EUROTECH

> APPLICATION STORY

VIPER Aid to Acoustic Positioning

Applied Acoustics is a leading manufacturer of undersea positioning, tracking and sub-bottom profiling equipment. These systems are used in a wide variety of subsea commercial, military and environmental projects. They are also vital to research and supporting advances in oceanographic knowledge.

Eurotech & Applied Acoustics

One of the most versatile, stable and easy to use is the Applied Acoustics Easytrak Portable acoustic navigation system, in which Eurotech's VIPER single board computer plays a key communications role. Easytrak can undertake a wide range of tracking and positioning tasks for seabed mapping, towfish tracking and controlling robotic vehicles. It is also used to locate subsea divers, so is critical to the safety of personnel.

In recent years robotics has revolutionised the range and scope of ocean research and the type of projects that can be undertaken in the incredibly hostile deep water environment. For instance, in May 2009 a new type of deep sea robotic vehicle called Nereus reached the deepest part of the world's oceans, making a dive of 6.8 miles in the Mariana Trench in the western Pacific, where pressure reaches 16,000 pounds per square inch, and becoming the deepest diving vehicle ever.

Remotely Operated Vehicles (ROVs) and Autonomous Underwater Vehicles (AUVs) are now indispensible to much underwater exploration and increasingly the targets for Easytrak's capabilities. AUVs are not linked to base by umbilical cables and are therefore more flexible in their ability to acquire marine data, so accurate navigation and positioning systems are particularly important.

Systems for underwater positioning range from Long Baseline (LBL), where an array of transponders may be operated on a baseline several kilometres long, to Ultra-Short Baseline (USBL) systems like Easytrak. Easytrak Portable consists of two main parts: a splash-proof waterproof console with display screen and keyboard linked by cable to a transceiver deployed over the side of the vessel into the water. The transponder is an acoustic beacon about the size of a small torch, fitted to the underwater sonar equipment, robotic vehicle or diver. Communication works by acoustic pulses passing between the transceiver and transponder, with reception to the most powerful Applied Acoustics beacons exceeding 1,000 metres in reasonable conditions. The Eurotech VIPER will then interpret these acoustic signals and instantly display them as accurate workable readings. The velocity of sound through water is calculated by an equation incorporating velocity, compressibility and density. The denser and more compressible a medium is, the slower the sound waves will travel. However, sound travels through water about four times faster than through air, because although water is dense, it is virtually incompressible. The calculation process is complex. Underwater acoustic systems can be affected by background noise and conditions such as water aeration, which can attenuate signals severely. Sound pulses may also bend due to refraction caused by different temperature layers in the water.

Range and Bearing

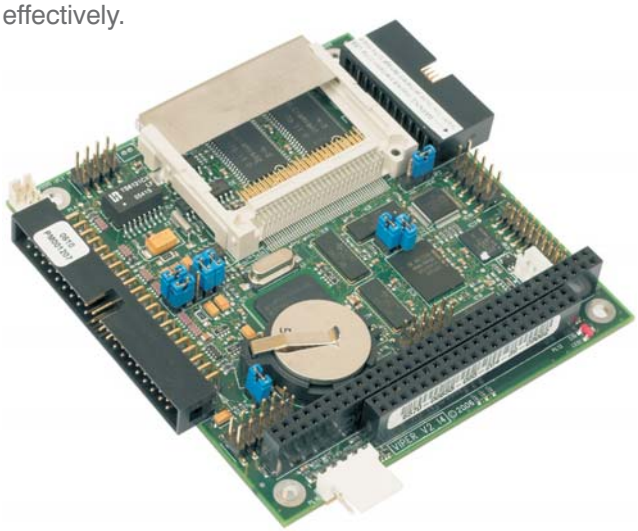
Positioning is achieved through establishing the range and bearing of the target to base. Once in the water, the acoustic beacon will listen for a specific acoustic signal from the transceiver. When this is received, the beacon will send a different signal pulse back to the transceiver.

The time taken for these two acoustic signals to be transmitted and received back will identify the distance, or range, of the beacon to transceiver. The bearing of the target is calculated by computing the small time differences between the acoustic signals received due to their different signal paths.

With calculations made for range and bearing, the beacon's positioning can be computed. Information such as depth can be transmitted back to the

transceiver. This is when the number crunching takes place.

A Digital Signal Processing (DSP) Board, incorporated into the waterproof console, will carry this out by processing the incoming acoustic signals. The Eurotech VIPER embedded processor board acts as the hub of the DSP system, translating signals via the FPIF interface board with the LCD display and also interfacing with the front panel keyboard. A continual accurate positioning update is provided to project controllers on the surface, providing them with the data to direct their personnel and equipment effectively.



Flexible Operation

Easytrak is a highly flexible system which can detect a variety of underwater targets and use different beacon types. The equipment, the VIPER board not least, has to have robust capabilities in order to deal with a difficult operating environment. Based on the RISC processor, the Eurotech VIPER is an ultra low power fanless single board computer (maximum consumption 1.9W as well as very low power standby mode). The system also has a wide operating temperature (from -20°C to +70°C). The board runs on Windows CE software and communicates with the DSP to interpret target positioning and displays results on the 640 x 480 resolution LCD TFT Display.

The VIPER has many serial interfaces to allow for the integration of a GPS receiver, external motion sensors, gyrocompass and a data-out port for use with customer navigation packages. This covers the pitch, roll and heading sensors that compensate for vessel movement and the ports on the Easytrak console that allow it to interface with gyros and vertical reference units (VRUs) for greater positioning accuracy. It also enables the operation of Easytrak's GPS input, which provides latitude and longitude corrected coordinates of the target beacon or beacons.

Mike Fitch, Senior Design Engineer at Applied Acoustics, commented: "The VIPER was chosen mainly because of its compact size, low power consumption and multiple I/O. The embedded operating system allows for a fast start-up and the board has proved very reliable in operation. We have been delighted with its performance."