height represents a considerable advantage over earlier 5U or 6U implementations. In a typical survey vessel with five systems this represents a vertical rack space saving of over a metre, which is very significant in an onboard environment. The reduced size also yields

reductions in weight and audible noise. Additionally, the compact package resists flexing during rough weather punishment, reducing incidents of board displacement or hard drive damage. And if replacement units are ever needed, shipping a 1u chassis in a Peli-case is lower cost and more trouble-free than larger unit transportation.

The DA series Apollo achieves its 1U height by eliminating the backplane typical of earlier designs. With emphasis nowadays shifting to digital communications rather than long distance process I/O, the backplane's role has diminished, so its inefficient 'right angle' configuration could be exchanged for the Apollo's newer, more compact coplanar solution. Shock or vibration can unseat boards from backplane slots all too easily, so eliminating the backplane alone reduces system failure problems by around 90% in addition to saving space.

The Apollo ICE is a standard product designed and manufactured by Eurotech Ltd in the UK. Eurotech Ltd, part of the international Eurotech Group, designs, develops and manufactures industrial single board computers, PCs and complete solutions for hostile and demanding environments. CodaOctopus designed the Apollo ICE platform into their DA series system by working closely with Eurotech Ltd. The standard Apollo units meet military specifications for shock and vibration and are engineered to handle the heat output from Celeron M or Pentium M CPUs; however some custom engineering was needed to fully comply with CodaOctopus's requirements.

"The key reasons for choosing Eurotech were the Apollo's Linux/Windows dual boot ability and its slimline rugged chassis", commented Rob Carsley, Product Development Manager at CodaOctopus Products Ltd, "However the choice also paid dividends with their custom engineering support. They helped us with the metalwork necessary for breaking out the interface electronics, cabling, jumpers and connectors for the two PCI cards within the 1u chassis height. They also worked with us to set up rugged connections to the two displays and two printers supported by our system".

The two PCI cards handle the data acquisition channels and associated triggering. Software selection allows the Coda DA series to either be triggered by the subsea devices or to trigger them. The interface electronics designed by CodaOctopus provides signal conditioning for the data channels using plug-in anti-aliasing filters and amplifiers.

The Apollo ICE has one Centronics and one VGA monitor output as standard. In the DA series version, Eurotech cabled the CPU's LVDS output to a daughterboard for conversion into a second VGA monitor output. Similarly, Eurotech connected a USB channel from a daughterboard to a chassis mounted circular Lemo connector. CodaOctopus provides a cable that mates with this rugged connector and, with built in conversion electronics generates the Centronics output for the second printer.

Eurotech supplied the Apollo ICE units with the dual boot Linux/Windows XP environment and drivers ready installed. CodaOctopus installed updates for some display drivers, which ensured that the Coda DA series would support every display monitor available on the market. After this, no further effort was needed before CodaOctopus installed and commissioned their applications software for acquisition, post-processing and interpretation.

"The Apollo ICE, with Eurotech's support, allowed us to bring our updated software suite to market without delay", Rob Carsley stated. "And since installing the first system about six months ago we have not seen a single field failure. Meanwhile our customers have become more competitive by offering a faster and more sophisticated service to their users. We also have confidence in this package as a long

term solution, because Eurotech has guaranteed to support our Linux and Windows environment with Apollo for five years, irrespective of changes in hardware availability”.