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Sea-Bird Electronics Inc.

Small Beginnings, Global Impacts

By Raina O. Clark

Sea-Bird Electronics began humbly in 1978 from the home of Art Pederson, an engineer in the Applied Physics Lab at the University of Washington. Pederson took early retirement from the University and acquired a commercial license for a couple of designs he had been working on in the lab, instruments for measuring Conductivity and Temperature in the ocean. Integrating these sensors with a commercial pressure (Depth) sensor, Art built Sea-Bird's first CTD. These three elements, CTD, determine density, which in turn drives ocean currents. These currents are key to scientific inquiries such as climate change analyses, as well as shorter-term tasks like fisheries and port management, hurricane preparedness and search and rescue.

When Pederson named the company, he chose "Sea" for his home city of Seattle and "Bird," his wife's maiden name, in recognition of her part in the start-up. Sea-Bird started out building CTD research instruments for university scientists, then began supplying science agencies like NOAA, EPA and USGS.

"Sea-Bird really got its legs and reputation for the very best measurement you can make in the 80s and early 90s" under Pederson's tenure, said current president, Dr. Norge Larson. Ken Lawson, Sea-Bird's second president from 1991 to 2005, grew the company from 27 to 84 employees in his years at the helm and transitioned its original custom products into a diverse line of standard instruments. Fast forward to today and Larson says "there isn't a university or research institute in the world involved in this field that doesn't use our instruments." Sea-Bird now employs about 110 people. In addition, Sea-Bird has created an umbrella group — Sea-Bird Scientific — currently comprised of four companies employing more than 200 people at five locations around the globe. "Our ability to help customers achieve their goals has really grown," Larson said.

Sea-Bird has witnessed and participated in the maturation of oceanography as a science. Modern electronics and computing power led to a huge growth in the ability to make measurements with an accuracy never before possible. One important result of this technological advancement has been a deeper understanding of density and the ocean's complex circulation patterns.

"If you know the density you have a much better idea of the three-dimensional motion of the ocean," Larson explained. "Ocean currents are driven by pressure gradients revealed as density gradients, and play a dominant role in influencing weather and the climate. There are plenty of instruments that measure simple motion and current at a point in time and space, but density data from high-accuracy, highly stable CTDs provides the essential information for an additional element — predicting and forecasting via numerical models."

Dr. Norge Larson, Sea-Bird Electronics' President

Two other oceanographic research instrument companies, WET Labs and Satlantic, have affiliated with Sea-Bird. WET Labs makes underwater sensors to measure inherent optical properties and detect biological, chemical and geological processes, and Satlantic specializes in measuring light from the sun that is altered by ocean processes. The combination of these companies provides better support for integration of multiple sensors in one package.

Sea-Bird's founder retired in 1991 and stayed associated as a consultant for some time. Pederson still lives in Seattle and travels the world. "He's off trekking in Switzerland now," Larson said. "It's a great image of retirement."

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A research vessel deploys an Argo float carrying Sea-Bird's CTD sensor.

Partnering with the Scientific Community

Larson earned his PhD in Ocean Physics from the same Applied Physics Laboratory, where Pederson was his department manager. When Larson joined Sea-Bird in 1988 he had a choice between taking a position in academia or going into business with Pederson's young company.

"The scientist in me has no regrets," Larson said. "I believe that Sea-Bird has enabled other scientists to make great contributions. That is very satisfying."

At Sea-Bird, Larson's job was to formalize the work Sea-Bird does with the science community. Being a scientist himself and a co-practitioner helped Larson understand what customers were trying to do. "I did a lot of field oceanography during my degree work — lots of time on ships." This helped him translate input from the field back to the company and further improve Sea-Bird's instruments.

The central theme has always been "how do we improve the data?" Larson said. "We've had an unwavering focus on the quality data that scientists need. The business has to follow that focus. Often the meaningful improvements are the result of a long, slow unrelenting pursuit of what's not working well and how to fix it."

Larson said there are four parts in Sea-Bird's quest to continually improve the quality of data available to the scientific community: make the instruments as perfect as possible, work with scientists to improve the methods by which the instruments are used, work around the practical restrictions aboard research vessels and develop defensible corrections for any errors in the data.

