



Issue No. 3, September 2006

COASTAL RESEARCH

a newsletter from the Coastal Ocean Institute
and Rinehart Coastal Research Center



A message from the Director of the COI



I started composing this letter while I was visiting Salt Lake City and feeling inspired to share some news of an initiative

that will dramatically change coastal ocean science. At the time, I was attending a workshop to help plan the National Science Foundation's Ocean Observatories Initiative (OOI), a program that will invest \$309 million in ocean observing infrastructure over six years. \$57 million of that will be spent on observatories along U.S. coasts.

Oceanographers have long used moored- and robotic instruments to supplement their ship-based measurements. But when instruments, gliders, drifters, and moorings of different types are linked together as "observatories," they change the view from that of a microscope to a telescope, gathering broad views of the physical, biological, and chemical processes at work in the ocean. The vision is to construct a network of ocean platforms—instruments and sensors, long-term power supplies, advanced computer command and storage capability, and fiber-optic cables or satellite and acoustic communications systems—all feeding continuous streams of data and imagery back to researchers and the Internet.

Throughout the workshop, my fellow scientists repeatedly used the word "transformational" to describe this initiative. One way to think of

it is through a weather forecasting analogy. I am constantly amazed and pleased by the accuracy of weather forecasts these days. How did forecasters get to this point? They built not only advanced computing systems and atmospheric models, but also the extensive networks of instruments that continually feed data to those models. Our goal is to bring the same level of understanding and forecasting capability to ocean processes.

Many WHOI scientists can see clear applications of observatory science. (In my case, I foresee networks of instruments that can remotely detect harmful algae or their "red tide" toxins.) The first step is to construct the backbone of power cables, computer networks, platforms, and communications systems that can support all of our new instruments and sensors. As described herein, the Salt Lake City meeting was a communal effort to reach consensus on the best places to set up these new NSF-funded ocean observatories.

In this issue, we also highlight some of these revolutionary changes in the field and the crucial role WHOI scientists have played. The Martha's Vineyard Coastal Observatory, for example, has served as a critical test bed for pioneering instruments and technologies that will soon be deployed at other observatories throughout the world.

This is a very exciting time for those of us working along the coast.

—Don Anderson

COI Fellow Chris Reddy

Associate Scientist, *Marine Chemistry & Geochemistry Department*

I have a success story to share—about how COI support for my science, and exposure through *Oceanus* magazine—profoundly advanced my research.

Two years ago, I wrote an article for *Oceanus* on oil spills that I have used for teaching and educating the media. A year later, with funding from my COI fellowship, I was conducting preliminary research at the Santa Barbara oil seeps when I learned that a private foundation had read my *Oceanus* article and was interested in my work. My lab needed a new mass spectrometer (\$200,000), but it can be exceedingly difficult to get federal funding for such equipment. The foundation agreed to fund the spectrometer if we could leverage additional funds from the U.S. Department of Energy (DOE). Jim Luyten also pledged WHOI support.

When DOE awarded my proposal (\$500,000), they intimated that the private foundation support was a significant factor in their decision.

Many things fell in place at the right time for this effort. At the root, this is about solid science, but make no mistake—support could not have materialized without leverage provided through my COI fellowship, the Development Office, and the excellent marketing tool that is *Oceanus*.



Tom Kleindinst

Scientists, Government Weigh an Investment in Ocean Observatories

Oceanography is on the verge of a revolution. Instead of sporadic, expeditionary glimpses of the ocean from ships and subs, oceanographers would like to establish a permanent presence in the ocean. Like the engineers who crafted the Interstate Highway System, researchers have been planning an infrastructure of long-term ocean-observing outposts that can transmit round-the-clock data from remote oceans to shore-based scientists.

In July, the dream took a big step toward reality: House and Senate appropriations committees approved a budget for the National Science Foundation (NSF) that includes \$13.5 million for the Ocean Observatories Initiative (OOI).

Through the initiative, NSF will spend \$309.5 million over six years to build an integrated observatory network. The project will be managed by the scientist-led Ocean Research Interactive Observatory Networks (ORION), which will contract with oceanographic institutions and companies to build the pieces.

OOI may be the biggest program in the history of ocean sci-

ence—not only in dollars, but in the effort expended to forge collaborations among researchers who have historically pursued research through individual projects.

“This has been an historic event for us,” said John Trowbridge, former COI fellow and now director of WHOI’s Center for Ocean, Seafloor and Marine Observing Systems (COSMOS).

Many of the most fundamental, planet-shaping processes occur in the ocean, out of human sight. Over the past century, citizens, sailors, and scientists have glimpsed these processes—first from the shore, then from ships, buoys, and submersibles, and recently from satellites. Each approach has advanced our understanding of the oceans.

