SonTek/YSI: Strength Through Diversity

San Diego-Based SonTek Builds on Existing Oceanographic Technology as a Part of YSI

Twelve years ago, two professionals left a leading water instrumentation company to develop their own venture. This new company was built on two important premises—that precision water velocity measurement should be innovative, practical and affordable; and the working environment should be open, informal and collaborative.

Today, this company, SonTek/YSI Inc., is a leader in the water velocity measurement market. Its founders are no longer with the company, although one, Ramon Cabrera, remains a senior technical advisor. However, SonTek's technical leadership, innovative culture and highly educated workforce (oceanographers, hydrologists and fluid dynamics experts) are primary reasons for its ongoing success.

SonTek's core product lines measure water flow and velocity using acoustic Doppler technology. The company is based in San Diego, California, in a 15,000-square-foot engineering and manufacturing facility. It employs 40 people, representing 16 different nationalities.

SonTek facility in San Diego, California.

Getting its Feet Wet

SonTek initially got its feet wet in the laboratory market. In 1993, SonTek received its first major contract from the U.S. Army Corps of Engineers Waterways Experimental Station. The task was to deliver an acoustic Doppler velocimeter (ADV®). This new device was invented by SonTek and continues to be its core technology. Originally designed for laboratory use, the ADV is a single-point, high-resolution Doppler current meter used for detailed studies of 3D velocity fields. Since its introduction, the ADV has become established as a standard for high-resolution velocity data.

Today, more than 1,000 SonTek ADVs are used worldwide, taking measurements in laboratories, oceans and rivers. After its commercial release, applications for the ADV quickly evolved for the oceanography market.

Chris Ward, who leads sales and marketing, said, "Oceanography applications are at our roots and they remain the company's biggest installed base."

In 1995, the company received funding from the National Science Foundation to develop a low-cost, compact current profiler called the acoustic Doppler profiler (ADP®). At the time, the leading competitive instrument was an acoustic Doppler current profiler that sold for more than $40,000. SonTek's ADP was smaller and cost half as much without sacrificing technical integrity. Today, there are more than 800 ADP systems used in rivers and oceans worldwide.

For applications in the port and harbor-monitoring market, SonTek introduced its side-looking Doppler current profiler in 1997. This technology now commands a 90 percent market share. SonTek introduced its Argonaut® current meter platform in the 1990s. Using the latest complementary metal oxide semiconductor circuitry, the Argonaut significantly decreased power consumption over the previous generation of Doppler hardware. Its

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compact size, low cost and flexible architecture lends it to a wide variety of applications. For example, the Argonaut-mooring deployments (MD) is designed for long-term deployment in deep-ocean and low-backscatter environments. Today, there are more than 2,000 Argonaut-based devices used worldwide.

Managing Growth

From the late 1990s through the turn of the century, SonTek experienced growth in both physical size and new product development. During this period, the Argonaut-ADV, Argonaut-DVL, Pulse Coherent-ADP, RiverCAT and FlowTracker products were developed and released. Much of the company's growth was fueled by an increased demand for products in the surface-water hydrology market.

In 2001, YSI Inc. acquired SonTek. YSI is a private, employee-owned sensor technology company based in Yellow Springs, Ohio. YSI's largest customer base is in the environmental-monitoring market. Its high-precision sensors are components of instruments and monitoring systems that measure water quality, primarily in freshwater applications. YSI is a leader in the measurement of dissolved oxygen, which is necessary for the survival of plant and animal life in water.

SonTek, legally renamed SonTek/YSI and a wholly-owned subsidiary of YSI, remains in San Diego, California. Its facility has nearly doubled in size since the merger. The number of employees has increased 25 percent and manufacturing throughput time has decreased by 50 percent.

Philosophically, both companies felt as if their cultures and legacies of innovation were a perfect match. At the time of the acquisition, Gayle Rominger, senior vice president of YSI, stated, "We now have a powerful and strategic combination of capabilities in both water quality and water quantity. Together, both companies will leverage our technology, sales and marketing efforts."

