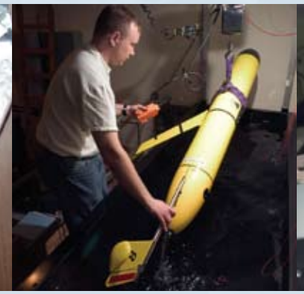
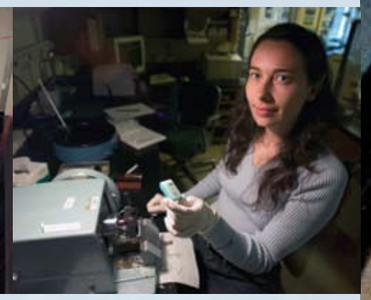
"WHOI is educating the world about its oceans, and I salute the Institution's scientists, students, and sea-going research activities. I've had a swell time over the past 35 years sharing my good fortune as a catalyst of sorts. I love kick-starting a project—like the Rinehart Initiative for Access to the Sea—and watching it take off. There's an old Irish saying: 'There are no pockets in shrouds,' and I've pretty much lived by that.

I challenge you to join me in supporting this important new venture for WHOI. It's very exciting."

Gratia Rinehart Montgomery, Trustee



The $20 Million Access to the Sea Fund has three components:

Ocean Science Venture Fund ($10 million endowment)

— Support ship time for high-risk or innovative research, for instrument testing and evaluation, and for exploratory research in remote locations
— Support for development of innovative analysis and visualization techniques for data collected from ships, vehicles, or observatories
— Support for scientists and engineers, graduate students, and postdoctoral scholars to participate in sea-going research

Ocean Technology Venture Fund ($7 million endowment)

— Seed money for scientists and engineers to develop new approaches for sea-going research, and for the collection and interpretation of data from new sensors and instrumentation
— Support for the development and testing of new vehicles or ocean observing systems, or for enhancement of existing systems that will provide scientists with new capabilities to do research at sea
— Support for development, testing, or purchase of new sensors or equipment that will enhance the capabilities of WHOI's ships and underwater vehicles

R/V *Tioga* Fund ($3 million endowment)

— Support of ship time for conducting research from *Tioga*
— Purchase of equipment that will enhance the scientific and technical capabilities of *Tioga*
— Fund dedicated cruises for students on *Tioga* to introduce them to marine instrumentation and sea-going research

Overleaf, from left: R/V *Tioga*, WHOI's coastal research vessel; SeaBED, an autonomous underwater vehicle; mooring recovery in the Arctic; a glider, used to measure upper ocean properties; sample preparation for the study of toxicology in marine mammals.

Development Office
Woods Hole Oceanographic Institution
Fenno House, MS 40 — Woods Hole, MA 02543
508-289-4895 — development@whoi.edu — www.whoi.edu

Photos inside from left: Dana Yoerger, Robert Weller, Jayne Doucette, Tom Kleindinst, Dana Yoerger, and Tom Kleindinst, WHOI
Above: All photos by Tom Kleindinst, WHOI, except middle photo by Chris Linder, WHOI.
Cover: Christopher Knight, ©2004 Woods Hole Oceanographic Institution

Access to the Sea

Woods Hole Oceanographic Institution

Access to the Sea Fund

No other institution is as well positioned as WHOI to lead the development of new ocean observing technology, the integration of new technology with sea-going capabilities, and the management, mining, and visualization of the huge volumes of new data that will be generated. By rising to this challenge, we can expect the pace of discovery to accelerate, which will significantly improve our understanding of the world's oceans and enhance the opportunity for their wise use and stewardship.






From left, recovery of WHOI's *Jason 2* remotely operated vehicle; launch of a mooring for the study of air-sea interactions; Coupled Boundary Layers Air-Sea Transfer (CBLAST) Low Wind Component, which is part of the Martha's Vineyard Coastal Observatory; the Autonomous Benthic Explorer (ABE), built and operated by WHOI; reviewing data on harmful algal blooms; R/V *Knorr*, WHOI's multipurpose global class ship.

Changing Paradigms

Advances in technology in the last decade are causing a quiet but radical reinvention of oceanography.

For generations, oceanographers worked with the "expeditionary science" model: They went to sea in ships, collected samples and made measurements, then carried out analyses ashore over months or years. While this way of working will not disappear, new technology is changing the questions oceanographers can ask, accelerating the pace of discovery, and changing the very nature of where and how they work.

With advances in sensor technology, materials science, data telemetry, and real-time data processing, traditional ship-based expeditionary research will be complemented by fleets of free-swimming vehicles and networks of instruments permanently installed in the oceans that can continuously monitor and explore large areas of the ocean over long periods of time, and telemeter data to shore in real-time. Oceanographers can "go to sea" from the comfort of their laboratories, controlling instruments deployed in remote parts of the deep sea from their desktop, and observe and model changing conditions in the oceans as they occur.

Nurturing Innovation

The unique partnership of science and engineering at WHOI is taking full advantage of technological advances. Some examples include:

— **Laboratory on a Chip:** Miniaturized sensors and digital imagery developed at WHOI now allow *in situ*, real-time analysis of chemical and biological measurements that previously took months in shore-based laboratories.

— **Eyes in the Ocean:** Development at WHOI of new generations of vehicles, like the *Alvin* replacement, the deep-diving Hybrid Remotely Operated Vehicle, and Sentry, will allow even the most remote parts of the seafloor to be explored and studied.

— **Continuous Monitoring:** Moored buoys and seafloor observatories, like those used at the Martha's Vineyard Coastal Observatory and off Hawaii, now allow us to observe the oceans continuously over many months or years, regardless of weather.

Ensuring Future Leadership

Maintaining our excellence in ocean science will depend on our staying at the forefront of new technologies for exploring the world's oceans. We can imagine great opportunities on the horizon:

— Powerful, custom-designed genomic chips that will help map the distribution of harmful algae or discover new species of microbes;

— Networks of sensors linked by fiber-optic cable running for thousands of kilometers across the seafloor, carrying immense volumes of data to shore-side laboratories from even the most remote parts of the world's oceans;

— Fleets of autonomous, self-propelled vehicles that exchange data acoustically and automatically adjust their tracks to find, survey, and sample hydrothermal vents or water masses in the deep sea;

— Advances in materials science and nanotechnology that shatter current limits of power usage and miniaturization of deep-diving, robotic vehicles, allowing them to carry out missions of many months to a year or more;

— High-definition digital imagery, chemical-, tactile-, and audio-sensors with fiber optics to provide at-depth ocean observational experience to scientific investigators aboard a research vessel or in their laboratories.