But each view has been limited. Research cruises last only a few days or weeks and don’t allow researchers to observe changes over seasons or years. Satellites offer broad and long-term observations, but they typically penetrate just the top few meters of water. Moorings, buoys, and drifters have been limited by the availability of ships to deploy them, the volume of data that could be stored, and the

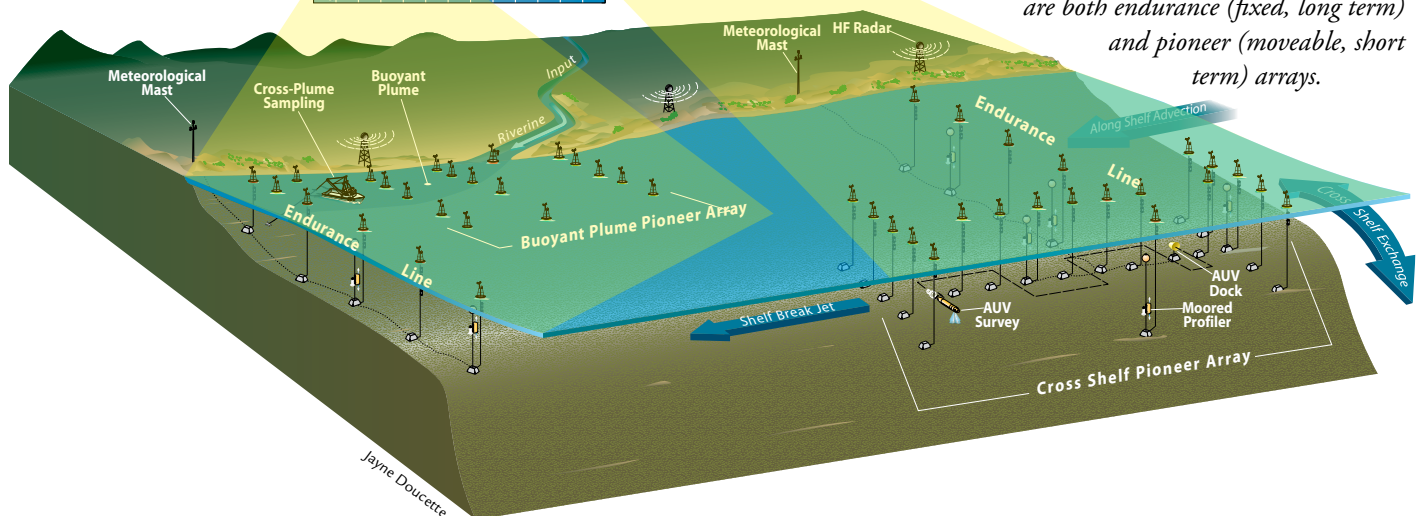
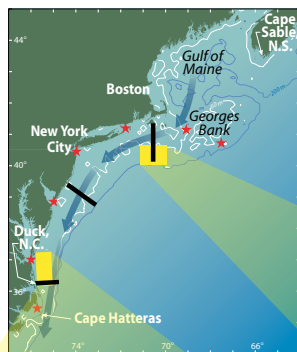
strength and longevity of batteries.

Advances in communications, robotics, platform design, sensor technology, and power systems make it possible to get broader views of the seas over longer periods. With Internet technologies, that information can be shared in real time with scientific colleagues, policymakers, educators, and students thousands of miles away.

Of the 85 scientists and engineers in leadership positions or on the advisory committees for the ORION program, 11 are affiliated with WHOI. In particular, former COI Director Ken Brink served as the first ORION Project Director from 2004-2005.

The ORION team is currently developing: (1) a vast cabled observatory off the Pacific Northwest coast; (2) a set of long-duration buoys that can fill in the gaps between existing U.S. and international monitoring programs; (3) two fixed “endurance”, cabled coastal observatories (one each for the Atlantic and Pacific); and (4) a coastal “pioneer array” that can be moved from one part of the world to another (see fig.). The goal is to start construction in 2007 and launch the first OOI science experiments by 2008. Stay tuned as this revolution moves forward.

—Mike Carlowicz



Schematic diagram of several coastal ocean observing system elements. Shown are both endurance (fixed, long term) and pioneer (moveable, short term) arrays.

Annual Call for Proposals

COI received 24 proposals requesting \$1.7M in response to our annual call for proposals, April 2006. We were able to fund 6, for a total of \$400,000. These projects support scientists from each department at WHOI. We also initiated two new programs—Student Research Awards and New Initiative projects, and funded three new COI Research Fellows.

Student Research Awards

Thanks to a generous donation from a COI committee member, we launched a new funding opportunity exclusively for Joint Program graduate students working in coastal ocean science. We received 11 applications and funded 7 projects. These awards provide modest (\$1,000–\$5,000), but crucial funding for thesis research expenses not otherwise covered by existing support. This includes equipment, outside analyses or services, and travel to collect data. Our students are especially proud when they can help contribute to their research expenses (which are usually covered by a supervising scientist).



Akiko Okusu

This student research grant is a wonderful opportunity and I sincerely appreciate it. I am extremely excited about the project and have already begun this week to organize the logistics for the field work.

–Jon Woodruff

New COI Research Fellows



Tom Kleindinst

Rob Evans, Associate Scientist

Geology and Geophysics Department

Rob will continue work to establish a national research program on coastal change, and for his own research program, will use geophysical approaches to study groundwater discharge and seafloor classification in nearshore environments.