For example, both YSI's sales and support office in the U.S. Gulf Coast region and its Massachusetts subsidiary, Endeco/YSI, now represent the SonTek product line. Also, YSI's offices in Europe and Asia have added SonTek specialists to enhance their marketing efforts in these regions. Endeco is a marine systems integrator based in Marion, Massachusetts. With their help, a massive vessel traffic management information system (VTMIS) was installed this year in the Bosphorus Straits. High current speeds prevail there and operational efficiency is paramount. The VTMIS platforms combine a large number of

(Left) Since the 2001 acquisition by YSI Inc., SonTek's manufacturing efficiency has significantly improved.

The Argonaut-MD open-water current meter is designed for high-precision current measurement on long-term mooring deployments. Shown here in titanium rated to 6,000 meters.

SonTek current meters and Endeco systems into real-time data collection platforms.

Each of the 15 data collection platforms integrates a vertical, downlooking 500-kilohertz SonTek ADP, mounted on the base, as well as a SonTek Argonaut-SL, mounted horizontally on the side of a fully self-powered Endeco EMM2000 buoy. A solar panel recharges the onboard battery pack in order for the system to remain operational indefinitely. Real-time data from the buoys are transmitted in a single collected-data stream by telemetry.

The Bosphorus Straits is a 20-mile-long channel that runs through Turkey, connecting the Black Sea in the north to the Marmara Sea in the south (the gateway to the Mediterranean Sea). It divides the city of Istanbul into Europe and Asia.

The straits are considered to be among the most challenging waterways in the world to navigate because of the large amount of maritime traffic passing in close proximity to Istanbul, home to 12 million people.

The VTMIS will monitor the 45,000 vessels per year, moving between the Black and Mediterranean seas. Based on the reported water current velocities from the buoys, the vessel traffic controller and oil tanker pilots can make informed decisions as to the safest and most efficient navigational paths. This protects the marine environment of the straits from pollution that results from vessel collisions and groundings.

New Products

Engineers from both SonTek and YSI collaborate on new products that combine the companies' technologies. As the adage goes, "Two heads are better than one."

In 2003, the companies released their first jointly developed product. The YSI ADV6600 water-quality monitor combines the acoustic Doppler velocity capability of SonTek's Argonaut ADV instrument with the water-quality sensors in YSI's multiparameter sondes. The ADV6600 can measure dissolved oxygen, conductivity, temperature, pH, oxygen-reduction potential, pressure, velocity, direction, turbidity, chlorophyll, rhodamine, chloride, ammonia and nitrate, along with calculated parameters such as specific conductance and salinity.

The ADV6600 internally logs data and its interface is accessible through custom software. It is uniquely suited for estuary monitoring and long-term deployments.

SonTek Oceanography Products

SonTek products serve three major markets: oceanography, hydrology and laboratory. Research and development goals for all markets are to make products smaller, easier to use and more practical.

Products across the markets utilize the same foundational technology—when a new product is developed for one market, with slight modifications and focus on applications engineering, the same technology can be implemented into another market.

Key products for the oceanography market include:

Acoustic Doppler Profilers. SonTek's ADP is a high-performance water current profiler that is accurate, reliable and easy to use. The ADP uses state-of-the-art transducers and electronics designed to reduce side-lobe interference problems that plague other current profilers. This allows the ADP to make the very near-boundary (surface or bottom) current measurements critical to shallow-water applications.

Other applications include boat-mounted monitoring with complete positioning, including bottom-tracking and differential global positioning system interface for transects; real-time systems for near-shore, port and harbor monitoring; and autonomous systems complete with batteries and a recorder for offshore buoy or bottom-mounting.

SonTek's pulse-coherent acoustic Doppler profiler (PC-ADP) is ADP-optimized for high-resolution, short-range boundary layer studies. The PC-ADP combines the precision of an ADV with the profiling capability of an ADP. Based on the mini-head ADP design, the exceptionally small PC-ADP probe-head generates a much lower flow disturbance than a standard ADP head. The optimized beam geometry provides increased maximum resolvable velocities, increased profiling ranges, reduced side-lobe interference and reduced beam-to-beam velocity decorrelations.

