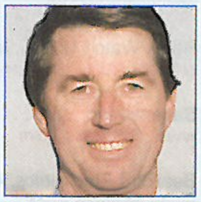
Innovention: Science, Art and Design — Kevin Hardy



Kevin Hardy is director of engineering at DeepSea Power & Light Inc. He spent 34 years at Scripps Institution of Oceanography, where he retains an advisory position to the director. Hardy is a fellow of the Marine Technology Society.

I share a sense with many that an exciting new age of technological innovation and application in the ocean sciences is dawning. Once upon a time, ocean scientists exchanged strings of Nansen bottles for compact conductivity, temperature and depth sensors. Today, there is a wonderful convergence of new technological advancements in electronics, sensors, materials, novel power sources, vehicles and analysis techniques that are moving topside processing under water. Crossover technologies from other fields, such as flash memory, Bluetooth, universal serial bus, lithium-ion batteries, global Internet, graphic standardization and voice-over-Internet protocol, add colors to the instrument designer's palette. Certainly, challenges to the future loom elsewhere. Together, these external and internal forces are pushing and pulling, dynamically reshaping academic, commercial and government interests in the sea. Such strain forces change, and foresight brings innovation.

In universities, often seen as an upstream source of ideas, a bifurcation between "big" and "small" science is constantly being debated. Some university research groups seek long-term stability by converting their science to service, while breakthroughs that herald scientific leadership often occur in the single-researcher groups struggling to afford technical support, turning to industry for complete systems with documentation, software and support.

The larger programs also contract industry for specialized services, such as cable laying. Both favor manufacturers who provide whole solutions over components, helping create a growing marine industry to develop and supply the tools of science, commerce and national interest.

Future sensors may one day be produced that are sensitive to specific compounds suspended in the cold, dark, wet, corrosive and conductive ocean. They may be fluoresce within a spectrum excited by ultra-violet emitters and seen by detectors, or produce some other measurable and quantifiable natural phenomena yet to be discovered. Current developments in high-performance ceramic spheres (such as those from San Diego, California-based DeepSea Power & Light Inc.) and pressure-tolerant electronics (such as those from Windsor, Colorado-based Hydro Technologies) complement advances in sensors to revolutionize access to the deepest depths.

Computer-aided engineering synthesizes mechanical and electronic systems, providing expert knowledge to design teams. Still, models must be tested, and commercial high-pressure test facilities provide the opportunity to control variables of the real world, saving the cost of ships, testing mechanisms, calibrating sensors and recovering instrument remains taken past their limits for forensic engineering.

The Global Ocean Observing System (GOOS) will allow researchers around-the-clock access to a network of fixed field instruments. To reduce the probability of aliasing, there will be a tendency to oversample. This will generate a vast amount of data, and processing becomes the critical path. Data-analysis techniques have not kept up, even with faster processing computers and more graduate students. Advances in cyber infrastructure can move that data, like raw material in train cars, to be processed elsewhere. Agencies recognize the need to provide funding to create solutions to this bottleneck. We may apply new combinations of what we already know, perhaps fusing computer image recognition and artificial intelligence, to reduce the data volume to human scale.

Still, GOOS misses the largest mass of ocean, down the continental slope, across the abyssal plains and into the deep-ocean trenches.

It is getting difficult and costly to get to sea. The Unified National Laboratory System has fewer ships, while the cost per day has gone up. Meanwhile, new mechanical, electronic and communications technologies favor smaller instruments. Undersea vehicles give those instruments wings, or at least webbed feet, to gather measurements both in temporal and spatial domains. As vehicles shrink in size, they grow in capability, and "ships of opportunity" become more relevant. Non-profit organizations with an interest in ocean exploration, such as the SeaKeepers (Ft. Lauderdale, Florida) and the Waitt Foundation (La Jolla, California), may play a role in providing researchers time at sea.

Add, then, the glider to the family of undersea vehicles. Gliders radically extend the range of autonomous underwater vehicles by the efficient use of differential buoyancy. But, they are painfully slow, and even with frequent telemetry of data, analysis based on that data have to carefully avoid aliasing errors. Another means to motion are untethered free vehicles, following Scripps' John Isaacs' and Woods Hole Oceanographic Institution's Harold "Doc" Edgerton's 1960s designs.

Engineers can perform "idea mining" by revisiting these past designs with today's technology—similar to scientists' data mining. Such thinking brings opportunities for industry and scientific institutions, reducing entry costs and fostering advancements, assessing risks and benefits differently.

Scientific institutions will benefit faster from more competitive proposals than later royalties. Industry is challenged with new product development, with no guarantee of amortization. Federal agencies can leverage both the national science and industrial base by facilitating such interaction. With industry, rapid prototyping and low-volume production techniques speed innovation, and bring the latest technologies to the deck of a ship faster and at lower cost.

The legacy of ocean engineering pioneers is passed on by student engineering projects. It will not be long until we read of an innovative student using an iPod coupled to a fish finder to command an acoustic control system, and the future will be revealed again. /st/

SEA TECHNOLOGY®

The Worldwide Information Leader for Marine Business, Science & Engineering

February 2007, Volume 48, No. 2

For more information on any of these subjects, visit our Web site at www.sea-technology.com and click on the article titles in the Table of Contents or e-mail the editorial staff at oceanbiz@sea-technology.com.

For more information on these news items, visit our Web site at www.sea-technology.com.

COVER—The excitation laser of the Deep-Ocean Raman *In-Situ* Spectrometer (DORISS2) focused on a barite mound in the Monterey Bay, off California. The spectrometer was supplied by Kaiser Optical Systems Inc. (Ann Arbor, Michigan). The mound is inhabited by some colorful Brisingida. The photo was taken using a mounted still camera (Coolpix 990) on the remotely operated vehicle Tiburon.

NEXT MONTH—An operational real-time, large-scale visual mosaicking and navigation system...Improved AUV navigation through multi-sensor data fusion...Testing and evaluation of interferometric sonar technology...Sub-Optics 2007 conference preview...Interdisciplinary ocean sensor technology development...Tsunami monitoring system: implementing global real-time data telemetry...The towed torpedo emulator.

VOLUME 48, NO. 2
SEA TECHNOLOGY
FEBRUARY 2007

THE INDUSTRY'S RECOGNIZED AUTHORITY FOR DESIGN, ENGINEERING AND APPLICATION OF EQUIPMENT AND SERVICES IN THE GLOBAL OCEAN COMMUNITY

FEBRUARY 2007
SINGLE ISSUE PRICE $4.50

SEA TECHNOLOGY

www.sea-technology.com

WORLDWIDE INFORMATION LEADER FOR MARINE BUSINESS, SCIENCE & ENGINEERING

INSTRUMENTATION: MEASUREMENT, PROCESSING & ANALYSIS