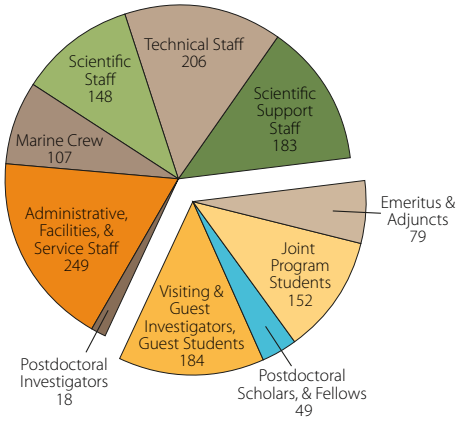
Woods Hole Oceanographic Institution

2006 Annual Report

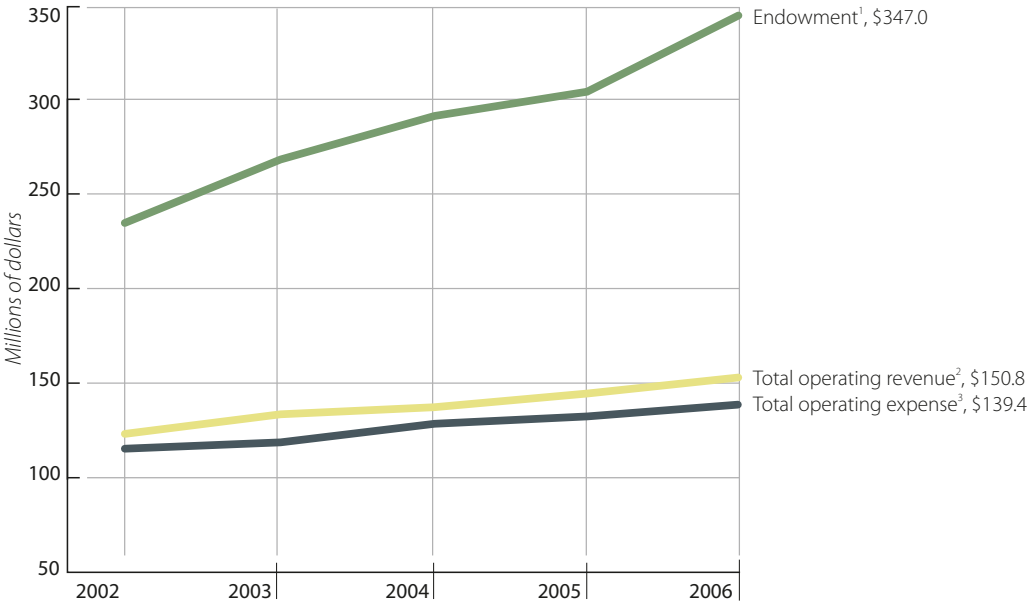
WHOI at a Glance



WHOI employees totaled 911 in 2006; others affiliated with the Institution (separate wedge) totaled 464.

Financial Trends

Totals in millions of dollars

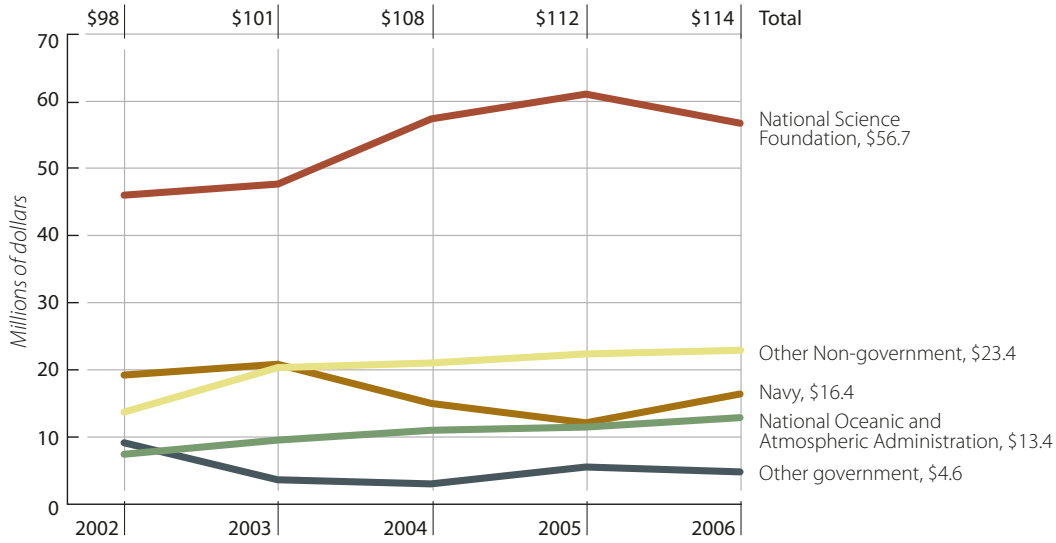


The Institution endowment ended 2006 at $347 million, with a 15.5 percent rate of return, outperforming our benchmark.

[1]Endowment comprises cash and securities to provide income for maintenance of the organization. Market value is as of December 31.
[2]Total operating revenue is total funding of the Institution's research and education programs, including a component of endowment income appropriated for operations during the financial year ending December 31. See Financial Statements, Note 2, page 58.
[3]Total operating expense is cost incurred in support of research, education, and operations during the financial year ending December 31. See Financial Statements, Note 2, page 58.

Research Funding

Totals in millions of dollars



The $2 million increase in research funding (up 1.8 percent over 2005), was driven primarily by growth in funding from the United States Navy and the National Oceanic and Atmospheric Administration.

Contents

Woods Hole Oceanographic Institution is a private, nonprofit, marine research and engineering, and higher education organization. Its mission is to understand the oceans and their interaction with the Earth as a whole, and to communicate a basic understanding of the ocean's role in the changing global environment. Established in 1930 on a recommendation from the National Academy of Sciences, the Institution is organized into five scientific departments, interdisciplinary research institutes, and a marine policy center. The Institution conducts a joint graduate education program with the Massachusetts Institute of Technology.

John Dyke, WHOI

Front cover: WHOI Engineer Cliff Pontbriand handles the lines as the autonomous underwater vehicle (AUV) *Sentry* is lowered into the water off the WHOI dock as R/V *Atlantis* looms in the background. The new AUV had its maiden voyage aboard R/V *Tioga* in April 2006. Funding for *Sentry* was provided by the National Science Foundation and The Russell Family Foundation.

Patrick Rowe, WHOI

Back cover: WHOI Engineer Frank Bahr (left) and Research Specialist Jeff Lord of the WHOI Upper Ocean Processes Group conduct at-sea repairs on an ASIMET (Air-Sea Interaction Meteorology) buoy in the Gulf Stream.

Design and Production: Jim Canavan

Editors: Mike Carlowicz, Lonny Lippsett, Kate Madin, Stephanie Murphy, Amy Nevala, and Jeannine Pires

Letter from James R. Luyten, Acting President and Director

The search for understanding is a basic human need that defines us as a species. We yearn to know the world around us—how it works, what it is made of, and how it impacts our lives. As our understanding develops, we strive to apply that knowledge toward solving the problems that we face. This essential human trait is responsible for extraordinary advances in countless areas of importance to our society. For example, GPS navigation was developed from knowledge gained through space exploration and advances in computing technology. Now it's used to plot accurate locations of shorelines and navigational directions of our cars.

The myth of the ivory tower holds that scientists want to retreat from the daily realities merely to satisfy their own curiosity. We know that has never truly been the case, although scientists and researchers are, by nature, curious. While the relevance of some basic science may appear remote, the reality is that our findings and knowledge have always led us to a greater understanding, sparked advancement, and spurred applications that solve problems and create new opportunities. Basic research is the essential fuel in this cycle of human innovation.

Curiosity-driven science and its practical application have a long tradition at WHOI, from our earliest days when part-time oceanographers—amateurs in the original sense of the word, individuals who did things for the love of it—collected water samples during sailing expeditions because there was so little data on the oceans. It grew more systematic in our work serving the nation during World War II, where our findings were used to keep submariners safe and give our Navy an advantage over our enemies.

Today, our science is applied to solving the big problems and issues of society, such as natural disasters, environmental effects on human health, the management of ecosystems, global food and fresh water supplies, energy resources, and global climate change.

How is WHOI positioned to respond to this need for both basic and applied research? Our traditional funding agencies like NSF and NOAA are increasing the scope and shifting the nature of the projects they fund, calling for large multidisciplinary projects run by multiple institutions over extended periods. Newer funders, ranging from foundations to corporations, are following suit. WHOI anticipated this need when it established its interdisciplinary Ocean Institutes in 2000 and decided to build two new laboratory buildings in 2004. The labs, which were completed in spring 2006, bring together researchers from different disciplines to share common interests and enhance collaborative research.

To address the large scale, multi-year observatory projects coming from NSF and NOAA, we have established a Center for Ocean, Seafloor, and Marine Observing Systems (COSMOS). Directed by John Trowbridge, one of our senior scientists, the office will provide administrative, management, and systems engineering oversight of large observatory and observing systems projects at WHOI.

Tom Kleindinst, WHOI

Chairman of the Board Jim Moltz (left) with Jim Luyten at the October Board of Trustees and Corporation meeting.

To make ourselves more competitive with new applied, market-driven research interests we created the Office for Applied Oceanography (OAO). The mission is to help connect WHOI researchers with private companies interested in our research and engineering work. Led by Dan Stuermer, Vice President, External Relations, the OAO provides a mechanism for helping scientists and private companies navigate issues like intellectual property, publishing rights, and non-disclosure agreements, and to encourage and foster creativity in the workplace.

When Bob Gagosian retired in June 2006 and I agreed to step in as Acting Director, I knew my tenure would be short—I have longstanding plans to retire!—but I wanted it to be a tenure of substance. Having been part of the Institution since 1968, I am proud of all it has accomplished and all it can offer our society. I want to leave it in good shape for the next director to steward. Over the past year, I challenged our staff to develop a strategic plan for the Institution, and I am proud of the results of their effort. They developed a plan whose basic principles call for retaining freedom of scientific pursuit, maintaining our excellent seagoing and shore-based capabilities, and pursuing basic and applied sources of funding that will keep us at the forefront of ocean science, engineering, and education. These goals are consistent with WHOI's mission and represent WHOI's pursuit of the quest for understanding.

Ultimately, it is people who make an Institution. My experience with WHOI tells me we will undoubtedly meet the challenges we set for ourselves in implementing our strategic vision. Success will require the continued pursuit of basic and applied research in tandem, as well as unparalleled levels of cooperation among researchers, scientific institutions, and society's decision makers. I am confident the next director will inherit a stronger institution, well positioned not only to tackle the problems ahead, but to lead the way.

Letter from Laurence P. Madin, Acting Director of Research

This past year has seen a significant awakening of the public to the prospect of global climate change. After many years of research results and a prolonged debate within government and the public media, there has been a clear shift in awareness and acceptance of the evidence for impending changes that will affect virtually all natural systems and societies. This perception has only been enhanced by extremes of climate and weather events in the last few years, including hurricanes, floods, and record temperatures. While such individual events are not necessarily evidence of the changing climate, at the least they are portents of what we might expect in the future, and they have focused the public attention like never before.

Global climate change looms as the single most important environmental factor that will affect life on Earth in the coming century. Although most people will think of it in terms of the terrestrial environment, it is clear that almost every cause and effect of climate change is closely related to processes and events in the oceans. Even a partial list would include heat absorption and transfer, ice cover, sea level changes, circulation, acidification, biological productivity and diversity, ecosystem composition and function, extreme weather, coastal erosion, ocean shipping and commerce, and national defense. Clearly, ocean scientists now face an unprecedented challenge, on an accelerating schedule, to understand these relationships and consequences. Through our Ocean and Climate Change Institute and many other programs and individual projects, WHOI continues to play a leading role in ocean and climate research on many scales of time and space.

Both basic and applied sciences are needed to respond to these global changes. Our climate is controlled by fundamental interactions among the sun, atmosphere, land, ocean, and biosphere, including humans. Basic research allows us to understand these interactions, and reconstruct how they have controlled climate in Earth's history. We can use that same basic knowledge for the development, evaluation, and application of practical strategies to minimize the harmful changes, or to adapt our civilization to those changes that are unavoidable.

Much of our forecast for climate changes ahead is based on understanding the paleo-climatological record, the evidence preserved in the chemistry of ice, ocean sediments, fossils, and corals, which reveals past conditions of temperature and chemistry. WHOI research at time scales ranging from hundreds to millions of years ago helps us understand the natural climate variations of the Earth and the responses of its chemical and biological systems.

Photo-Op

From left, WHOI biologist Michael Moore, Scott Kraus of the New England Aquarium, and Larry Madin briefed congressional committees on research on endangered North Atlantic right whales.

But changes in climate are now apparent in our own time. In the Arctic, the effects of climate warming are already having dramatic effects. WHOI scientists have research programs on a variety of topics, from Polar Ocean circulation to ecosystem effects on everything from plankton to whales to native hunters. In December 2006, we began the Clark Arctic Initiative, based on a gift from Jim and Ruth Clark, which will enable us to support new research on the effects of climate change on the physical, chemical, and biological systems of the Arctic region. Coinciding with the International Polar Year in 2007, the Clark Initiative will jumpstart innovative research programs and leverage additional federal support over an initial period of five years, firmly establishing WHOI's capability and leadership in Arctic climate science. A vital component of this research is the instrumentation developed by WHOI scientists and engineers to monitor Arctic conditions, some of which is now used by researchers in other nations.

In physical oceanography, WHOI researchers have focused on how the interaction of Arctic ice cover and North Atlantic circulation has led in the past to abrupt changes in climate for Europe and North America. WHOI-developed moorings, floats, and gliders have all been instrumental in collecting the data needed to assess this possibility. Elsewhere in the world ocean, WHOI scientists in the CLIVAR Mode Water Dynamic Experiment (CLIMODE) program are researching the role of 18° water in air-sea interactions affecting climate, while in the tropical Pacific, WHOI moorings help monitor the ocean conditions affecting El Niño events.

The ocean is responsible for absorbing about a third of the excess carbon dioxide that has entered the atmosphere due to human activity. This is primarily a chemical process, but the distribution of carbon in the ocean is also controlled by biological activities. Interactions among organisms form a 'biological pump' that can either cycle carbon between ocean and atmosphere or transport it to the deep sea, but the operation of this pump may be affected by future changes in ocean temperatures, circulation, and chemistry. Much of this work in the U.S. is coordinated through the Ocean Carbon and Biogeochemistry program, headquartered at WHOI. Our scientists are leaders of programs that quantify the workings of these biogeochemical systems, so that we can better predict how Earth's ocean will respond to continuing increases in atmospheric carbon dioxide.

Progress in climate science involves discovering underlying mechanisms, interpreting and predicting their effects, and finally guiding the creation of effective responses. WHOI's robust combination of basic science, ocean access, creative engineering, and intellectual independence can ensure that we remain at the forefront of research to understand and manage the greatest environmental challenge that Earth has faced in human history.

Larry Madin

Marine Facilities and Operations

www.whoi.edu/marops

WHOI-operated research vessels spent more than 800 days at sea in 2006. *Alvin* had more than 130 dives and *Jason* spent more than 1,340 hours in the water. During 2006, the *Knorr* spent 40+ days in the Antarctic studying the sub-Antarctic and Polar fronts. In an effort to foster international scientific exchange, WHOI worked closely with the U.S. Embassy in Chile to plan and host a tour of the *Knorr.* U.S. researchers made presentations to Chilean scientists, educators, and officials. After departing Chile, *Knorr* found signs of a very recent volcanic eruption at East Pacific Rise (EPR). *Knorr* continued the year with a West Coast cruise before heading back to WHOI to participate in a large scale mooring project.

In early 2006, *Alvin* underwent a scheduled overhaul and *Atlantis* was in dry dock before *Alvin* re-certification dives off Bermuda. After diving in the Gulf of Mexico to study hydrothermal vents, *Atlantis* and *Alvin* were directed to the EPR to investigate the volcanic eruption discovered by *Knorr* earlier in the year. A multidisciplinary research team from six institutions was assembled for this leg to study this extraordinary event.

The *Oceanus* started the year with less than 150 funded days but in the spring added an additional 25 days to its schedule. WHOI scientists were awarded these additional days to study and map harmful red tides in New England coastal waters. *Oceanus* spent the summer working with the *Knorr* and five other research vessels to support WHOI scientists in the largest mooring deployment ever carried out from UNOLS vessels. Scientists and technicians deployed and successfully recovered 62 moorings off the New Jersey coast.

In 2006, NSF approved adding WHOI's highly successful autonomous underwater vehicle (AUV) *ABE* to the National Deep Submergence Facility (NDSF), where it will join *Jason* and *Alvin* in serving the needs of the nation's deep submergence science community. *Sentry*, the next generation of AUV, is undergoing final sea trials and is slated to replace *ABE* in the NDSF in 2008. During 2006, work continued at WHOI on two new deep submergence vehicles: a replacement for the venerable *Alvin*, and a new 11,000-meter (36,000 foot)-capable hybrid AUV/ROV known as *Nereus*. A preliminary design review of the personnel sphere for the new sub was completed in 2006 and fabrication is slated to begin in 2007. Sea trials for *Nereus* will also be carried out in 2007.