It's not only about having the best instruments possible, it's about enabling scientists to use them in practical ways to get the highest quality data. "We began to involve ourselves heavily in the use of these instruments. We worked with scientists to do things better."

Larson also acknowledged that there are very practical limitations for using these types of instruments aboard ships. "Our personal contacts and relationships with scientists allowed us to observe deployments, develop methods to get around these restrictions and provide advice on future deployment techniques. That's only possible when you have that relationship and that credibility."

That kind of credibility leads to some exciting inquiries from the scientific community. "Scientists doing cutting-edge work come to us with interesting questions," Larson said, citing one group whose Sea-Bird instruments were measuring super-cooling, sub-freezing temperatures in the ocean, yet the water was not frozen. "Could the measurements be for real?" they wanted to know, "and, what does this imply about the physics of freezing water?"

"These kinds of questions make it a really fun place to work," Larson said. "We can bring both our own scientific knowledge and our knowledge of instruments to bear. It's very rewarding to be able to work on fundamental questions in nature."

Managers are the New Market

Managers in many related fields are benefitting from the advancement of oceanography and its scientific tools, including fisheries, public health and safety, ports, water quality, natural disaster preparedness, search and rescue and weather forecasting.

For example, during the Macondo oil well spill in the Gulf of Mexico, agency managers needed to figure out where the oil was going. They thought that the flow of oil from the well was greater than the amount of oil appearing at the surface. Sea-Bird CTDs determined the density of the water in the vicinity of the well, while fluorometers from WET Labs detected the oil. The combined measurements revealed that a cloud of oil rose to a specific density of water at mid-depth, then spread out at that density, rather than settling to the bottom or rising to the surface. "Our instruments gave managers a lot of information as well as the environmental context and could tell them where the cloud of oil was and where it would go," said Larson.

New instruments for managers have opened up a new set of

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Sea-Bird Electronic employees at the company's Bellevue, Wash. location, June, 2011.

markets for Sea-Bird. These new instruments are "the same thing we've already built, but they work a little more autonomously or automatically. We've discovered ways to make our instruments more turn-key," Larson said. This makes it easier for the non-specialist to use scientific-grade instruments and get high quality measurements. The post-processing that scientists have usually done in the lab can now be done by the instrument itself, in the field. The instrument cuts out some of the steps by doing data processing internally and outputting finished data. A good example is Sea-Bird's MicroCAT, "a very focused instrument measuring temperature, salinity, pressure and oxygen in the water," Larson explained. Managers can use the MicroCAT, along with other data, to make decisions about opening and closing fisheries. "It allows managers to be much more sophisticated about their decisions, taking into account more than just present fish counts." They're able to forecast better because they know more about the conditions that will impact fish counts into the future.

"Managers need data about present conditions," Larson said, which has led to an increasing demand for real-time data. "Managers need to know what's going on now. We also build the communication devices that make that possible."

The Argo Project

One international initiative Sea-Bird is particularly proud to be a part of is the Argo project. This project consists of thousands of underwater probes around the globe monitoring the condition of the ocean. The probes are robotic floats weighing about 80 pounds each and carrying Sea-Bird's CTD sensors.

The Argo float is deployed from a research ship or aircraft into the ocean. It descends to a depth of 0.6 miles, drifts for ten days, then descends to 1.2 miles. The float's internal pump then inflates a bladder which causes it to rise to the surface. During its ascent it takes salinity, temperature and pressure measurements, then transmits data to a satellite when it reaches the surface. The data is posted on the Internet and used by oceanographers as well as weather and climate forecasting centers. The float bladder deflates and the unit sinks again to begin a new cycle. The battery life is designed to last for 150 cycles, about four years.

The Argo project launched its first probes in 2000. There are now about 3,500 throughout the ocean.

Of course, these types of undertakings frequently face funding battles and like these projects, Sea-Bird is also vulnerable to the economy, budgets and politics. What has helped, Larson said, is the success of oceanography as a science and the demand for data that comes with pressing human problems, like safety and climate change. "We've managed to grow at a reasonable rate," Larson said, "and we've grown every year." It's also heartening he said, that "there's a clear recognition of the need for our type of data in the President's budget."