Applications include bottom boundary layer studies, low flow studies and directional wave spectra.

Acoustic Doppler Velocimeters. The ADVOcean probe is an extremely rugged version of the ADV developed for use in environments such as the surf zone. An integrated pressure sensor is available for directional wave applications. Researchers from Scripps Institution of Oceanography have used a SonTek ADV for measurements in the surf zone of a San Diego beach. The ADV was then deployed at low tide and left in place to study near-bed velocities in the surf and swash zones with the changing tides.

Other applications include autonomous underwater vehicles, remotely operated vehicles, benthic layer studies, near-shore monitoring, and water supply and treatment.

Hydra. The Hydra combines SonTek's advanced Doppler techn-ology with the best pressure, compass tilt and turbidity sensors available. The Hydra provides, in one seamless package, a powerful data-acquisition system, high-resolution velocity sensor, strain gauge pressure sensor and top-of-the-line sensors from other manufacturers. The Hydra is capable of multiple-burst sampling schemes. The system can support up to three independent sampling strategies simultaneously.

A typical example is gathering a five-minute average for mean properties, followed by two minutes of data at four hertz for wave studies, followed by a burst of 30 seconds at 25 hertz for turbulence studies, followed by a sleep period to conserve power. Applications include bottom boundary, directional waves, sediment transport and surf zone research.

Argonaut Current Meters. The Argonaut-MD measures water motion at a single point almost anywhere in the ocean. This 3D, vector-averaging current meter is small, light and inexpensive. The MD's low-power electronics and high-capacity alkaline battery pack are perfect for long-term deployments. Optional high-sensitivity transducers are available for regions with low scattering conditions. With standard temperature and optional pressure and conductivity sensors, the MD is ideal for measuring in areas that ADPs/ ADCPs miss.

Argonaut-MDs are currently used in the Tropical Atmosphere Ocean (TAO) project, supported by the National Oceanic and Atmospheric Administration/Pacific Marine Environment Laboratory. The TAO project is part of a multi-national effort to provide data for improved detection and forecasting of El Niño and La Niña. An array of moorings containing Arg-

onaut-MDs run across the Pacific Ocean. These moorings telemeter real-time oceanographic and meteorological data to shore via satellite.

The Argonaut-MD is also being used in a project in the Shetland Isles. As part of the British government's Sustainable Energy Program, Engineering Business Ltd. designed, constructed and deployed what is believed to be the world's first full-scale tidal generator, the Stingray. The Stingray is proposed to be one of many systems employed as a part of a tidal generator farm. An Argonaut-MD is attached to the side of the Stingray to measure tidal currents so that engineers can accurately correlate current velocity with the effects of dynamic loading on the hydroplane.

The product line also includes the Argonaut-SL and Argonaut-XR for hydrological and harbor-monitoring applications, the Argonaut-ADV for single point measurements with limited power and the Argonaut-DVL for underwater navigation.

SonTek Services

In addition to state-of-the-art products and software, SonTek also provides dedicated technical support services. Its employees spend many hours helping customers configure products and systems to meet their specific measurement needs. Engineers work day and night to design and build prototypes while field representatives are outside in all types of weather checking on various systems.

SonTek routinely hosts a variety of educational and training seminars. Classes—usually initiated by customer requests—are hosted at its San Diego facility, including on-the-water demonstrations of ADP bottom tracking and in-the-water FlowTracker demonstrations.

In conjunction with YSI's Shanghai, China, office, SonTek held its first ever RiverCAT Regatta for Chinese hydrology survey administrators in March.

SonTek will host its second Users Conference in Orlando, Florida, January 19-21, 2005. This conference is designed for customers who use acoustic Doppler instruments in surface-water hydrology or estuarine applications. SonTek's applications engineers will be available to discuss specific measurement applications. */st/*

For more information, e-mail oceanbiz@sea-technology.com.