After long years of dedicated service to the Institution, both Barrie Walden and Dudley Foster retired in 2006. Andy Bowen succeeded Barrie as head of the Deep Submergence Operations Group and Bob Brown took over as head of the *Alvin* group.

—Robert Detrick, Vice President for Marine Facilities and Operations

Atlantis and *Alvin*

Days at sea: 264

Cruises: 13

Investigators served: 264

Nautical miles: 20,354

Alvin *dives:* 134

Atlantis and *Alvin* began 2006 at their home port of Woods Hole. *Atlantis* carried out an intensive North Atlantic winter study while *Alvin* underwent overhaul. Upon re-certification, *Alvin* and *Atlantis* headed west through the Panama Canal. After surveying a recent eruption at the East Pacific Rise (EPR), *Atlantis* began a series of West Coast cruises. These cruises included studies of methane seeps, testing of autonomous bottom-transecting instruments, Juan de Fuca vent studies, and deploying instruments at borehole sites. In late fall, *Atlantis* and *Alvin* returned to EPR for tracer studies and a vent fluids sampling program.

Knorr

Days at sea: 269

Cruises: 10

Investigators served: 184

Nautical miles: 38,637

Knorr began 2006 on its way to the Antarctic to carry out a study of polar fronts, and then headed north to Galápagos where researchers sampled basalts and identified first signs of the recent eruption at EPR. *Knorr* then transited to the West Coast of the U.S. for the first time in several years to study the California current. During the transit back to WHOI, researchers collected plankton data with a towed video recorder. Once back at WHOI, *Knorr* deployed a 40' spar buoy in support of a large multi-ship mooring program. In the fall, *Knorr* headed to Greenland to continue an ongoing mooring study.

Oceanus

Days at sea: 169

Cruises: 14

Investigators served: 183

Nautical miles: 20,642

Oceanus began 2006 in lay-up status. The first cruise began in April with a multi-year mooring program in the Northwest Atlantic. In May, researchers studied the chemical contaminants in the Hudson River plume. After studying benthic sediments, a new hybrid remotely operated vehicle (HROV) was tested. A series of cruises were added to map indicators of local red tide blooms. In the summer, *Oceanus* participated in a large multi-ship mooring program. *Oceanus* ended the year with several multi-year mooring programs.

Tioga

Days at sea: 110

Trips for education: 6

Passengers: 561

The 60-foot research vessel *Tioga* began 2006 in Massachusetts Bay and Cape Cod Bay, monitoring water quality through CTD surveys. Research and education efforts found *Tioga* working from Portsmouth, New Hampshire, to the New Jersey coast during the year. Red tide surveys during the spring and summer in New England waters complemented similar work done in 2005. *Tioga* continued serving as a platform for testing oceanographic instruments, including tethered tests of the new AUV *Sentry*. September found *Tioga* working in the Hudson River, charting the physics of the river with deployed moorings and the MAST (Mobile Array for Sensing Turbulence) system.


Oceanus
Craig Marquette, WHOI
Davis Strait
Nuuk, Greenland
Juan de Fuca Ridge
Astoria
Woods Hole
R/V Oceanus
San Francisco
San Diego
Charleston
Bermuda
Galveston
Jacksonville
Key West
R/V Atlantis
Manzanillo, Mexico
East Pacific Rise
Galápagos
R/V Knorr
Tioga
John Dyke, WHOI
Atlantis
Tom Kleindinst, WHOI
Knorr
Tom Kleindinst, WHOI
Valparaiso, Chile
Puntas Arenas, Chile
E. Paul Oberlander, WHOI

Applied Ocean Physics and Engineering Department

www.whoi.edu/science/AOPE/dept

The year 2006 was exciting and productive for the Applied Ocean Physics and Engineering (AOPE) Department, as researchers developed the next generation of ocean instruments, sensors, and vehicles, while engaging in numerous interdisciplinary science and engineering field programs. As in past years, the AOPE Department's broad spectrum of activities revolved around five central themes: ocean acoustics and signal processing, environmental fluid dynamics, submersible vehicles, observing systems and sensors, and engineering services.

In acoustics, the biggest show in 2006 was the SW06 shallow water acoustics experiment, which involved most of the Ocean Acoustics Laboratory (OAL), as well as personnel from WHOI's Physical Oceanography Department, the Mooring and Rigging Group, and Computer and Information Services. This two-month experiment off the New Jersey coast involved seven different ships (including R/Vs *Knorr*, *Oceanus,* and *Tioga* from WHOI), 62 long-term mooring deployments (all but five of which were deployed by John Kemp and a superb WHOI team), and numerous investigators from across the U.S. and Canada. Designed to investigate acoustics, nonlinear internal wave oceanography, and autonomous vehicles, the experiment was an enormous success, and every principal investigator came back with a high-quality data set.

The Coastal Ocean and Fluid Dynamics Laboratory (COFDL) spent 2006 extending its exploration of the dynamics of the ocean to ever larger and smaller scales. Dennis McGillicuddy led a team of researchers to the Sargasso Sea to investigate the influence of eddies on the productivity of the upper ocean and its influence on the carbon cycle. The team exploited the latest techniques in model-data assimilation to provide real-time guidance of the cruise plan, which included a complex suite of physical and biological measurements to determine the mechanisms of eddy mixing. At the other end of the spectrum, Houshuo Jiang is developing "eddy-resolving" models of the flow over sand ripples, with which he is testing Peter Traykovski's acoustic measurements of ripple formation and migration.

The world of vehicles continues to blossom, with the Ocean Systems Laboratory (OSL) developing the new Remote Environmental Monitoring Units (REMUS) 3000 autonomous underwater vehicle (AUV), adding ever more sensors to the other REMUS vehicles, and demonstrating the ability to dock and re-launch AUVs, so as to make them available for long-term missions in observatory work and naval reconnaissance. In the Deep Submergence Lab (DSL), tried and true vehicles like *ABE* and *JASON* have become day-to-day operational systems doing science all over the world, while "new and improved" vehicles and systems such as HROVs (Hybrid Remotely Operated Vehicle), *Jaguar, Puma, Sentry* and others are pushing the state-of-the-art capabilities each day. One could joke that a robot ship laden with ROVs and AUVs is the oceanographic ship of the future, with its captain and its science party sitting comfortably on shore sipping brandy while watching their computer monitors. But to the scientists and engineers in OSL and DSL, that is more of a challenge than a joke, and I, for one, would hesitate to bet against them.

—James F. Lynch, Department Chair

Tom Kleindinst, WHOI

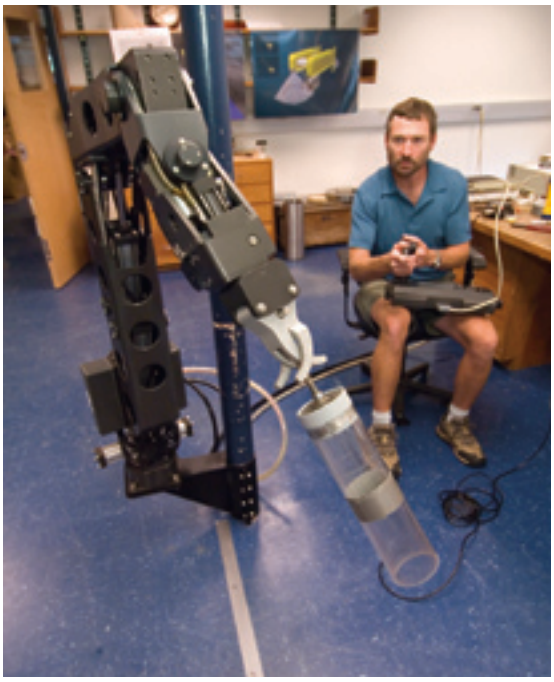
Jim Lynch (left) with Department Administrator John Reilly.

Tom Austin, WHOI

At the WHOI dock, Aaron Kayes of the Naval Oceanographic Office (NAVOCEANO) holds the line and Frank Raspante of Hydroid Inc., lends a hand to steady the REMUS-6000 vehicle as it undergoes harbor trials. The AUV was developed and built by the WHOI Oceanographic Systems Lab for NAVOCEANO.

Lauren Mullineaux, WHOI

Jim Ledwell, Brian Guest, and Ryan Jackson (left to right) flank an *Alvin*-mounted system that Guest built to release tracers into the water. The experiment was part of a project led by biologist Lauren Mullineaux to study how the larvae of hydrothermal vent animals disperse and colonize new sites.



Tom Kleindinst, WHOI

→ Engineer Matt Heintz tests the robotic arm for *Nereus*, a new vehicle from the Deep Submergence Laboratory. *Nereus* will be capable of exploring the deepest parts of the ocean as either a tethered vehicle controlled by scientists from shipboard or a programmable, autonomous vehicle.

Matt Grund, WHOI

WHOI scientist Richard Camilli shakes hands with pilot Konstantinos "Kostas" Katsaros, as he emerges from the submersible *Thetis* of the Hellenic Center for Marine Research. They made a successful dive to investigate hydrothermal vents near the flanks of a volcano at the island of Milos, while making the first ever deployment of a mass spectrometer on a submersible. Camilli's miniature mass spectrometer "Gemini" (the black canister on the back of the sub) can detect and measure multiple chemicals rising from undetected seeps and hydrothermal vents, revealing their locations.

Craig Marquette, WHOI

Dave Morton of OASIS, Inc. launches a "sonobuoy" hydrophone receiver from the R/V *Endeavor* off New Jersey. The hydrophones measured underwater sound and transmitted data to the ship via satellite, part of the Shallow Water Acoustics 06 program to study how sound travels in the ocean.

In 2006, members of the Biology Department traveled to the poles, the tropics, shallow lagoons, and the deep sea. Research in biology covers a broad range of life forms from microscopic to some of the largest marine mammals on the planet. Equally broad is the range of sub-disciplines in biology, from studies at the genomic level to large-scale processes and modeling.

Among the expeditions undertaken by Biology staff were: several visits to new volcanic eruptions at 9°N East Pacific Rise to study the effects on pre-existing communities, creation of new habitat, and the emergence of new communities; examination of biophysical constraints to larval dispersal at coral reef habitats in Belize; exploration of diverse habitats and development of field programs at the Liquid Jungle Laboratory in Panama; investigation of plankton dynamics in the Chukchi and Beaufort Seas; deployment of the video plankton recorder along a transect from Panama to Woods Hole; and investigation of gelatinous zooplankton in the Antarctic.

Tom Kleindinst, WHOI

Research Associate Erich Horgan holds a sample from an Arabian Sea plankton tow, as Department Chair Judy McDowell looks on.

Biological research benefits from the development of new tools that facilitate observations, analyses, and interpretation of phenomena. The Biology Department staff has been innovative in creating and deploying tools that open new opportunities for research. The D-tag (noninvasive digital archival tag) developed by engineer Mark Johnson and deployed by Peter Tyack and colleagues has enabled them to study the foraging behavior of many species of marine mammals. The VPR (video plankton recorder) was adapted for use on REMUS (an autonomous underwater vehicle), while Cabell Davis and Dennis McGillicuddy towed the instrument across the North Atlantic Ocean to examine the distribution of *Trichodesmium*, an important, abundant photosynthetic ocean bacterium. The VPR is a digital video microscope that samples at a rate of 30 frames per second and automatically sorts distinct images from one another. They were able to characterize the continuous distribution of *Trichodesmium* from the Azores to slope waters south of Woods Hole. Autonomous underwater vehicles have also been used to track baleen whales over time periods of weeks to months. Mark Baumgartner and physical oceanographer Dave Fratantoni have equipped gliders with passive acoustic recorders, in addition to sensors that gather environmental data. This allows them to correlate whale behavior with prey abundance and changes in other environmental variables.

Research in biology not only provides basic knowledge, but also in many instances has practical implications for conservation and resource management and for biomedicine. Scientists in the Biology Department contributed to the understanding of the sea urchin genome, a project that required contributions from 240 scientists in 11 different countries. Mark Hahn, John Stegeman, and Postdoctoral Fellow Jed Goldstone identified a large group of genes that encode proteins involved in protecting sea urchins from toxic chemicals. Don Anderson and his colleagues have developed a harmful algal bloom forecasting system that will monitor the southern Gulf of Maine and adjacent New England waters and predict where and when harmful algal blooms will occur. This system uses a combination of large- and small-scale survey cruises, autonomous gliders, moored instruments and traps, drifters, satellite imagery, and numerical models for hind-casting and forecasting blooms and their effects on shellfish resources.

Promotions and appointments in the scientific and technical staff of the Biology Department provide further evidence of the strength and diversity of research activities. Rebecca Gast was promoted to Associate Scientist with Tenure. Becky's research focuses on protista (algae and protozoa)—specifically their distribution and ecology, adaptation to cold environments, and symbiotic relationships. A recent paper in *Environmental Microbiology* describes some of her research in the Antarctic on dinoflagellates, and her photomicrograph was chosen for the journal's cover. Michael Moore was promoted to Senior Research Specialist. Michael's research focuses on marine mammals, including factors that contribute to marine mammal stranding, human impacts on whale populations, and the reproductive biology of the right whale. Michael also provides scientific leadership to the Cape Cod Stranding Network.

Staff members in the Biology Department are very productive in their own research and contribute extensively to the broader scientific community, nationally and internationally. The staff provides leadership and other services to federal agencies, scientific journals, universities, the National Research Council, and other national and international committees. Staff members also provide leadership to the WHOI Ocean Institutes, the Center for Oceans and Human Health, and the vital fleet committee of the University-National Oceanographic Laboratory System. Such leadership activities benefit our own scientific enterprise and help maintain the vitality of oceanography.

—Judy McDowell, Department Chair

Cabell Davis, WHOI

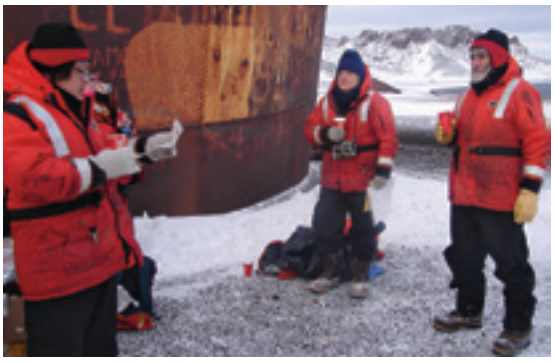
MIT/WHOI Joint Program student Colleen Petrick examines the contents of a plankton net, as fellow student Nick Loomis looks on. The collected plankton were used to make three-dimensional images with a holographic imaging system developed by Cabell Davis.

Carin Ashjian, WHOI

On a gray day in August 2006, WHOI Research Associate Phil Alatalo (right) and Captain Bill Kopplin motored out to the R/V *Annika Marie* at Barrow, Alaska. Alatalo participated in Carin Ashjian's study of oceanographic conditions prior to the annual bowhead whale migration there.

Kate Madin WHOI

Researchers and crew aboard the R/V *Laurence M. Gould* recover a new Large Area Plankton Imaging System (LAPIS) after a test in Antarctic waters in March 2006. Designed by biologist Larry Madin, researcher Erich Horgan, and WHOI engineers, LAPIS captures images of fragile, gelatinous plankton while they drift hundreds of meters deep without producing turbulence that disrupts their behavior.



Janis Umschlag, WHOI

Rudi Scheltema (right) was co-principal investigator on his fifth cruise to study how invertebrate larvae are distributed across the swift Antarctic Circumpolar Current. While there, he celebrated his 80th birthday with toasts and tributes from 20 colleagues and friends, including researcher Isabelle Williams (center) and Dr. Christopher Mah of the Smithsonian Museum of Natural History. About 100 Gentoo penguins were late for the picnic on Deception Island.

Tom Kleindinst, WHOI

Research Assistant Dawn Moran and biologist Rebecca Gast (right) examine a bacterial culture in the laboratory. Gast worked with colleague Linda Amaral-Zettler (Marine Biological Laboratory) to identify potential human pathogens (such as the bacterium *Legionella*) in Mount Hope Bay, Rhode Island.