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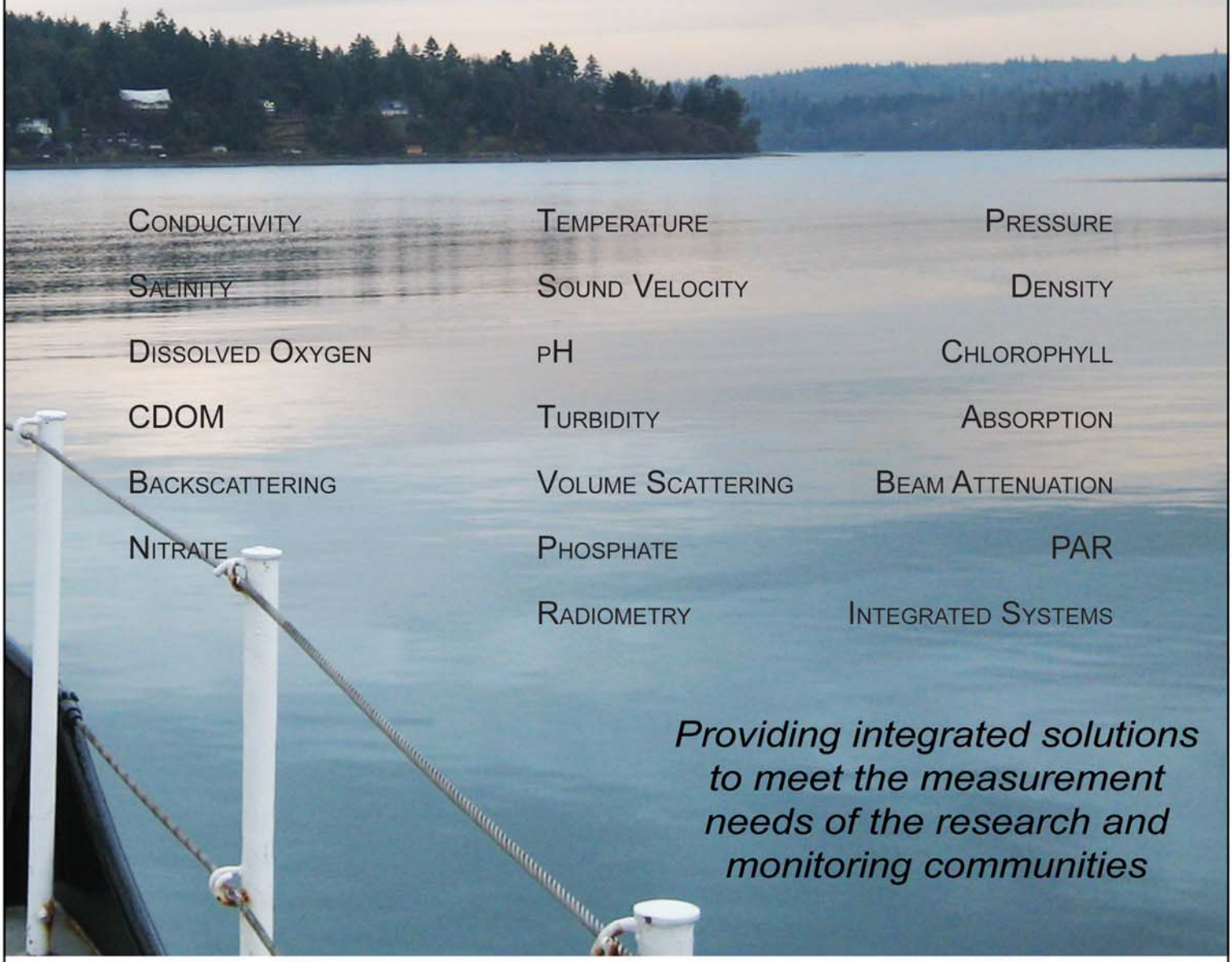
Sea-Bird Scientific

Satlantic, WET Labs, and Sea-Bird Electronics: Partners in Instrumentation

Accurate, stable, and reliable aquatic instruments from the smallest streams to the deepest oceans



Conductivity	Temperature	Pressure
Salinity	Sound Velocity	Density
Dissolved Oxygen	pH	Chlorophyll
CDOM	Turbidity	Absorption
Backscattering	Volume Scattering	Beam Attenuation
Nitrate	Phosphate	PAR
	Radiometry	Integrated Systems

Providing integrated solutions to meet the measurement needs of the research and monitoring communities

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