Andone Lavery, Assistant Scientist

Applied Ocean Physics & Engineering Department

Andone plans to use high-frequency sonar as a tool to learn more about the biology and physics of coastal waters, such as the mixing of water masses, which move nutrients between the sea surface and seafloor—essential to maintaining coastal ecosystem health.



Tom Kleindinst



Tom Kleindinst

Becky Gast, Associate Scientist

Biology Department

Becky plans to pursue coursework in epidemiology. In association with the Woods Hole Center for Oceans and Human Health, she will work to more effectively plan and evaluate research on human pathogens in the coastal marine environment.

New Initiatives

A major role of COI is to fund individual or small team projects, however, many of these projects need additional funding at levels that cannot be provided by internal or donor funds. There is a clear need to develop programs at the federal level, but that requires organization, coordination, and hard work.

Through this new program, we are providing development funds for “initiatives” that can lead to sustained and significant funding for teams of investigators at WHOI who share a common research interest in coastal ocean science:

Rob Evans, Geology & Geophysics; Rocky Geyer, Applied Ocean Physics & Engineering – Development of a National Program on Coastal Dynamics Research. This project addresses a major theme of the COI—the Changing Shoreline Initiative. Rob and Rocky will work with other scientists at WHOI and key federal agencies to take the next steps in developing a multi-agency national research program on coastal change. The ultimate goal is to establish a peer-reviewed competitive program from which WHOI scientists can seek funds for large scale interdisciplinary research programs in the general area of “Coastal Dynamics”.

Al Plueddemann, Physical Oceanography; John Trowbridge, Applied Ocean Physics & Engineering; Heidi Sosik, Biology – Coastal ecosystem research in the Northwest Atlantic. This initiative focuses on developing a coupled observation and modeling framework that will enable predictive understanding of seasonal-to-interannual variability in the continental shelf ecosystem. This is an important effort that can lead to greater WHOI involvement in the rapidly growing Ocean Observatories Initiatives.



Tom Kleindinst

John Stewart
*Coastal Ocean Institute
 Committee Member*

John Stewart worked on the management of R&D in aerospace and other technical industries as a Director of Mckinsey and Company for many years. He has a view of how R&D is conducted in Europe, the U.S. and Canada, in both for-profit and non-profit organizations. Government service includes membership on the Defense Science Board; Chair of a study of U.S. shipbuilding and Naval Architecture for the Marine Board of the National Research Council; and Executive Director of the National Commission on Productivity. Recently, he has been on the Visiting Committees of two medical schools and the Boards of two hospitals. He has been affiliated with WHOI since 1995 and is a member of the COI Committee.

Elsewhere on this page, John offers his views on the relationship between WHOI and those who provide funding support through charitable donations. It reflects his pragmatic views of the nature of progress in scientific research.

Some people argue that you've got to have blind faith in order to invest in scientific research. Every time you fund a bit of science, you are taking a gamble, investing in a risky stock that could just as easily bust as it could boom. But that's not really true. While the outcomes of scientific research are not predictable, successful research organizations have some important traits in common: People, portfolio, and patience.

Good people are essential. No amount of effort can overcome mediocre and unimaginative employees. No shortcuts, substitutes, fancy equipment, or overspending can create success if the people are not talented. WHOI is home to first-class minds.

Healthy research institutions have portfolios that are diverse and daring. Without sufficient resources to push the intellectual envelope, research organizations can be driven toward mediocre portfolios. Mediocre research organizations can have as much as one-third of their resources committed to projects that don't advance knowledge. Narrowly directed government funding and political fads have done too much of this.

Sometimes one person guides development of a research portfolio. More often, it is through wide consultation, openness to new ideas, and creative dialogue that a team of scientists collectively arrives at the investigations that are most likely to produce advances. Not everyone buys into all of the details, but by being aware of the knowledge and expertise around them, and by adopting a spirit of collaboration, researchers can maintain a sharp focus and efficiently use their resources.

Those who would fund scientific research need - most of all - patience. We would all love to see results in a few months, or even a year. We are constantly bombarded with "scientific breakthroughs" announced in the media, and our expectations get raised unrealistically. We need to remember that the weekly stream of "new discoveries" comes from dozens of scientific fields and hundreds of institutions. We also need to consider whether some of those "discoveries" are in fact "new" or just re-packaged or incremental steps.

Research is unpredictable, and the ebbing, trial-and-error motion toward results can be frustrating. (How can those scientists take so long to find out so little?) Almost every significant advance in knowledge has been preceded by lots of work that never made the papers. It was boring, tedious, and often discouraging...but it was necessary. Major insights come from months and years of step-by-step, incremental progress. Scientific advances are more often evolutionary than revolutionary, and true leaps in any one field (such as oceanography) happen slowly.

WHOI has very good people, most of whom are leaders in their respective fields. WHOI is also a very collaborative, lively environment where knowledge and ideas are shared, questioned, and embraced. WHOI scientists know where knowledge is lacking and they know the right questions to ask.

They also know that "patient funders" are in short supply. Be a patient funder.
 — John Stewart

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