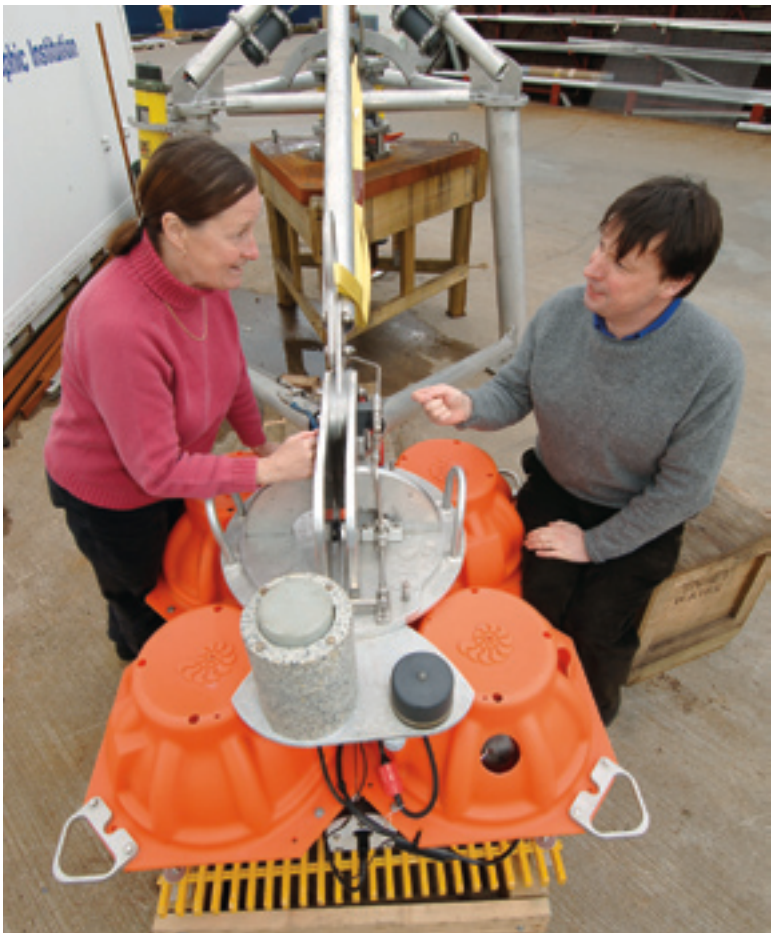
Geology and Geophysics Department

www.whoi.edu/science/GG/dept

The Geology and Geophysics Department investigates the interactions between the earth, ocean, and atmosphere through studies that range from the geological structure and tectonics of ocean basins to the dynamics of coastlines, from the history of ocean circulation and its relation to climate change, to the interaction between geological and biological systems.

Among its 85 staff and 36 postdoctoral and Joint Program students, the Department had 274 active projects underway in 2006, and members traveled all over the world collecting data and samples. Some led or participated in research cruises to the Mid-Atlantic Ridge, the East Pacific Rise, the western Pacific, the Indian Ocean, and the Arctic. Others conducted fieldwork on land, collected volcanic gases and rock samples from volcanoes in Nicaragua, Italy, and Russia; deployed seismometers in Samoa; examined past, intense hurricane activity in the Caribbean; and investigated coastal processes along the East Coast of the U.S., in Brazil and Lithuania, and in the Danube River Delta.

Scientific highlights for 2006 include significant advances in understanding how the seafloor is created at mid-ocean ridges. In a paper published in *Nature*, Deborah Smith and her collaborators demonstrated that detachment faulting (long-lived normal faulting that exposes lower crustal rocks) is more important in the generation of ocean crust at slow-spreading ridges than previously suspected. This finding is having significant impact in both the marine and continental communities. In addition, Dan Fornari and Adam Soule participated in two event-response cruises to the East Pacific Rise after scientists detected a new lava flow and eruption that occurred sometime in late 2005. Their role was to characterize the nature and extent of the volcanic eruption using a deep-towed camera system.



Tom Kleindinst, WHOI

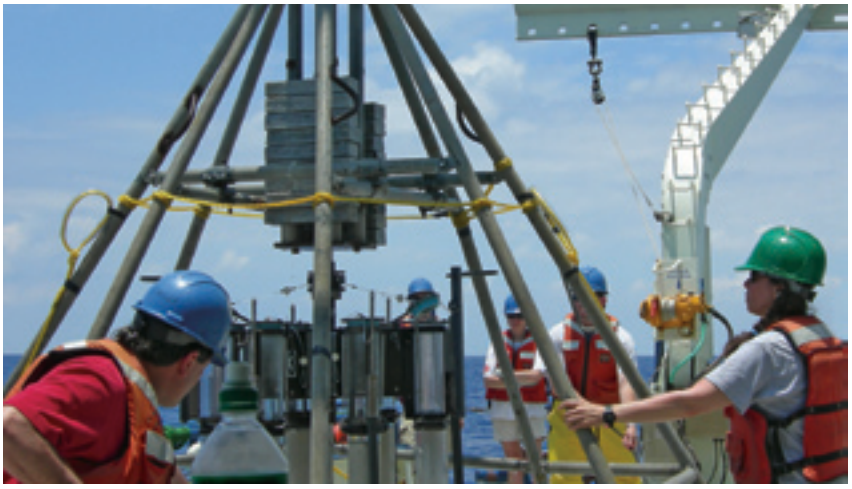
Department Chair Susan Humphris examines and discusses the Broadband Ocean Bottom Seismograph (BBOBS) with John Collins.

In February 2006, Karen Bice attended the annual meeting of the American Association for the Advancement of Science to report on a study conducted on sediments drilled by the Integrated Ocean Drilling Program off the coast of Suriname. Bice and colleagues found evidence for ocean surface water temperatures of 33° to 42°C (91° to 108°F) between 84-100 million years ago, during a period of elevated CO_2 levels in the atmosphere. If this interpretation proves correct, then actual future warming from elevated CO_2 concentrations may be much greater than predicted.

Jeff McGuire and John Collins were the recipients of a major grant from the W.M. Keck Foundation to investigate earthquake predictability. The project will capitalize on their earlier discovery that earthquake foreshocks routinely occur before mainshocks on some oceanic faults, suggesting that short-term prediction may be feasible under certain circumstances. They will collect data at the East Pacific Rise using new, ocean-bottom seismometers with extended capabilities to record large earthquakes, to better understand the physical mechanisms behind the foreshock sequences, and to decipher their relation to fault-slip in the subsequent large earthquakes.

There has been one addition to the scientific staff this year. Bill Thompson, who came to WHOI as a postdoctoral scholar in 2004, was appointed an assistant scientist. He brings expertise in reconstructing the history of sea level from records preserved in corals and relating it to climate change. John Hayes, one of the Department's National Academy of Sciences members and an international leader in isotope biogeochemistry, retired this year but will stay active as a Scientist Emeritus.

—Susan Humphris, Department Chair



Joan Eberhardt, Pratt Institute

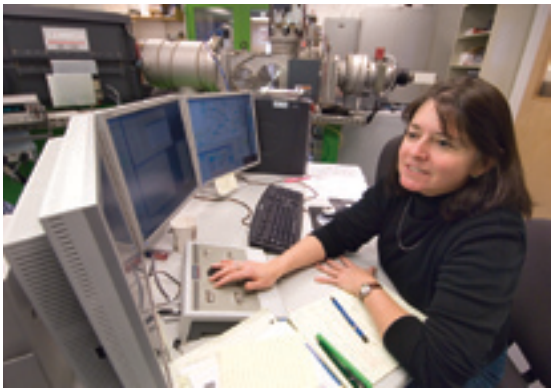
Aboard R/V *Oceanus* near the Bahamas in May 2006, Dan McCorkle and Joan Bernhard (green hat) recover a multi-corer full of sediment, from which they isolate and culture tiny organisms called foraminifera to study how environmental factors influence their shell chemistry (a proxy for ancient ocean temperatures).

Peter Clift, University of Aberdeen

Liviu Giosan (red shirt) and Pakistani scientists from the National Institute of Oceanography used "percussion coring" in the dry floodplain sediments of the Indus River Delta. From cores, Giosan can reconstruct development of the floodplain during past climate changes. The group also searched for Saraswati, a mythical river described in Hindu holy books that vanished in ancient times.

Amy Nevala, WHOI

Ken Sims climbs over the crater lip into Masaya volcano in Nicaragua in March 2006. With European colleagues and climbing friends, Sims spent ten days sampling concentrated volcanic gases in and near the volcano to learn about processes taking place in the magma far below.



Tom Kleindinst, WHOI

At WHOI's Northeast National Ion Microprobe Facility, Karen Bice uses the secondary ion mass spectrometer to measure the ratio of magnesium to calcium in the shells of long-dead plankton in seafloor sediments 90 million years old. She will use these shells and CO_2 concentrations inferred for the same period to test climate model predictions of past upper ocean temperatures.

Twila Moon, University of Washington

A line of bright tents on top of the Greenland ice sheet marks the research area of Sarah Das, who is measuring the speed of ice movement, working to understand the flow of meltwater from supraglacial lakes down through cracks in the massive ice sheet, and the implications for the stability of the ice in a warming climate.

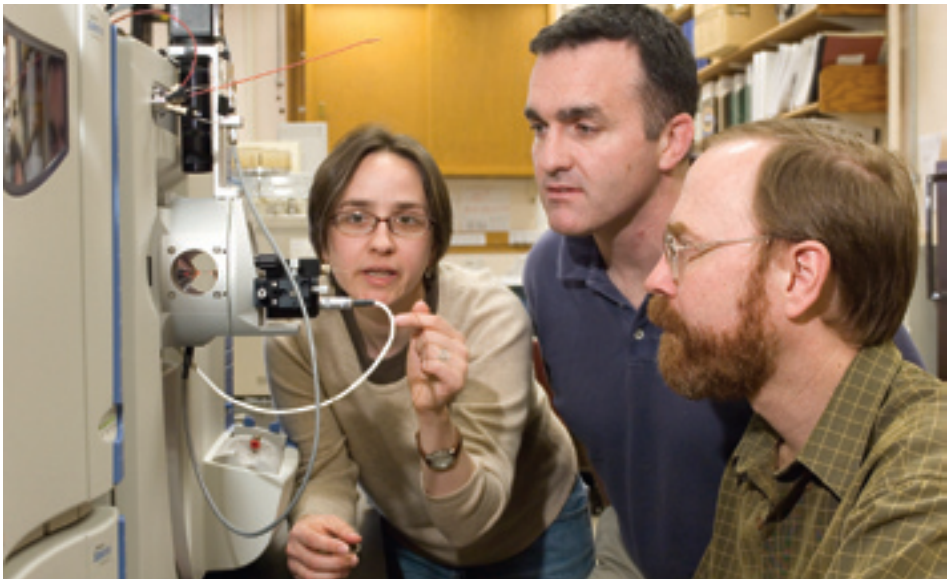
Scientists and staff in the Marine Chemistry and Geochemistry Department (MC&G) continue to advance our understanding of the distribution of chemicals, not only in the ocean, but also at the boundaries between the atmosphere and ocean, the ocean and its margins, and deep in the ocean's interior at the seafloor boundary. Each year we find MC&G scientists at far-flung places on this planet, collecting their precious samples. Each sample brings with it new results to help us understand a wide range of processes, from the controls on climate change to the cycling of nutrients that support life on this planet. Back in the labs, scientists are developing new models to assess change, acquiring and inventing new instruments, and pioneering new methods to make ever more sensitive chemical analyses.

Though many MC&G scientists collect samples far from home, you don't have to go so far to conduct topnotch science. A unique study took place in WHOI's backyard—Waquoit Bay—a site MC&G scientist Matt Charette has used repeatedly to study processes that occur underground when fresh groundwater enters the salty sea. While Matt's focus has been on the delivery of nutrients, in particular nitrogen, to this coastal bay, he recently teamed up with Carl Lamborg, a new assistant scientist hired in 2006 who specializes in mercury cycling. They supervised an undergraduate WHOI Summer Student Fellow, Sharon Bone, who measured groundwater mercury inputs into Waquoit Bay. Mercury is released globally from natural and anthropogenic sources and carried via rain into groundwater everywhere. What they found was that groundwater is a significant and overlooked source of mercury to coastal waters. While the shellfish are still quite safe to eat, this "subterranean estuary" delivers to coastal waters many different chemicals that are now being monitored by scientists.

Meanwhile, back in the lab, Liz Kujawinski and Chris Reddy were awarded a grant of $1 million in 2006 from the U.S. National Science Foundation (NSF) for a new Fourier-transform ion cyclotron resonance mass spectrometer (FT-ICR MS), essentially a room-sized mass spectrometer that is particularly sensitive for identifying large organic compounds. For example, it can resolve complex natural organic compounds used by marine microbes, or detect man-made petroleum products or pharmaceuticals. With this instrument and a second one—an LTQ mass spectrometer—obtained with an additional grant of $500,000 from the Gordon and Betty Moore Foundation, they are establishing a world-class analytical facility for oceanography applications for researchers inside and outside of WHOI. The new facility will allow all users to probe the composition of marine and terrestrial organic matter samples, and assist in studies on the fate and transformations of complex organic compounds in the environment.

The groundwater mercury project and this new mass spectrometer facility have a so-called "broader impact," a term used by NSF to describe activities that go beyond the scientific research hypotheses and goals. The Waquoit field site is used as a training ground for many undergraduate and graduate students, including minority Summer Student Fellows. The FT-ICR MS facility represents enhanced infrastructure for the broader Earth Sciences community.

There are many other projects in MC&G. Mak Saito developed an interactive Website for his research cruise in the Antarctic. Scott Doney and Dave Glover invited minority undergraduates to a WHOI science meeting and *Tioga* cruise. Karen Casciotti regularly mentors local high school students in her lab. Jeff Seewald brings students from Bridgewater State College on his summer research cruises. And many other scientists participate in outreach to the media, policy makers, and interact with local K-12 teachers. So, along with topnotch science, MC&G scientists are bringing their energy to bear on a wide range of activities that expand marine science beyond our walls and ships, and into broader communities and the public's attention.

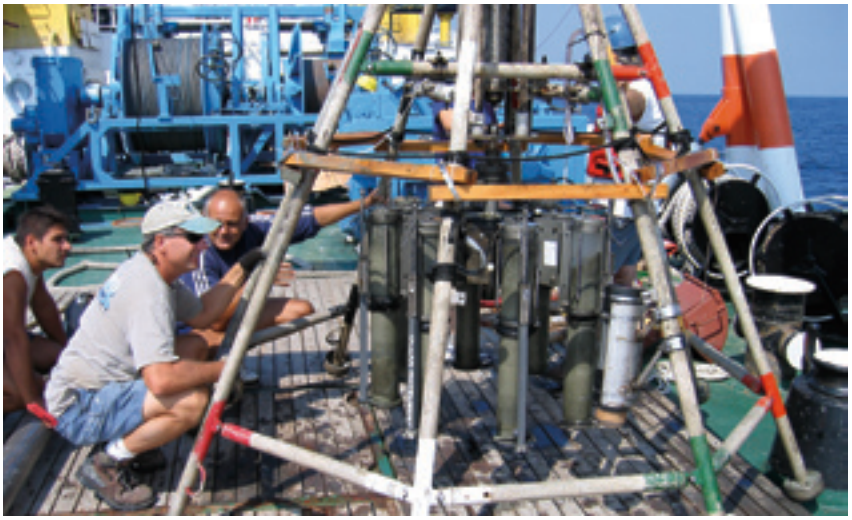


Tom Kleindinst, WHOI

Assistant Scientist Liz Kujawinski explains the finer details of the electrospray ionization interface to Associate Scientist Chris Reddy (center) and Department Chair Ken Buesseler. The interface is attached to the LTQ-mass spectrometer, one of two mass spectrometers in the new FT-ICR-MS facility.

As Department Chair, it has been a pleasure to assist in the hiring and mentoring of new staff, while watching the Department's scientific accomplishments grow at all levels in what is arguably one of the largest and strongest marine chemistry departments in the world. In 2007, Tim Eglinton will take over the helm as the next MC&G Chair. My experience as Chair certainly brought with it a renewed appreciation for the dedicated scientific and supporting staff in the MC&G Department and throughout this Institution.

—Ken Buesseler, Department Chair



Marco Coolen, WHOI

Aboard the Bulgarian R/V *Akademik*, Research Specialist Alan Gagnon (in the hat) and Bulgarian scientists inspect Niskin bottles during a Black Sea cruise with Assistant Scientist Marco Coolen. The researchers collected sediment and microbial life from the anoxic bottom—containing fossil DNA sequences—and water from the stratified water column. With these samples, Coolen will reconstruct the ancient Black Sea microbial community and compare it with modern species diversity.

Terrence Rioux, WHOI

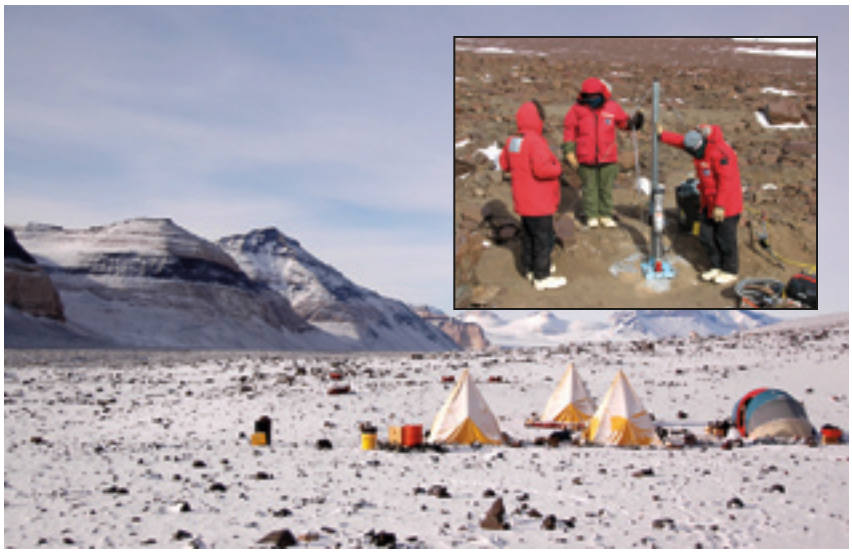
Undeterred by a snowstorm when timing matters, Joint Program student Michael Holcomb (red hood), Research Assistant Byron Pedler, and Assistant Scientist Ben Van Mooy (kneeling) recover experimental plates that were suspended under the WHOI pier for set times. Van Mooy's applied research project on deterrents to bacterial biofouling was funded by the U.S. Navy.

Tyler Goepfert, WHOI

→ Working in open water in Antarctica's Ross Sea, Assistant Scientist Mak Saito deploys a water sampler from the R/V *Nathaniel Palmer*. The object of the CORSACS project (Controls On Ross Sea Algal Community Structure) was to learn more about water chemistry and biology and the factors that control the growth and abundance of two types of important phytoplankton in the Ross Sea.

Paul Craddock, WHOI

Associate Scientist Jeff Seewald and his vent-sampling team (Joint Program student Eoghan Reeves, kneeling in front, and behind from left are: Peter Saccocia, Associate Professor of Earth Sciences at Bridgewater State College, WHOI Assistant Scientist Olivier Rouxel, Seewald, and Bridgewater State College student Emily Walsh) line up on the R/V *Melville*, with everyone holding purpose-built titanium fluid samplers. The group spent a month in the eastern Manus Basin, near Papua New Guinea, collecting hydrothermal vent fluids to analyze their composition. At this site, a back-arc spreading center, the fluids were so acidic that they required titanium containers.



Photos by G4 Science Party

Assistant Scientist Laura Robinson made her home for almost two months of 2006 in a yellow tent among the stones of Beacon Valley, Antarctica. Robinson was part of a team drilling into ancient ice that carries clues to Earth's long-past climate conditions. [Insert] About to travel back a million years, Robinson (right) holds the rig, while Jim Green (center, Ice Coring and Drilling Services of the University of Wisconsin, Madison) guides the drill into the hole.

Physical Oceanography Department

www.whoi.edu/science/PO/dept

Research in the Physical Oceanography Department seeks to describe and understand the ocean and how it interacts with the atmosphere. Laboratory experimentation, analytical and numerical modeling, analysis and synthesis of data, collection of new observations, and development of new observational methods are the approaches used. These last two are particular strengths at WHOI.

The CLIVAR Mode Water Dynamics Experiment (CLIMODE), in and just east of the Gulf Stream, examined how processes contribute to form a large volume of water each winter known as 18° water. Terry Joyce, John Toole, Dave Fratantoni, Fiamma Straneo, Al Plueddemann, Bob Weller, Leif Thomas, and others used moorings, a drifting spar, ship-based sampling, and satellite remote sensing as well as modeling. John Toole and Ruth Curry deployed a moored array along "Line W." Bob Beardsley, Dick Limeburner, and Sean Whelan deployed and recovered a mooring in the Ross Sea. At the other pole, Andrey Proshutinsky continued mooring work. Fiamma Straneo set moorings in Hudson Strait. Plueddemann and Weller maintained surface moorings off northern Chile, in the trade winds in the western North Atlantic, and north of Oahu. The fieldwork of the Kuroshio Extension System Study (KESS) finished with mooring recoveries by Steve Jayne. Mike McCartney analyzed observations made at the Vema Fracture Zone, Guiana Abyssal Gyre, and east of Kerguelen Plateau, and studied the circulation around the Grand Banks. Bob Pickart continued observations in the Labrador Sea and analyses of other high latitude currents.

Profiling floats and ocean gliders were deployed by Breck Owens, Dave Fratantoni, and Glen Gawarkiewicz. Amy Bower deployed RAFOS floats. Some floats added to the global array, while others were elements of specific studies; some glider deployments were done to explore predictability and methods for tactical oceanography. A REMUS autonomous underwater vehicle was used to study winter water formation east of Cape Cod by Andrey Shcherbina and Glen Gawarkiewicz, who also participated in the Shallow Water Acoustics 06 experiment in collaboration with the AOP&E Department. Profiling instruments deployed under the ice by John Toole, Andrey Proshutinsky, and Mary-Louise Timmermans showed great promise. Ray Schmitt worked to develop a new salinity sensor and a fast response temperature sensor. A new free-fall profiling microstructure instrument is under development by Kurt Polzin.

Tom Kleindinst, WHOI

Sean Whelan (left) and Bob Weller examine the meteorological sensors on a surface buoy used in the CLIMODE experiment.

Laboratory, analytical, and numerical approaches have a strong heritage. The summer Geophysical Fluid Dynamics program involved Jack Whitehead, Karl Helfrich, and Claudia Cenedese. Their research included laboratory experiments on hydraulic phenomena, flow down slopes, and the interaction of eddies with islands and currents. Larry Pratt and Jack Whitehead worked together on a textbook, *Rotating Hydraulics*. Lisan Yu developed a new climatology of the air-sea fluxes. Joe Pedlosky's foci included instability of time dependent flows, eddies, and the bottom boundary layer on the continental shelf. Ken Brink and Steve Lentz researched coastal currents and dynamics. Paula Fratantoni studied shelfbreak currents and their contribution to climate variability.

Modeling of high latitude processes involved Andrey Proshutinsky (Cook Inlet tidal dynamics), Jiayan Yang (Arctic Ocean dynamics), Mary-Louise Timmermans (ventilation of the deep Arctic Ocean), and Peter Winsor (circulation in the Arctic Ocean). Other model studies were done by Mike Spall (ocean circulation and water mass formation), Xin Huang (forcing of the ocean by the atmosphere), Steve Jayne (mixing by internal waves generated by flow over topography), and Alison Macdonald (transports of mass, heat, freshwater, nutrients, and carbon). Several investigators share interests in eddies: the role of mesocale eddies in the general circulation (Pavel Berloff) and eddy-mixed layer interaction (Leif Thomas).

This year Young-Oh Kwon was appointed assistant scientist, coming to us from the National Center for Atmospheric Research. Annalisa Bracco left for Georgia Tech; Jim Lerczak left for Oregon State University. Previous Chair Nelson Hogg retired and will continue as a Scientist Emeritus. Jim Price was appointed associate dean. Breck Owens received the W. Van Alan Clark, Jr. Chair. John Lund was awarded the Ryan C. Schrawder Award. Students Tom Farrar, Stephanie Waterman, Jim Thompson, and Melanie Fewings received AGU Outstanding Student Paper Awards. Fiamma Straneo received a Bjerknes Fellowship, and Pavel Berloff has a Royal Society USA Research Fellowship. Pavel Berloff, Margaret Cook, Paul Fraser, Paula Fratantoni, Heather Furey, Glen Gawarkiewicz, Craig Marquette, Jason Smith, Fiamma Straneo, and Dan Torres were promoted.

—Robert Weller, Department Chair

Chris Linder, WHOI

Postdoctoral Investigator Andrey Shcherbina stands near a *REMUS* AUV in Belize in May 2006. Shcherbina and Senior Scientist Glen Gawarkiewicz are collaborating with biologists Simon Thorrold and Jesús Pineda to study factors affecting dispersal and reproduction of the Nassau grouper, in work funded by the Oak Foundation.

Sean Whelan, WHOI

On an Antarctic summer midnight in December 2006, a Mercedes Benz Snowcat called a Piston Bully pulled a shipping container on skis across the frozen Ross Sea. The "Bully" carried supplies for a research team deploying a moored buoy designed by WHOI Senior Research Specialist Richard Limeburner. The buoy will measure ocean currents under the ice sheet, in support of the ANtarctic DRILLing program (ANDRILL), part of the International Polar Year.

Ian Green, Marine Mammal Observer

→ From left, Engineering Assistant Kris Newhall, Seaman Brian MacKenzie from the Canadian icebreaker *Louis S. St-Laurent*, Senior Engineering Assistant Will Ostrom, and Research Specialist Rick Krishfield stand with an ice-tethered profiler (ITP), which will measure ocean conditions under the ice while drifting across the Arctic with the floe.

Fiamma Straneo, WHOI

Crew members of the Canadian Coast Guard vessel *Pierre Radisson* snag a yellow float to drag it away from the ship while deploying the rest of the mooring in the Hudson Strait in September 2006. The innovative mooring, designed for Associate Scientist Fiamma Straneo, measures sea ice thickness and fresh water outflow from the Strait, while remaining below the winter ice cover.

Stephanie Waterman, WHOI

In fog and waves, Associate Scientist Steve Jayne (from left), Engineering Assistant Brian Hogue, and Senior Engineering Assistant Scott Worrilow pull a current meter onto the deck of the R/V *Melville*, for a project studying the warm Kuroshio Current off Japan.

"We commend the Institution for its many strengths, including its clear mission, comprehensive planning processes, exceptionally well-qualified student body, dedicated and highly competent faculty, and the unique repository of oceanographic legacy data maintained by the library."

That was one of the lead sentences in a letter we received this year from the New England Association of Schools and Colleges, Inc., Commission of Higher Education, continuing our accreditation. Formal notification was the culmination of an accreditation process involving many WHOI scientists and staff who helped prepare documents and other material for the comprehensive review of the Institution. Close interactions between research and higher education and the participation of students and postdocs in theoretical, experimental, and observational ocean sciences and engineering are at the heart of WHOI's Academic Programs. External assessments, such as the recent accreditation review, provide us with one indication of the success of our efforts.

Jayne Doucette, WHOI

WHOI and the five other Woods Hole science institutions sponsored the first Woods Hole Diversity Day.

During the 2005–2006 academic year, 28 masters and doctoral degrees in ocean science and engineering were awarded as part of the Institution's Joint Program with the Massachusetts Institute of Technology. As of Fall 2006, the Joint Program has awarded 754 degrees. Thirty-one new students enrolled in the program during 2006, and the total fall enrollment was 148.

Thirteen postdoctoral scholars were selected in 2006. Private and public funds that support this important program, whose size and scope is unique among U.S. oceanographic institutions, comes from many sources including postdoctoral scholar endowment funds and annual grants from benefactors, the four WHOI Ocean Institutes, the WHOI-NOAA Cooperative Institute for Climate and Ocean Research (CICOR), and the U.S. Geological Survey.

Our successful summer programs continued in 2006. The Geophysical Fluid Dynamics (GFD) Program met for its 48th summer in Woods Hole with 61 staff members, seven guest students, and nine fellows. The topic was "Ice," selected in preparation for the International Polar Year (IPY), which began in March 2007.

Twenty nine students were chosen from a group of 185 applicants to participate in our Summer Student Fellow program. The summer fellows are undergraduates and a few recent graduates who attend lectures and workshops and conduct an independent research project under the supervision of a WHOI scientific staff or senior technical staff member during a 10-12 week program. The students came from 23 U.S. colleges and universities and four international universities.

On August 10, 2006, WHOI and the five other Woods Hole science institutions sponsored the first Woods Hole Diversity Day.

Mingxi Yang, WHOI

Postdoctoral Fellow Jed Goldstone (left) teaches Summer Student Fellows Thiago Parente (center) and Katie Barott to sample killifish near the New Bedford Harbor Superfund site in order to examine the lingering effects of PCBs released during the manufacturing of transformers in the 1970s.

Jayne Doucette, WHOI

Hovey Clifford (hat) demonstrates ocean sampling techniques to Summer Student Fellows aboard *Tioga* in July 2006.

The event featured a guest speaker, a panel discussion and a street festival. Such events help focus attention on the need to increase diversity in ocean science, and I believe that the WHOI academic programs need to contribute our share to this important national priority.

—James A. Yoder
Vice President for Academic Programs and Dean

Courtesy of Pheobe Lam, WHOI

Postdoctoral Scholar Phoebe Lam (right) deployed McLane pumps to collect particles in the water column on a Southern Ocean cruise aboard the *Aurora Australis*.

Coastal Ocean Institute

www.whoi.edu/coi

The Coastal Ocean Institute (COI) promotes scientific inquiry into phenomena that shape our coastal waters and ecosystems. Through research grants, scientific gatherings, and the development of state-of-the-art facilities, COI encourages innovative, interdisciplinary research and technology development that can improve our understanding of the processes at work along our shores. COI also fosters communication efforts to help civic leaders, students, and citizens become better informed about the complexities of this dynamic environment and the possibilities for sustaining and restoring it.

Our research themes focus on examining threats to, and abuses of coastal waters; examining the biological, physical, geological, and chemical processes at work where air, sea, and land meet; and instrument development that improves our ability to measure, monitor, and analyze the fundamental processes shaping the coastal region. To support these themes, COI funded six research projects and two new initiatives in 2006.

We also initiated support for three new COI Fellows. Rob Evans (Geology & Geophysics) who uses geophysical approaches to study groundwater discharge and seafloor classification in nearshore environments; Becky Gast (Biology) who is studying the epidemiology of infectious diseases in coastal areas; and Andone Lavery (Applied Ocean Physics & Engineering) who is using high-frequency sonar as a tool to learn more about the biology and physics of coastal waters.

In addition, we continued to support three other Fellows: Jeff Donnelly, a geologist (jointly funded with the Ocean and Climate Change Institute) who is studying climate change recorded in sediments; Chris Reddy, an organic chemist who studies the source, transport, and fate of organic compounds in seawater; and Carin Ashjian, a biologist who is investigating the effects of climate change on Arctic coastal ecosystems. Carin's fellowship is made possible through the generous support of the COI committee.

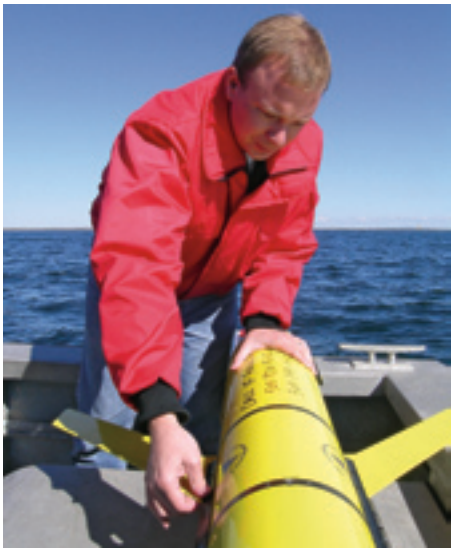
Two COI postdocs and one Joint Program graduate student were supported this year. Anders Carlson is investigating the interactions of ice sheets, oceans, and the climate system on orbital to centennial time scales, and Brian White is examining the role of internal waves in the horizontal transport of plankton. Graduate student Jon Woodruff is studying coastal systems and sediment transport and disposition during extreme coastal flooding.

With funding from a COI committee member, we provided a new opportunity exclusively for Joint Program graduate students working in coastal ocean science. Seven students received modest research awards which provided crucial funding for thesis research expenses not otherwise covered by existing support.

—Donald Anderson, Institute Director

A sampling of COI research projects for 2006

↓ **Dave Fratantoni, Heidi Sosik, John Trowbridge,** and **John Lund** (below) are evaluating the capability of autonomous gliders to collect physical and biological data along the continental shelf in support of the moored assets of the Ocean Observing System (OOS). Their work is an important step in developing a Northeast regional observing system.



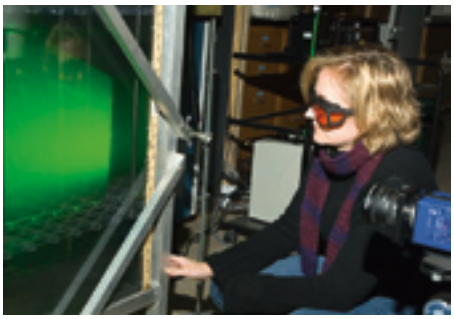
Dave Fratantoni, WHOI

Liviu Giosan is researching extreme environmental changes that occurred in the past to better understand how coastlines are affected by the acceleration of sea level rise.

Henrieta Dulaiova, Matt Charette, and **Richard Camilli** are using a radon-methane-nitrate mapping system to measure submarine groundwater discharge into surface waters. This system provides for rapid turnaround of information on discharge and non-point-source pollution.

Al Plueddemann, John Trowbridge, and **Heidi Sosik** are developing a coupled observation and modeling framework that will enable predictive understanding of seasonal-to-interannual variability in the continental shelf ecosystem in the Northeast.

Steve Lentz is studying the cross-shelf transport and associated upwelling in the Hudson Shelf Valley, investigating the physics of this flow and determining the relationship between onshore flow and phytoplankton bloom events.



Tom Kleindinst, WHOI

↑ **Lauren Mullineaux** and **Heidi Fuchs** (above) are building a turbulence tank to study the responses of mussel larvae to turbulence and downwelling flow in order to create a physical transport model to estimate mussel dispersal in Cape Cod Bay.

Rob Evans and **Rocky Geyer** are working with other WHOI scientists and key federal agencies to develop a national research program on coastal change.

Houshuo Jiang and **Peter Traykovski** are investigating wave energy dissipation and sediment transport over a rippled seabed.

Deep Ocean Exploration Institute

www.whoi.edu/doei

The Deep Ocean Exploration Institute (DOEI) is dedicated to supporting multidisciplinary research in the fields of oceanography, earth sciences, and engineering to understand the dynamic planetary processes occurring in the deep ocean and within Earth's interior. These intertwined processes are the "pulse" of planet Earth. They help regulate where and how magmatism and earthquakes occur and the evolution of ocean chemistry. They also profoundly influence biological, microbiological, and biogeochemical processes on and below the seafloor.

The development and implementation of innovative technologies that seek to image, sense, and sample remote areas of the deep ocean and Earth's interior are also essential elements of DOEI's mission.

To support these goals, DOEI funded eight new research projects in 2006 that encompass all of the Institute's research themes: seafloor observatory science, fluid flow in geologic systems, and Earth's deep biosphere. DOEI provided additional discretionary funding to other researchers and students to help facilitate opportunities for science and engineering. In addition, DOEI currently supports two research fellows (Stan Hart and Wenlu Zhu, both in the Geology and Geophysics Department), three postdoctoral fellows, and a graduate student in its efforts to expand the research options available to scientists and engineers in all departments at WHOI.

DOEI-sponsored activities have also included outreach and education in various forms. With Academic Programs, DOEI co-supports the Geodynamics Program at WHOI, which annually offers students and staff stimulating lectures by scientists on diverse research topics, as well as a field trip. The program helps nurture student involvement in research and an awareness of a broad spectrum of research topics in the oceanographic and earth sciences.

DOEI provides public and educational outreach through the Dive and Discover™ Website (www.divediscover.whoi.edu). Dive and Discover™ continues to be an important part of the WHOI outreach program for K-12 students and the general public. An average of 69,000 visitors per month connected to the site to learn about oceanographic science, WHOI research programs, and to follow the online expeditions. In 2006, Dive and Discover™ hosted Expedition 10 to the Antarctic. It explored the ecology and physiology of salps, jelly-like creatures that are an important part of the food chain in the Antarctic ecosystem.

—Dan Fornari, Institute Director

A sampling of DOEI research projects for 2006

Chris German, Olivier Rouxel, and **Lauren Mullineaux** are tracing the fate of iron and other enriched chemicals in hydrothermal vent plumes, the microbes that interact with them to derive energy, and the larvae of vent fauna that are transported within the same plumes.

↓ **Alison Shaw** sampled the active volcano Klyuchevsky in northern Kamchatka. She is geochemically analyzing the samples for volatiles to better understand magmatic processes in arc volcanoes.

Stefan Leuko

Nobu Shimizu is developing new methods, with the Northeast National Ion Microprobe Facility at WHOI, to use uranium/lead dating of extremely young zircons to help learn how ocean crust forms.

Adam Soule is using the WHOI TowCam system to examine areas of recent volcanism and tectonism along the Lucky Strike segment of the Mid-Atlantic Ridge.

Meg Tivey is developing software programs that will help investigations of how fluids flow within ocean crust, and how resultant chemical reactions modify the earth and provide energy for life deep in the ocean and below the seafloor.

Zhengrong Wang, Stan Hart, Jeff Seewald, and **Bernhard Peucker-Ehrenbrink** are experimentally studying magnesium isotope fractionation during chemical reactions between seawater and magnesium-rich minerals to explore how water and rock interact and how fluids are transported and mixed in hydrothermal vent systems.

Sheri White is working on a new technique—laser Raman spectroscopy—to measure dissolved gases *in situ* in vent fluids emitted at seafloor hydrothermal sites.

Clara Chan

↑ **Mark Kurz** measures primordial noble gases in recently erupted seafloor rocks to search for clues to the origin and evolution of the early Earth. He is developing new sampling techniques to ensure that the rocks are not contaminated by noble gases from the atmosphere.

Jack Whitehead is conducting laboratory experiments to understand the processes by which migrating magma erupted at the Mid-Ocean Ridge forms lava tubes and is transported across the seafloor.

Ocean and Climate Change Institute

www.whoi.edu/occi

To foster greater understanding of the ocean's role in climate change, the Ocean and Climate Change Institute (OCCI) supported several new research projects, two new OCCI fellows, and a postdoctoral scholar. The Institute also continued support for an ongoing fellow, postdoctoral scholar, and MIT/WHOI graduate student.

Projects launched in 2006 included research to: estimate the present circulation and climate state of the ocean, study the photochemical production of CO_2 in the ocean, empirically test a hypothesis on Arctic Ocean sedimentation, conduct a time-dependent paleocirculation study, and produce a "white paper" on ocean salinity. Other OCCI-sponsored projects are highlighted below.

The OCCI also provided funding to establish or supplement Atlantic and Arctic Ocean observing systems to enhance understanding of the region's potential impacts on climate change. These included: continuation of a freshwater observation array off southeast Greenland, enhancement of particle and carbon flux studies on Line W in the western Atlantic, a demonstration of Spray gliders in basin-scale climate monitoring between Greenland and the Iberian Peninsula, and development of a salinity sensor for ocean surface drifters. Other research on the region included studies of: the deep Arctic Ocean as an indicator of climate change, the importance of oceanic mixing to circulation and climate change, a simulation of abrupt climate change by changes in freshwater forcing, and the role of meltwater release in abrupt climate change during the last deglaciation.

The Institute continued fellowship support to Peter Winsor and awarded two new fellowships in 2006 to Delia Oppo and Ruth Curry. Oppo studies past climate change using corals and the fossilized shells of tiny organisms called foraminifera. Curry examines ocean salinity measurements in the recent past as indicators of present climate change.

A new postdoctoral scholarship was awarded to Justin Ries from Johns Hopkins University, who joined the Marine Geology and Geophysics Department in December 2006 to study past climate change using various paleo-chemical tracers. Continuing postdoctoral support went to Ted Durland in the Physical Oceanography Department, who is studying the role of equatorial waves and the Indonesian Throughflow in El Niño/Southern Oscillation dynamics. The OCCI also provided funding for MIT/WHOI Joint Program student Natalie Goodkin in the Marine Chemistry and Geochemistry Department, during the final year of her Ph.D. thesis on Bermuda corals and modern climate change.

—Terrence M. Joyce, Institute Director

A sampling of OCCI research projects for 2006

Karen Bice is evaluating the skill of climate models to reconstruct past changes documented by marine fossils and evaluating their ability to reliably predict how increasing CO_2 in the atmosphere may raise future ocean temperature changes.

Rui Xin Huang developed a model simulating the physical processes that occur when sea ice forms and melts—an important component of more comprehensive models used to simulate polar circulation and climate changes.

↓ **Paula Fratantoni** is investigating how fresh water from the North Atlantic Shelfbreak Current off the eastern U.S. leaves the coast to have impacts on the ocean and climate in the North Atlantic.

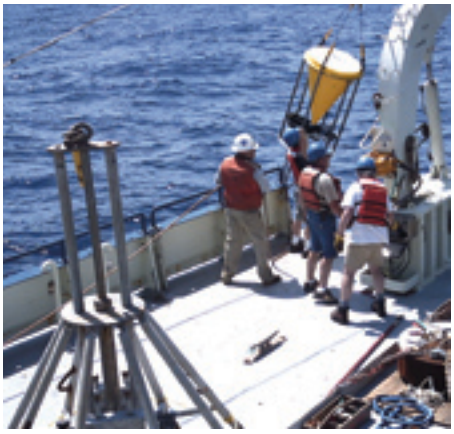
Tom Kleindinst, WHOI

Annalisa Bracco examined the role of the Indonesian Throughflow (between the Pacific and Indian Oceans) in linking El Niño and monsoon cycles—to better understand the ocean's role in determining precipitation patterns in one of the world's most densely populated regions.

Olivier Marchal is developing a statistical method aimed at determining if the uranium isotopes, protactinium-231 and thorium-230, deposited in seafloor sediments can reveal insights into ocean circulation in the geological past, especially during the last deglaciation.

Jack Whitehead has developed a laboratory model of deep-ocean circulation with many features of an actual ocean (such as a layer of lighter warmer water in the tropics and turbulent sinking flow near a polar sea) to better quantify the ocean's role in climate.

Laura Robinson is using geochemical methods on the carbonate skeletons of fossil deep-sea corals to shed light on changes in the deep circulation of the North Atlantic Ocean during times of rapid climate change in the past.



Timothy Eglinton, WHOI

↑ **Timothy Eglinton** deployed a sediment trap off the New England coast to investigate how carbon is transported from continental margins to the deep ocean—an important component of the oceanic carbon cycle that plays an integral role in regulating Earth's climate and life.

Ken Buesseler and James Valdes are establishing a long-term ocean-atmosphere observatory off Cape Verde, an ideal site to examine how windblown minerals enter the ocean to stimulate biological productivity and remove CO_2 from the atmosphere, cycling carbon to the depths.

Ocean Life Institute

www.whoi.edu/oli

The sea harbors a great diversity of life, with complex interactions between species and the environment. Human impacts on sea life are growing every year, with global warming reducing ocean productivity, overdevelopment and pollution contaminating coastal waters, and an increasing demand for food driving over-harvesting of the world's fisheries. Addressing these issues requires an understanding of the underlying processes controlling diversity and productivity of ocean life, which, in turn, requires a combination of exploration and quantitative analysis. The Ocean Life Institute's (OLI) mission is to support high-risk, high-reward basic research that leads to fundamental new insights in ocean biology that can be used to help solve problems of societal relevance.

In 2006, OLI continued to support two special research initiatives, The North Atlantic Right Whale Initiative and The Coral Reef Fish Connectivity and Conservation Initiative. The Right Whale Initiative involves an active and diverse group of researchers whose work is featured in a new book, *The Urban Whale*, published by Harvard University Press (2007). Members of the Coral Reef Fish Connectivity and Conservation Initiative are focused on understanding the degree of isolation between populations of coral reef fish. OLI is also encouraging research in the areas of ecosystem-based management and ocean modeling and observing systems, in order to foster the transition of scientific findings and methods into operational tools for managers and society.

In addition to these research initiatives, five OLI research grants were funded in 2006. These included studies of: DNA in *Trichodesmium*, a cyanobacterium critical to the ocean nitrogen cycle; ocean physics and behavior of bluefin tuna on the Grand Banks; echolocation strategies of harbor porpoises; pollutant stress in sea anemones; and invasive plankton in ship ballast water. Five grants also were awarded through the Tropical Research Initiative on topics ranging from ciguatera seafood poisoning in the Virgin Islands to fossil plankton DNA in sediments of Palau.

OLI currently supports six Institute fellows, including our new fellow, Hal Caswell, who is studying mathematical ecology of populations and communities as it relates to conservation biology. In addition to fellows, OLI supported a new graduate student and postdoctoral scholar as well as providing discretionary funds to foster new research opportunities by scientists and students.

—Cabell Davis, Institute Director

A sampling of OLI research projects for 2006

Diana Franks, WHOI

↑ **Ann Tarrant** (above), **Mark Baumgartner**, and **Tim Verslycke** are working to learn how a dormant life-stage called diapause is regulated in the copepod *Calanus finmarchicus* by comparing which genes are expressed in active and diapausing animals. Copepods are plankton that are enormously abundant and important in the upper ocean, serving as the main food for baleen whales and many fish.

Jeff Donnelly will collect sediment cores from coastal mangrove swamps at the Liquid Jungle Lab in Panama and analyze them to determine the historical rainfall record. This undisturbed and undeveloped region has likely preserved records of the variability of the El Niño/Southern Oscillation weather pattern over thousands of years, and can provide clues about past controls of hurricane activity in the Caribbean.

Don Anderson and **Deana Erdner** are studying the distribution, abundance, and population genetics of the single-celled organism *Gambierdiscus toxicus,* which causes ciguatera fish poisoning in tropical regions. Their work will contribute to a long-term study of links between the organism, the environment, and the disease in humans.

Simon Thorrold, **Travis Elsdon**, and **Leah Houghton** will develop and test analytical methods—based on stable isotope analysis of fish otoliths—that will enable them to identify juvenile fish habitats from natural labels in the environment. The goal is to eventually trace tropical fish back to juvenile nursery areas in mangrove habitats and to assess the importance of mangrove areas to fish populations.

Marco Coolen is using the bottom sediment from Jellyfish Lake, a largely anoxic marine lake in Palau, as an archive of ancient microbe communities. By analyzing fossil DNA from the sediments, he can reconstruct the diversity and abundance of microbes over time. He will then match changes in the microbial community to the incidence of El Niño events for the past 100 years in order to estimate the impact of these events on aquatic microbes.

↓ **Mark Hahn** and **Kristen Whalen** (below) are studying biochemical mechanisms that allow some mollusks to eat gorgonian corals that possess stinging cells and toxins. Whalen will compare metabolic mechanisms in two mollusks for dealing with gorgonian toxins. Whalen and Hahn will focus on two types of proteins called transporter proteins, previously considered an indication of environmental pollution, that may enable some marine invertebrates to consume noxious compounds.

Ann Tarrant, WHOI

The Marine Policy Center (MPC) conducts social scientific research that integrates economics, policy analysis, and law with the Institution's basic research in ocean sciences. Recent MPC research has focused on such issues as the economic impacts of non-native aquatic nuisance species, also known as "invasive" species, and the likely effectiveness of vessel speed restrictions to reduce mortalities of the highly endangered North Atlantic right whale *(Eubalaena glacialis)*.

Thousands of non-native species have made their way into U.S. aquatic ecosystems, where they can threaten ecosystem stability by affecting the number and diversity of native species and the biological relationships among them. Since 1990, it has been public policy to minimize the economic and environmental impacts of those non-native aquatic species that become established. So far, policy responses have been based on a few crude estimates of economic damages, which have ranged from millions to billions of dollars. Better damage estimates are needed to help policy makers and environmental managers understand the gravity of an invasive species problem and identify appropriate management responses.

A project led by Research Specialist Porter Hoagland and Associate Scientist Di Jin addresses this need by developing a thorough review of the relevant biology, economics, and policy literatures as well as outlining a framework for assessing the damages associated with aquatic nuisance species in the U.S. The review focuses on commercial fisheries, recreation and tourism, shipping and navigation, and municipal and industrial water uses. The framework aims to produce refined estimates of the scale and distribution of the economic impacts of species invasions by carefully comparing the economic benefits and costs associated with alternative scenarios of an ecosystem with and without invasions.

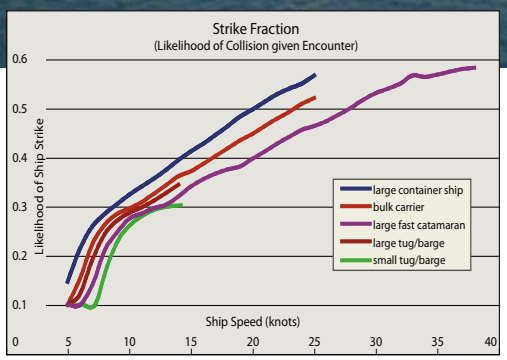
Dirk Schories

The European green crab (*Carcinus maenas*), native to the European Atlantic coast, may have spread to the U.S. Atlantic coast as early as 200 years ago. The species has now spread to the U.S. Pacific coast as well. Research at MPC has uncovered serious problems in the estimates of the economic impacts attributed to the green crab and other aquatic invaders.

Hoagland's and Jin's case study of the invasive European green crab (*Carcinus maenas*) uncovered serious errors in an earlier published estimate of the crab's economic impact, which had been used to help justify recent public policy. They found that, in addition to using data from the wrong geographic location, the earlier study's predictions of ecological effects rested on loose footing and economic methods were misapplied in constructing the damage estimate. In an article that appeared in the November 2006 issue of *BioScience*, they use the green crab example to call attention to the need for the more careful application of science and economics to avoid implementing wasteful or feckless measures to deal with invasive species problems.

On another recent project, Research Specialist Hauke Kite-Powell teamed with scientists from the New England Aquarium to assess the likely effectiveness of proposed vessel speed restrictions to reduce right whale mortalities that result from "ship strikes," or collisions with large vessels. Unlike other proposed measures to address the problem, such as relocating shipping routes and designating areas to be avoided, the justification for speed restrictions has been a subject of some uncertainty and little consensus.

Photo courtesy of New England Aquarium



An aerial image of a ship and a whale illustrates the challenge of detecting and avoiding marine mammals from the bridge of large commercial vessels. Reducing ship speed may reduce the likelihood of a collision by giving the whale more time to move out of the path of an oncoming ship, as suggested by model results (right).

Using six years of observational data on encounters between right whales and vessels, the research team modeled the trajectories of both under different ship speed and whale response assumptions to determine the effect of vessel speed and size on the likelihood of collision. They found that the strike risk posed by a conventional ship moving at 20 to 25 knots can be reduced by 30 percent if it slows to 12 or 13 knots, and by 40 percent if it slows to 10 knots. Although whales can generally avoid collision if they detect and react to an oncoming vessel at a distance of 250 meters or more, the risk of a strike is considerable if the detection distance drops below 100 meters. Other research is beginning to quantify the likely severity of a resulting injury, which is also a function of ship speed.

—Andy Solow, Center Director

Woods Hole Center for Oceans and Human Health

www.whoi.edu/science/cohh/whcohh

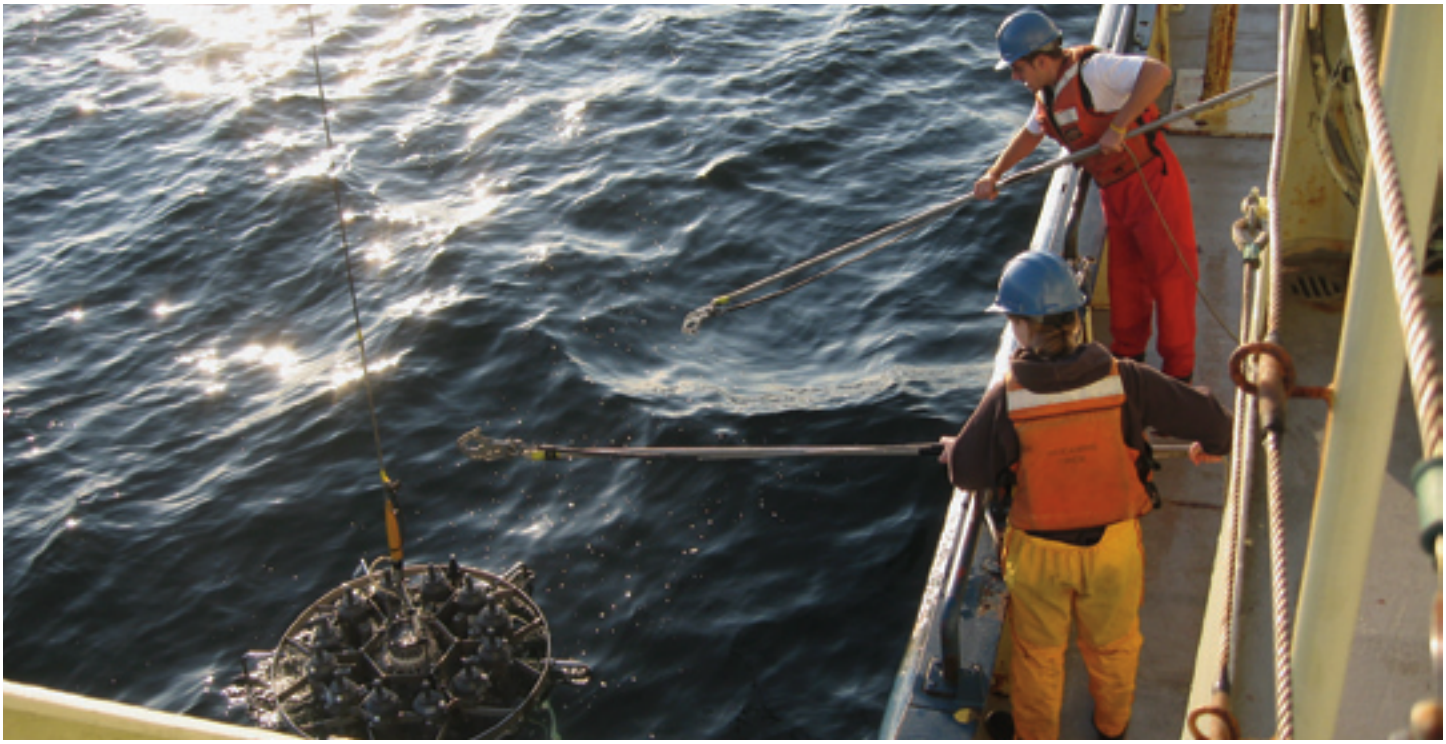
The Woods Hole Center for Oceans and Human Health (WH-COHH) continued research activities on human pathogens in coastal waters and on harmful algal blooms. In this annual report, we provide updates on two directions of importance.

A partnership between the Center and NOAA continues to make inroads into understanding the new regime of the harmful algae *Alexandrium fundyense* bloom dynamics and Paralytic Shellfish Poisoning (PSP) in the Gulf of Maine. WH-COHH researchers Don Anderson, Dennis McGillicuddy, and Bruce Keafer were the first to detect an offshore bloom of *Alexandrium fundyense* in May 2005. This bloom was the largest of its kind in the Gulf of Maine region in over 30 years. Close work between WHOI investigators and state and federal officials helped to avoid human illnesses from PSP, a potentially fatal syndrome associated with eating shellfish that have accumulated *Alexandrium* toxins. The apparent cause of this extraordinary event was a ten-fold increase in the abundance of the dormant resting cysts ("seeds") of *Alexandrium* in mid-Maine coastal sediments. With ship time funding provided by NOAA, WH-COHH researchers were able to remap the cyst beds following the 2005 bloom and document the persistence of the anomalously high levels of cysts. Based on that information, WHOI investigators predicted another severe year for PSP in 2006. Those predictions were borne out, and COHH investigators provided real-time forecasts of the bloom as it unfolded, confirming the importance of assessing cyst abundance. Once again, NOAA was able to provide ship time on WHOI's R/V *Oceanus* to facilitate measurements of this regional-scale phenomenon, yielding extremely useful information not only for scientific purposes but also for federal, state, and local coastal resource managers.

WH-COHH investigators accomplished follow-up studies of the environment in Lake Pontchartrain, Louisiana. A WHOI Morss Colloquium and Workshop, organized by biologist Becky Gast, addressed the impacts of hurricanes Katrina and Rita on human pathogens in Lake Pontchartrain. Members of three NSF-NIEHS Centers for Oceans and Human Health (Miami, Hawaii, and Woods Hole) and researchers from Louisiana State University gathered in Woods Hole to synthesize the research and to provide assessments of the human health risks. The collective results indicated that the lake quickly returned to usual levels of indicator organisms. While the lake is not clean, the impacts of the hurricanes were fortunately short-lived. Work confirmed that the 17th Street Canal in particular is a continuing source of human pathogens for the lake. Canal effluents move along shore and ultimately out into the Gulf of Mexico where they are further diluted. The Miami COHH group found that soils from both flooded and non-flooded areas had high levels of human fecal indicators. There is little information regarding the health standards for these indicators in soils. CDs of presentations from the colloquium were distributed and a summary of the workshop is on the COHH Website. The group also finalized an important manuscript that is soon to be published in a high impact journal.

In other developments, the WH-COHH has funded several new pilot projects (Don Anderson, and Mitch Sogin at MBL), which will use new high-throughput DNA sequencing approaches to address genomic and microbial diversity of pathogens and harmful algae. Projects to assess public health and economic consequences (Porter Hoagland and Hauke Kite-Powell) also were funded.

—John Stegeman, Center Director



Dennis Evangelista, WHOI

Joint Program student Christie Wood and Postdoctoral Investigator Alfredo Aretxabaleta prepare to recover the CTD rosette during the NOAA Rapid Response to the New England Red Tide cruise which took place during June 6–17, 2006.

Cooperative Institute for Climate and Ocean Research

www.whoi.edu/science/cicor

The Cooperative Institute for Climate and Ocean Research (CICOR) is strategically situated to harness the leadership and research excellence of WHOI in service of NOAA's mission and goals. CICOR strengthens the relationships between the two institutions that have been forged over decades by scientists and technicians from WHOI and across NOAA line offices. CICOR is a catalyst for collaborative work within the region in the fields of climate, coastal and ecosystems research, and its scientists are leaders in national and international forums, including the Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS), which serves the interests of NOAA and the Integrated Ocean Observing System (IOOS). In 2006, CICOR supported 75 projects totaling more than $6 million in funding. Since its inception in 2001, CICOR has supported more than 110 research projects and outreach activities, bringing the five-year budget to more than $32.6 million.

Last year CICOR established two associate directorships within the organization to foster communication and collaboration between NOAA and local scientists and engineers in the areas of coastal and ecosystems research and their relationship to climate. The first associate directors are Kenneth Brink (Physical Oceanography) and Jesús Pineda (Biology). While they focus on coastal and ecosystems initiatives, CICOR Director Robert Weller coordinates NOAA research efforts in climate.

Tom Kleindinst, WHOI

Physicist Christoph Waldmann from the Research Center Ocean Margins of the University of Bremen addresses QARTOD IV (Quality Assurance of Real-Time Oceanographic Data) workshop participants in Woods Hole in June 2006. QARTOD is a continuing multi-agency effort to address the quality assurance and quality control issues of the Integrated Ocean Observing System (IOOS) and the broader international community.

Tom Kleindinst, WHOI

Summer Student Fellow Amy Kidd and CICOR Postdoctoral Scholar Jeremiah Hackett study the genetics of toxic algae in the culture lab.

One role of the NOAA Cooperative Institutes is to engage the academic and private research communities in working with NOAA to develop plans for research and coordinated efforts. For example, CICOR sponsored the February '06 meeting of the OceanSITES Science and Data Teams held in Honolulu, HI, to coincide with the AGU/ASLO Ocean Sciences meeting. In addition to funding the meeting for NOAA, the CICOR office produced an OceanSITES brochure and a companion Website—featuring an interactive map of global ocean observatories and related data links that are being used to promote sustained global ocean time series observations.

In 2006, CICOR also co-sponsored the annual QARTOD (Quality Assurance and Real-Time Oceanographic Data) meeting with the NOAA office of National Ocean Services (NOS). QARTOD is a continuing multi-agency effort formed to address the quality assurance and quality control issues of the Integrated Ocean Observing System (IOOS) community.

Through technological developments in observations and modeling, CICOR has advanced toward meeting NOAA goals:

- CICOR contributions to major elements of the global ocean climate observing system—including ARGO profiling floats, gliders, reference stations, and collection of high quality surface meteorology from volunteer observing ships—improve the quality and quantity of climate observation.
- CICOR's Andrey Proshutinsky partnered with NOAA and others to produce the consensus document: *The State of the Arctic*, contributing to state-of-the-science assessments of the climate system.
- Data from observations and analysis of the harmful algal blooms studied by WHOI biologist Don Anderson has been combined with physical oceanographic data by researchers Dennis McGillicuddy and Ruoying He, who produced a computer-modeled simulation of the spread of toxic algae along the Northeast coast. This work has improved the reliability, lead-time, and effectiveness of information used by NOAA managers.

CICOR also continued its strong contribution to WHOI Academic Programs. Ricardo De Pol Holz arrived from Chile to work as a postdoctoral investigator with Lloyd Keigwin (Geology and Geophysics) on paleoceanography and the role of the ocean in global climate change. Joint Program student Carlos Moffat continued working with Robert Beardsley and Breck Owens in Physical Oceanography on the circulation of the coastal ocean of the shelf west of the Antarctic Peninsula, as part of the Southern Ocean Global Ocean Ecosystem Dynamics (SO GLOBEC) program. CICOR supported three Summer Student Fellows and hosted three scholars funded through the NOAA Hollings Scholarship Program.

—Robert Weller, Center Director

Woods Hole Sea Grant Program

www.whoi.edu/seagrant

The Woods Hole Sea Grant Program is part of the National Oceanic and Atmospheric Administration's national Sea Grant network of 32 programs. Collectively, Sea Grant promotes cooperation between government, academia, industry, scientists, and the private sector to foster science-based decisions leading to better understanding, conservation, and use of coastal resources.

More than half of Woods Hole Sea Grant's annual budget of $1 million supports multi-year research projects in environmental technology, estuarine and coastal processes, and fisheries and aquaculture, as well as smaller, "new initiative" grants. Sea Grant research addresses local and regional needs, and many projects have national or even global implications.

In 2006, Sea Grant supported nine projects at WHOI and other institutions that focused on topics ranging from wintertime coastal currents around Cape Cod to studies of submarine groundwater discharge, nutrient dynamics, and plankton community structure. To examine plankton community structure in local waters, principal investigators used local ferries as "ships of opportunity" in a prototype program to collect high-resolution physical, chemical, and biological data in Nantucket Sound.

Jim O'Connell, WHOI

Dune and beach profiling on Nantucket with University of Massachusetts Field Station volunteers.

More than one-third of Woods Hole Sea Grant's budget is dedicated to research translation, outreach, and education. Sea Grant reaches its audience through one-on-one advice, training programs, publications, Websites, workshops, and lectures. Collaboration with the Barnstable County Cooperative Extension Service brings outreach and demonstration projects to local communities in fisheries, aquaculture, and coastal processes. As a partner with the Massachusetts Coastal Zone Management Program and the Waquoit Bay National Estuarine Research Reserve, Woods Hole Sea Grant participates in the Massachusetts Coastal Training Program designed to enable communities to better manage their coastal resources.

Jim O'Connell, WHOI

Boats at Cockle Cove Beach in Orleans.

In ocean science education, Woods Hole Sea Grant has contributed to workshops for K-12 teachers, assisted in the Center for Ocean Sciences Education Excellence – New England (COSEE-NE) programs for integrating research and outreach, and provided innovative publications directed at a general audience, such as Beachcomber's Companion©, an award-winning publication and Website (www.beachcombers companion.net) highlighting common Atlantic marine invertebrates. For over a decade, Woods Hole Sea Grant has partnered with colleagues at New Hampshire Sea Grant to provide marine career information to students. Woods Hole Sea Grant is also participating in a WHOI effort to promote effective research/outreach partnerships.

—Judy McDowell, Program Director

Diane Murphy, Cape Cod Cooperative Extension

An aquaculturist works at his shellfish grant in Wellfleet Bay. Woods Hole Sea Grant assists aquaculturists in managing their shellfish culture with up-to-date information on disease management and optimum growing conditions.

External Relations encompasses three areas of responsibility: a new Office for Applied Oceanography (OAO), to foster applied research supported by non-traditional funding sources; the Development Office, charged with private and foundation fund-raising; and the Board Relations Office, which helps conduct the business of the Board of Trustees and the Corporation.

The goal of OAO is to sustain growth in an era of flat federal funding for basic research by enabling our scientists and engineers to pursue a wider array of applied research opportunities through connections with industry, foreign governments, and U.S. government agencies like the Defense Advanced Research Projects Agency (DARPA). During World War II, the vast majority of work at WHOI was defense-related and highly applied—from developing smoke-screen methods to protect landing parties to anti-submarine warfare techniques. Our goal now is to increase applied work while maintaining critical mass in basic research.

Several new projects demonstrate the potential of this approach:

- WHOI whale expert Peter Tyack, along with physical oceanographer Dave Fratantoni and biologist Mark Baumgartner, are partnering with Rite Solutions, a company that received a Small Business Innovative Research grant from the Department of Defense to develop a system to minimize risks to marine mammals during naval exercises using sonar.
- WHOI geophysicist Jian Lin received a grant from the U.S. Agency for International Development's Office of Foreign Disaster Assistance to study earthquake mechanisms in Algeria and to train researchers to better assess earthquake risks and mitigate disasters in highly populated cities.
- Nautilus Minerals Inc. provided $950,000 to support a research cruise led by WHOI geophysicist Maurice Tivey in July that used WHOI vehicles *Jason* and *ABE* to explore gold-rich seafloor deposits 30 miles off Papua, New Guinea.
- Teledyne Benthos, an underwater technology firm, plans to build and market an expendable bathyphotometer developed and patented by WHOI engineer Paul Fucile to measure bioluminescence in the sea.

Natacha Aguilar, University of La Laguna, taken under permit from the Canary Islands Government

WHOI researchers have partnered with a private firm to develop ways to minimize the impact of sonar on marine mammals.

Photos courtesy of Jian Lin, WHOI

WHOI Senior Scientist Jian Lin (right, light blue shirt) poses with students and colleagues after teaching a course on earthquake research at the University of Algiers. [Left] Jian Lin (middle) and colleagues examine geological evidence of past earthquakes near the Mediterranean coast of Algeria. Lin's work in that nation has been funded by the Office of Foreign Disaster Assistance at the U.S. Agency for International Development.

OAO also helps scientists and engineers protect intellectual property, submit patents, and manage technology transfer and licensing.

In the realm of private fund-raising, our comprehensive campaign neared the 80% mark at the end of 2006, with nearly $160 million committed toward our $200 million goal. Newt Merrill, Chairman of the Board of Trustees Campaign Committee, has provided outstanding leadership, and we are confident that we will complete the campaign in 2008.

Our remaining tasks are to complete endowment of the four Ocean Institutes—which have demonstrated success in fostering interdisciplinary research while strategically leveraging other funding sources—and to fully fund the Access to the Sea Program—which provides opportunities for high-risk seagoing research and engineering with potential for breakthrough discoveries.

In the area of board relations, we are supporting efforts initiated by the Board of Trustees at the end of 2006 to take advantage of a transitional period in leadership by conducting a comprehensive review of the Corporation bylaws and the Board's governance procedures. It is the Board's intention to institute best practices that will meet the highest standards for non-profit accountability.

—Daniel Stuermer,
Vice President, External Relations

The ocean's relevance to human society hit home for the public in 2006, with great public interest in topics like climate change, coastal erosion, natural hazards, and toxic algal blooms. To promote the Institution's efforts, WHOI staff combined traditional outreach methods—judging science fairs, visiting classrooms, mentoring young students, initiating stories, and responding to media and public inquiries—with some new ways of connecting with the public on these issues.

The Morss Colloquia, funded by a generous gift by Elisabeth W. and Henry A. Morss Jr., supports a series of public forums on issues of global importance. In October, Colloquium co-conveners Di Jin (Marine Policy Center) and Jian Lin (Geology & Geophysics) brought international experts (including United Nations hazard management officials) together with regional emergency response personnel to discuss the lessons learned from the devastating 2004 Indian Ocean tsunami. A second colloquium was held in November, when Rebecca Gast (Biology) convened investigators to examine the impact of Hurricane Katrina on human pathogens in Louisiana's Lake Pontchartrain and to discuss their findings in a public forum. Additional forums under the Morss Colloquium banner are planned for 2007.

Another new effort to reach broader audiences was the use of podcasts—technology capitalizing on the popularity of the Apple iPod, which allows individuals to listen to or watch short interviews on-the-go. In 2006, WHOI Communications Department, with funding from the Ocean Institutes, produced eleven podcasts intended to excite the public about topics such as the importance of ocean observatories, vehicles used to explore the seafloor, deep sea corals, photo mosaicing, and hydrothermal vents. In addition to their use on the WHOI Website, the podcasts were also distributed through Apple iTunes. The Institution has subsequently been contacted by other organizations for permission to post these podcasts on their Websites.

Terrence Schaff, WHOI

WHOI oceanographer Dennis McGillicuddy chats with Barbara Mikulski (left), U.S. senator from Maryland and a strong advocate for federal science research, during a demonstration cruise on *Tioga* in August 2006.

One of the Institution's primary outreach Websites, Dive and Discover™, documented a WHOI-led expedition to the Antarctic in 2006 to study the region's ecosystem. The newly redesigned site increased its visitorship from approximately 550,000 to 829,000.

The "Science Made Public" summer lecture series in the Institution's Ocean Science Exhibit Center repeatedly reached capacity, offering talks by scientists on topics such as sea squirts, the Gulf Stream, healthy marine habitats, and the use of untethered robots to explore coral reefs. One talk by researcher Sheean Haley (Biology) featured her work teaching a 5th grade class about phytoplankton. She used math, science, and art to help students understand these important plants and how they survive.

The Ocean Science Exhibit Center staff collaborated with Senior Scientist Don Anderson (Biology) and his lab to create an exciting visual exhibit called Understanding Toxic Algae. The exhibit was highlighted in November during a teacher workshop called "The Life & Times of Toxic Algal Blooms," featuring the research of Kristin Gribble (Biology) and Dennis McGillicuddy (Applied Ocean Physics and Engineering).

In 2006, the number of visitors to the WHOI Website grew to nearly six million external visits. Among the top five visited pages on the site were the red tide and harmful algal blooms pages and the abrupt climate change topics page. Visitorship to the *Oceanus* magazine website rose to more than 370,000 visits, with the most-read stories relating to global warming, pollution, rising sea levels, and life in the Arctic. Never has the societal relevance of the ocean and the importance of communicating WHOI research been more apparent.

—Stephanie Murphy, Manager of Internal Communications and Public Information

Tom Kleindinst, WHOI

Biologists from seven institutions gathered in Woods Hole in November to compare notes on the public health impact of hurricane Katrina and to present their findings to the public.

Tom Kleindinst, WHOI

WHOI seismologist Jian Lin (left) and colleagues brought together leaders from the United Nations, science institutions, and coastal hazards managers to discuss lessons from the Indian Ocean tsunami.

Public Policy and Science Policy

Scientists at WHOI contribute to the discussion of public and science policy issues at the state, national, and international levels. Here is a selection of their activities in 2006.

Donald Anderson

Member, Steering Committee, The Oceanographic Society/UNESCO Ocean Meeting

Carin Ashjian

Co-Vice Chair, Arctic Icebreaker Coordinating Committee, UNOLS

Member, Arctic Research Consortium of the U.S. Board of Directors

Joan Bernhard

Member, Regional Class Research Vessel Technical Advisory Committee

Jim Broda

Member, Antarctic Research Vessel Oversight Committee (ARVOC)

Member, UNOLS Global Class Scientific Mission Requirements Committee

John Collins

Chair, Incorporated Research Institutions for Seismology (IRIS) Instrumentation Committee

Member, ORION Science and Technology Advisory Committee (STAC)

William Curry

Member and Chair, Earth Systems History Steering Committee

Cabell Davis

Chair, GLOBEC NWA Program Executive Committee

Jeff Donnelly

Marine Geoprocesses Councilor of the American Quaternary Association

Scott Gallager

Chair, ORION Sensors Advisory Committee

Chris German

Co-Chair, InterRidge Science Program

Co-Chair, ChEss Project (Census of Marine Life)

Porter Hoagland

Member, National Harmful Algal Bloom Committee

Alternate Member, Stellwagen Bank National Marine Sanctuary Advisory Committee

Susan Humphris

Chair, Integrated Ocean Drilling Program Science Advisory Structure Executive Committee

Di Jin

Member, American Economic Association; Association of Environmental and Resource Economists; and American Agricultural Economics Association

Lloyd Keigwin

Chair, Steering Committee, Rapid Climate Change Programme, NERC-UK

Darlene Ketten

Co-Chair, ASA Policy on Effects of Sound, Acoustical Society of America

Member, Advisory Board, Acoustic Exposure Guidelines NOAA Fisheries

Hauke Kite-Powell

"Economics of Ocean Observing Systems," presentation on Capitol Hill, Oceans Week, Washington, D.C.

Jian Lin

Chair, InterRidge Science Program and Steering Committee

Member, AGU Index Committee

Member, Ocean Science Task Force Team, Year of the Planet Earth Initiative, International Union of Geological Sciences (IUGS) and UNESCO

Member, Advisory Committee for State Key Laboratory of Marine Geology, Tongji University, Shanghai

Jerry McManus

Member, United States Advisory Committee, Scientific Ocean Drilling

Vice-Chair, Subcommittee on Quaternary Stratigraphy, International Commission on Stratigraphy

Scientific Advisory Board, Bjerknes Centre of Excellence, Bergen, Norway

Member, Board of Directors, (Canadian) Polar Climate Stability Network

Lauren Mullineaux

Executive Board member, NSF Ridge 2000 Steering Committee

Walter Paul

Member, NOAA National Data Buoy Center Advisory Panel

Rob Reves-Sohn

NSF RIDGE 2000 Steering Committee, ECOR Specialist Panel on Under-Ice AUV Operations

Ray Schmitt

Member, Executive Committee of the Ocean Studies Board of the National Academy of Sciences

Tim Shank

Member, Steering Committee, CoML, Seamount Ecosystems

Member, Steering Committee, CoML, Chemosynthetic Ecosystems

Member, Steering Committee, InterRidge Hydrothermal Vent Biology Working Group

Member, Steering Committee, Data Management Organization for the RIDGE 2000 Program

United States Deep Submergence Science Committee (UNOLS)

Nobu Shimizu

Chair, Institute for the Study of the Earth's Interior (ISEI) COE-21 International Advisory Committee

Andrew Solow

Chair, Outfall Monitoring Science Advisory Panel

Member, Science Advisory Panel, Massachusetts Executive Office of the Environment

Member, National Research Council Committee on NASA Earth Science Applications

Member, National Research Council Committee on Evaluating the JSOST Research Plan

Heidi Sosik

Member, NOAA's Coastal Ocean Applications and Science Team (COAST)

Member, International Ocean Colour Coordinating Group

Member, SCOR Panel on New Technologies for Observing Marine Life

John Stegeman

Chair, Institute of Medicine, National Academy of Sciences, Committee on Health Effects of Agent Orange in Vietnam Veterans

Ralph Stephen

Chair, Integrated Ocean Drilling Program (IODP), Industry Science Program Planning Group

Chair, Marine Metadata Interoperability Project, Science Advisory Panel

John Trowbridge

Chair, Science and Technical Advisory Committee for the National Science Foundation's ORION project

Peter Tyack

Member, Federal Advisory Committee on Acoustic Impacts on Marine Mammals, US Marine Mammals

Jean Whelan

Member of Department of Energy Gas Hydrate Advisory Committee

Peter Wiebe

Chair, UNOLS

U.S. Representative, Oceanography Committee, International Council for Exploration of the Sea

Co-chair, ICES study group on Management of Integrated Data

Member, Steering Committee, Southern Ocean GLOBEC

Member, Steering Committee, CoML Census of Marine Zooplankton

Member, Advisory Board, CoML Gulf of Maine Area Program

Chair, U.S. GLOBEC Georges Bank Program Executive Committee

Promotions

Applied Ocean Physics and Engineering

Keenan Ball
Research Engineer

Andy Billings
Engineering Assistant III

Dan Duffany
Engineer I

Jim Ryder
Senior Engineering Assistant I

Will Sellers
Senior Engineering Assistant II

Biology

Rebecca Gast
Associate Scientist

Sheean Haley
Research Associate II

Steven Molyneaux
Research Associate III

Michael Moore
Senior Research Specialist

Victoria Starczak
Research Specialist

Geology and Geophysics

Karen Bice
Associate Scientist

Mary Carman
Research Associate III

Jeffrey Donnelly
Associate Scientist

Alan Gagnon
Research Specialist

Jerry McManus
Associate Scientist

Delia Oppo
Senior Scientist

Ellen Roosen
Senior Research Assistant I

Li Xu
Research Specialist

Marine Chemistry and Geochemistry

Meagan Gonneea
Research Associate II

Robert K. Nelson
Research Specialist

Chris Reddy
Associate Scientist

Physical Oceanography

Pavel Berloff
Associate Scientist

Margaret Cook
Senior Research Assistant II

Paul Fraser
Engineering Assistant III

Paula Fratantoni
Research Specialist

Heather Furey
Research Associate III

Glen Gawarkiewicz
Senior Scientist

Craig Marquette
Research Engineer

Jason Smith
Senior Engineering Assistant I

Fiamma Straneo
Associate Scientist

Dan Torres
Research Associate III

Marine Policy Center

Ann Mulligan
Associate Scientist

Appointments

Applied Ocean Physics and Engineering

Tyler Andrade
Engineering Assistant I

Erik Dawe
Engineer I

Joshua Eaton
Engineer I

Brendan Foley
Research Associate III

Andrey Morozov
Research Engineer (casual)

Nicole Nichols
Engineer I

Hugh Popenoe
Engineer II

Christopher Rauch
Engineer II

Keston Smith
Research Associate III

Biology

Lara Gulman
Research Assistant II

Leah Houghton
Research Associate II

Katherine Libera
Research Assistant I

Melissa Patrician
Research Assistant II

Geology and Geophysics

Rebecca Belastock
Senior Research Assistant I

Maya Gomes
Research Assistant I

Brett Longworth
Research Associate I

Summer Praetorius
Research Assistant II

William Thompson
Assistant Scientist

Marine Chemistry and Geochemistry

Wolfgang Bach
Adjunct Scientist

John Farrington
Scientist Emeritus

Carl Lamborg
Assistant Scientist

Lauren Ledwell
Senior Administrative Assistant II

Syed Wajih Ahmad Naqvi
Adjunct Scientist

Laura Robinson
Assistant Scientist

Jean Whelan
Oceanographer Emeritus

Marine Policy Center

Guillermo Herrera
Adjunct Scientist

Awards and Recognition

Applied Ocean Physics and Engineering

Steve Elgar was selected for an "Excellence in Refereeing" award by JGR Oceans.

Janet Fredericks received the 2006 Linda Morse-Porteous Award.

Ruoying He received the Mary Sears Collaboration Award.

Rocky Geyer was awarded the 2007 Mary Sears Chair.

Jim Thomson won an outstanding student paper award for his Ocean Sciences presentation, "Infragravity Energy Loss in the Surfzone via Nonlinear Interactions," with coauthors Steve Elgar, Britt Raubenheimer, and Tom Herbers.

Biology

Don Anderson received the Yasumoto Lifetime Achievement Award, International Society of the Study of Harmful Algae.

Don Anderson's Laboratory received the U.S. Food and Drug Administration, Group Recognition Award.

Hal Caswell was appointed Fellow of the Ocean Life Institute.

Cabell Davis was appointed Director of the Ocean Life Institute.

Rebecca Gast was appointed Fellow of the Coastal Ocean Institute.

Mark Hahn was awarded the Walter A. and Hope Noyes Smith Chair.

Darlene Ketten was awarded a National Institutes of Health and National Research Council Senior Fellowship.

Michael Neubert was co-winner Presidential Award, American Society of Naturalists, given for the best paper published during 2005.

Geology and Geophysics

Mea Cook received an Outstanding Student Paper Award at the American Geophysical Union meeting.

Stan Hart was appointed Doctor Honoris Causa from the Institut de Physique du Globe de Paris, France.

Matt Jackson received an Outstanding Student Paper Award at the American Geophysical Union meeting.

Steve Manganini received the Al Vine Senior Technical Award.

Nobu Shimizu was named a Fellow of the American Association for the Advancement of Science.

Ralph Stephen was named a Fellow of the Acoustical Society of America.

Clare Williams received the Geophysics Division Award for student research by the Geological Society of America.

Marine Chemistry and Geochemistry

Erin Bertrand received a 2006 EPA STAR Graduate Research Fellowship.

Paul Craddock received a Schlanger ODP Fellowship for academic year September 2006–2007.

Scott Doney was awarded the W. Van Alan Clark, Sr. Chair.

Physical Oceanography

Pavel Berloff received a Royal Society USA Research Fellowship that aims to promote scientific ties between the United Kingdom and the United States.

Tom Farrar, Stephanie Waterman, Jim Thompson, and Melanie Fewings received Outstanding Student Paper Awards at the Ocean Sciences meeting.

John Lund was awarded the Ryan C. Schrawder Award.

Breck Owens was the recipient of the W. Van Alan Clark, Jr. Chair.

Fiamma Straneo received a three month Bjerknes Fellowship from the Bjerknes Centre for Climate Research in Norway where she worked dense water formation processes in the Nordic Seas.

Tom Kleindinst, WHOI

Trustees and Corporation Members

Tom Kleindinst, WHOI

Honorary Trustee Jim Clark (left) and Chairman of the Board of Trustees Jim Moltz (center) present retiring WHOI President and Director Bob Gagosian with an illustration of the Quissett Campus during the fall meeting of the Board of Trustees and Corporation. Gagosian joined WHOI in 1972 as a marine geochemist and served as Director from 1994 to 2006.

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President Emeritus

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Senior Scientist, Department Chair, and The Robert W. Morse Chair

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John J. Akens
Senior Engineer

Ben G. Allen
Senior Engineer

Laurence A. Anderson
Research Associate III

Alfredo Lopez Aretxabaleta
Postdoc Investigator

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Engineer II

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Research Engineer

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Engineer I

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Alessandro Bocconcelli
Research Specialist

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Research Specialist

Robert S. Brown
Senior Engineer

Richard Camilli
Assistant Scientist

Megan M. Carroll
Engineer II

Rodney M. Catanach
Engineer II

Alan D. Chave
Senior Scientist

Dezhang Chu
Research Specialist

John A. Colosi
Associate Scientist (LOA)

Erik Dawe
Engineer I

James A. Doutt
Research Associate III

Timothy F. Duda
Associate Scientist

Alan R. Duester
Engineer II

Daniel J. Duffany
Engineer I

Joshua A. Eaton
Engineer I

Calvert F. Eck
Research Engineer

Robert L. Elder
Research Engineer

Stephen L. Elgar
Senior Scientist

Norman Farr
Senior Engineer

Gonzalo R. Feijoo
Assistant Scientist

Brendan Foley
Research Associate III

Kenneth G. Foote
Senior Scientist

Ned C. Forrester
Senior Engineer

Philip E. Forte
Engineer II

Janet J. Fredericks
Information Systems Associate III

Lee E. Freitag
Senior Engineer

Robert Fuhrmann
Engineer II

Stephen R. Gegg
Information Systems Associate II

W. Rockwell Geyer
Senior Scientist

Robert G. Goldsborough
Research Engineer

Daniel Gomez-Ibanez
Engineer II

Mark A. Grosenbaugh
Senior Scientist

Matthew D. Grund
Research Engineer

Terence R. Hammar
Research Associate III

Ruoying He
Assistant Scientist (LOA)

Matthew C. Heintz
Research Engineer

Edward L. Hobart
Research Engineer

Jonathan C. Howland
Senior Engineer

Kelan Huang
Information Systems Associate III

Thomas P. Hurst
Engineer II

Frederic Jaffre
Engineer II

Houshuo Jiang
Assistant Scientist

Mark P. Johnson
Senior Engineer

Peter A. Koski
Engineer II

Valery K. Kosnyrev
Research Associate III

Andone C. Lavery
Assistant Scientist

James R. Ledwell
Senior Scientist, The Edward W. & Betty J. Scripps Chair

Steven Lerner
Senior Engineer

Stephen P. Liberatore
Senior Engineer

Ying-Tsong Lin
Postdoc Investigator

Glenn E. McDonald
Research Engineer

Dennis J. McGillicuddy
Associate Scientist

Andrey K. Morozov
Research Engineer

Arthur E. Newhall
Information Systems Specialist

Nicole Nichols
Engineer I

Catherine A. Offinger
Research Associate III

Griffith Outlaw
Engineer II

Tom Kleindinst, WHOI

Research Engineer Bob Elder tests refurbished pigtail wiring before reinstalling electrical components during a rebuild of the remotely operated vehicle *Jason*. Designed and built by WHOI's Deep Submergence Laboratory, *Jason* allows scientists to have access to the seafloor without leaving the deck of a ship.

Tom Kleindinst, WHOI

Technicians at the Sample Preparation Lab of the National Ocean Sciences Accelerator Mass Spectrometry (NOSAMS) Facility process natural carbon samples to produce graphite for AMS analysis. NOSAMS provides analyses of ^{14}C at natural abundance levels to the research community.

James W. Partan
Engineer II
Walter H.G. Paul
Senior Engineer
Kenneth R. Peal
Senior Engineer
Donald B. Peters
Senior Engineer
Robert A. Petitt, Jr.
Research Engineer
Clifford T. Pontbriand
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James C. Preisig
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Michael J. Purcell
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Harvey J. Walsh
Research Associate II

Jayne Doucette, WHOI

Machinist Dick Edwards (left) and *Atlantis* Assistant Engineer Paul Vinitsky move the ship's shore power cable.

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Postdoc Investigator
Peter H. Wiebe
Senior Scientist
Rachel Wisniewski
Postdoc Investigator
Cornelia Wuchter
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Research Specialist

Brad Rosenheim
Postdoc Investigator

Hans Schouten
Senior Scientist

Brian Schroeder
Research Associate II

Alison M. Shaw
Assistant Scientist

Nobumichi Shimizu
Senior Scientist

Kenneth W. Sims
Associate Scientist

Deborah K. Smith
Senior Scientist

S. Adam Soule
Assistant Scientist

Ralph A. Stephen
Senior Scientist

Stephen A. Swift
Research Specialist

William G. Thompson
Assistant Scientist

Maurice A. Tivey
Associate Scientist

Brian E. Tucholke
Senior Scientist

Karl F. Von Reden
Senior Research Specialist

Frank B. Wooding
Research Specialist

Li Xu
Research Specialist

Wenlu Zhu
Associate Scientist

Emeritus & Adjuncts - G&G

William A. Berggren
Scientist Emeritus

Tom Kleindinst, WHOI

(Left to right) George Hampson, John Farrington, Chris Reddy, Emily Peacock, and Bruce Tripp met in May at Winsor Cove in Falmouth to review the site of a 1974 oil spill. The original researchers have been studing the effects of contamination at the site for three decades. Reddy and Peacock are now studying the chemistry and composition of oil and its natural degradation processes using tools and techniques unavailable 30 years ago.

Carl O. Bowin
Scientist Emeritus

Johnson R. Cann
Adjunct Scientist

Patience Cowie
Adjunct Scientist

Wayne Crawford
Adjunct Scientist

Javier Escartin
Adjunct Scientist

Graham S. Giese
Oceanographer Emeritus

John M. Hayes
Scientist Emeritus

Kai-Uwe Hinrichs
Adjunct Scientist

W. Steven Holbrook
Adjunct Scientist

Susumu Honjo
Scientist Emeritus

Barbara E. John
Adjunct Scientist

Peter B. Kelemen
Adjunct Scientist

Charles Langmuir
Adjunct Scientist

George P. Lohmann
Scientist Emeritus

Larry A. Mayer
Adjunct Scientist

Peter S. Meyer
Adjunct Scientist

Maureen Raymo
Adjunct Scientist

David A. Ross
Scientist Emeritus

Robert J. Schneider
Oceanographer Emeritus

Roger C. Searle
Adjunct Scientist

Enid K. Sichel
Adjunct Scientist

Jonathan Snow
Adjunct Scientist

Uri S. Ten Brink
Adjunct Scientist

Elazar Uchupi
Scientist Emeritus

Richard P. Von Herzen
Scientist Emeritus

Marine Chemistry & Geochemistry Department

Ken O. Buesseler
Senior Scientist and Department Chair

Lary A. Ball
Research Specialist

Karen Casciotti
Assistant Scientist

Cynthia L. Chandler
Information Systems Associate II

Matthew A. Charette
Associate Scientist

Marco J.L. Coolen
Assistant Scientist

Joshua M. Curtice
Research Associate II

Scott C. Doney
Senior Scientist

Timothy I. Eglinton
Senior Scientist, The Stanley W. Watson Chair

Alan P. Fleer
Research Associate III (LOA)

Helen F. Fredricks
Research Associate II

David M. Glover
Research Specialist

Meagan J.E. Gonneea
Research Associate II

Nancy Grumet Prouty
Postdoc Investigator

Dierdre Alison Hall
Assistant Scientist

Konrad A. Hughen
Associate Scientist

Jeomshik Hwang
Postdoc Investigator

William J. Jenkins
Senior Scientist

Carl G. Johnson
Research Specialist

Elizabeth B. Kujawinski Behn
Assistant Scientist

Mark D. Kurz
Senior Scientist

Carl Lamborg
Assistant Scientist

Ivan D. Lima
Information Systems Associate III

Scientific & Technical Staff

Krista L. Longnecker
Postdoc Investigator
Dempsey E. Lott, III
Senior Research Specialist
William R. Martin
Associate Scientist
Scott J. Mccue
Information Systems Associate II
Matthew R. McIlvin
Research Associate II
James W. Moffett
Senior Scientist, The Mary Sears Chair
Daniel B. Montluçon
Research Associate III
Robert K. Nelson
Research Specialist
Bernhard Peucker-Ehrenbrink
Associate Scientist
Steven M. Pike
Research Associate II
Giora Proskurowski
Postdoc Investigator
Christopher M. Reddy
Associate Scientist
Daniel J. Repeta
Senior Scientist
Laura Robinson
Assistant Scientist
Olivier Rouxel
Assistant Scientist
Makoto Saito
Assistant Scientist
David L. Schneider
Research Associate III
Jeffrey S. Seewald
Associate Scientist
Edward R. Sholkovitz
Senior Scientist
Sean P. Sylva
Research Associate II
Margaret K. Tivey
Associate Scientist, J. Seward Johnson Chair as Education Coordinator
Benjamin Van Mooy
Assistant Scientist
Gregory T. Ventura
Postdoc Investigator
Wei Wang
Research Associate III

Emeritus, Adjuncts & Visiting Appointments– MCG

Wolfgang Bach
Adjunct Scientist
Michael P. Bacon
Scientist Emeritus
David F. Baker
Visiting Investigator
Minhan Dai
Adjunct Scientist
Michael D. Degrandpre
Adjunct Scientist
Werner Deuser
Scientist Emeritus
Geoffrey Eglinton
Adjunct Scientist
John W. Farrington
Scientist Emeritus
Roger François
Adjunct Scientist
Markus Kienast
Adjunct Scientist
Wajih Naqvi
Adjunct Scientist
Fred L. Sayles
Scientist Emeritus
Geoffrey Thompson
Scientist Emeritus
Thomas W. Trull
Adjunct Scientist
Jean Whelan
Oceanographer Emeritus
Oliver C. Zafiriou
Scientist Emeritus

Physical Oceanography Department

Robert A. Weller
Senior Scientist, Department Chair, and CICOR Program Director
Geoffrey P. Allsup
Research Engineer
Frank Bahr
Research Specialist
Pavel S. Berloff
Associate Scientist
Amy S. Bower
Senior Scientist
Annalisa Bracco
Assistant Scientist (LOA)
Keith F. Bradley
Research Associate III
Kenneth H. Brink
Senior Scientist
Benjamin H. Carr
Research Associate I
Michael J. Caruso
Information Systems Specialist (LOA)
Claudia Cenedese
Associate Scientist
James H. Churchill
Research Specialist
Ruth G. Curry
Research Specialist
John T. Farrar
Postdoc Investigator
David M. Fratantoni
Associate Scientist
Paula S. Fratantoni
Research Specialist
Paul D. Fucile
Senior Engineer
Heather H. Furey
Research Associate III
Nancy R. Galbraith
Information Systems Associate III
Glen G. Gawarkiewicz
Senior Scientist
Jason C. Goodman
Assistant Scientist
Melinda M. Hall
Research Specialist
Karl R. Helfrich
Senior Scientist, J. Seward Johnson Chair as Education Coordinator
David S. Hosom
Principal Engineer
Rui Xin Huang
Senior Scientist, W. Van Alan Clark, Jr. Chair
Steven R. Jayne
Associate Scientist
Xiangze Jin
Research Associate II
Terrence M. Joyce
Senior Scientist, Director of Ocean & Climate Change Institute, The Paul M. Fye Chair
Richard A. Krishfield
Research Specialist
Young-Oh Kwon
Assistant Scientist
Steven J. Lentz
Senior Scientist
James A. Lerczak
Assistant Scientist (LOA)
Richard Limeburner
Senior Research Specialist
Christopher A. Linder
Research Associate III

Tom Kleindinst, WHOI

Joint Program student Kristin Smith flame-seals organic carbon samples in combustion tubes in the Sample Preparation Lab of the National Ocean Sciences Accelerator Mass Spectrometry Facility.

Photos by Tom Kleindinst, WHOI

At the annual WHOI Employee Recognition celebration in July 2006, employees received awards from their peers for outstanding performance, representation of the WHOI spirit, and major contributions to the WHOI community. From left, John Lund won the Ryan C. Schrawder Award, given to an employee who has proved to be a valuable asset to scientific projects both at sea and ashore. Janet Fredericks won the Linda Morse-Porteous Award, recognizing an outstanding female technician. Rick Trask won the Vetlesen Award "for true selfless dedication of a major portion of him/herself to the entire WHOI community over a long period of time". The Human Resources Office won the Penzance Award, given to a group, for what one nominator called "exceptional work toward the betterment of the WHOI family. "

John M. Lund
Research Associate II

Alison M. Macdonald
Research Specialist

Craig D. Marquette
Research Engineer

Michael S. McCartney
Senior Scientist

Ellyn T. Montgomery
Research Specialist (LOA)

W. Brechner Owens
Senior Scientist

Gwyneth E. Packard
Research Associate II

Joseph Pedlosky
Senior Scientist

Robert S. Pickart
Senior Scientist

Albert J. Plueddemann
Associate Scientist

Kurt L. Polzin
Associate Scientist

Lawrence J. Pratt
Senior Scientist

James F. Price
Senior Scientist, Associate Dean

Andrey Proshutinsky
Senior Scientist

Luc Rainville
Postdoc Investigator

Ulrike Riemenschneider
Postdoc Investigator

Raymond W. Schmitt
Senior Scientist

Andrey Shcherbina
Postdoc Investigator

Michael A. Spall
Senior Scientist

Fiammetta Straneo
Associate Scientist

H. Marshall Swartz, Jr.
Research Associate III

Leif N. Thomas
Assistant Scientist

Mary-Louise Timmermans
Assistant Scientist

John M. Toole
Senior Scientist, The Columbus O'Donnell Iselin Chair for Excellence in Oceanography

Daniel J. Torres
Research Associate III

Richard P. Trask
Research Specialist

George H. Tupper
Research Associate II

James R. Valdes
Senior Engineer

Deborah E. West-Mack
Research Associate II

John A. Whitehead
Senior Scientist

Peter Winsor
Assistant Scientist

Jiayan Yang
Associate Scientist

Lisan Yu
Associate Scientist

Emeritus, Adjuncts & Visiting Appointments – PO

Robert C. Beardsley
Scientist Emeritus

Changsheng Chen
Adjunct Scientist

Jerome P. Dean
Oceanographer Emeritus

Claude Frankignoul
Adjunct Scientist

Joseph H. Lacasce, Jr.
Adjunct Scientist

Ray-Qing Lin
Adjunct Scientist

Robert C. Millard, Jr.
Oceanographer Emeritus

Richard E. Payne
Oceanographer Emeritus

Hugh Powell
Visiting Investigator

Philip L. Richardson
Scientist Emeritus

William J. Schmitz, Jr.
Scientist Emeritus

Bruce A. Warren
Scientist Emeritus

Marine Policy Center

Andrew R. Solow
Senior Scientist, Center Director

Andrew Beet
Information Systems Associate II

Hillel Gordin
Senior Research Fellow

Porter Hoagland III
Research Specialist

Di Jin
Associate Scientist

Scientific & Technical Staff

Hauke L. Kite-Powell
Research Specialist
Ann E. Mulligan
Associate Scientist

Emeritus & Adjuncts - Marine Policy

Jesse H. Ausubel
Adjunct Scientist
Arthur G. Gaines, Jr.
Oceanographer Emeritus
Guillermo Herrera
Adjunct Scientist
John H. Steele
Scientist Emeritus

Operational Science Services/*Alvin*

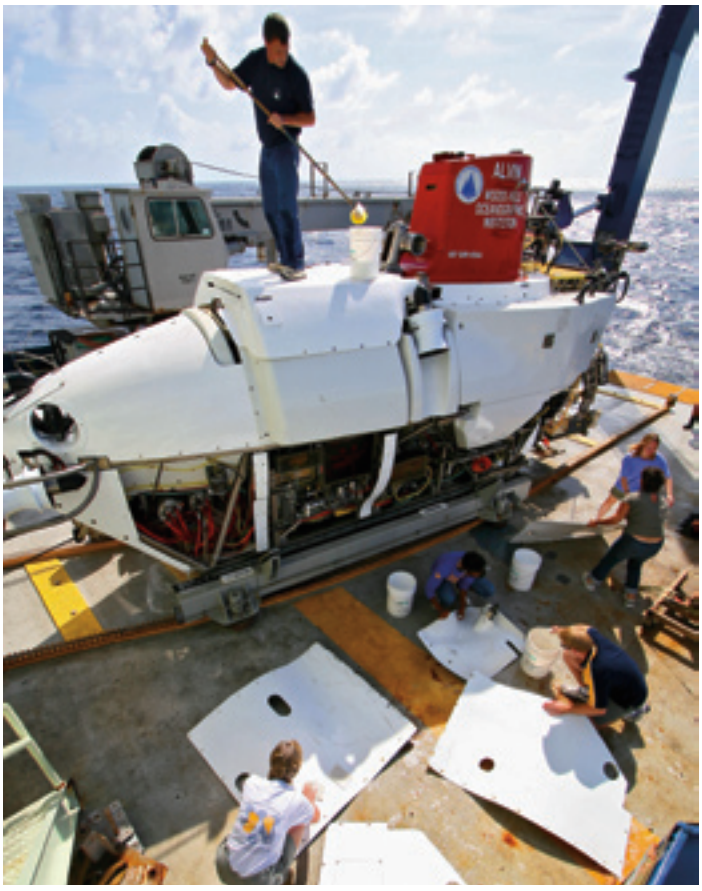
Gavin W. Eppard
Deep Submergence Vehicle Pilot
David C. Fisichella
Research Associate III
J. Patrick Hickey
Deep Submergence Vehicle Expedition Leader
William N. Lange
Research Specialist
Mark O. Spear
Deep Submergence Vehicle Pilot
W. Bruce Strickrott
Deep Submergence Vehicle Chief Pilot

Communications, Graphics & Media Relations

Danielle M. Fino
Information Systems Associate III
Dina A. Pandya
Information Systems Associate II

Computer & Information Services (CIS)

Julie M. Allen
Information Systems Specialist
Michael J. Bishop
Information Systems Associate II
Fay McIntyre Cali
Information Systems Associate II
Eric Cunningham
Information Systems Associate III
Jeffrey A. Dusenberry
Information Systems Associate III
Roger A. Goldsmith
Senior Information Systems Specialist



Lance Wills, WHOI

Working on the deck of the research vessel *Atlantis*, pilots and technicians from the *Alvin* Group scrub down the submersible between dives on the East Pacific Rise in December 2006.

Helen E. Gordon
Information Systems Associate II
Deborah K. Shafer
Information Systems Associate II
Robert Katcher
Information Systems Associate II
John Krauspe
Information Systems Associate III
Andrew R. Maffei
Senior Information Systems Specialist
Randal Manchester
Information Systems Associate III
Jonathan E. Murray
Information Systems Associate II
Elizabeth Owens
Information Systems Associate II
Warren J. Sass
Information Systems Specialist
Adam Shepherd
Information Systems Associate II
Angela York
Information Systems Associate II

Emeritus, Adjuncts & Visiting Appointments - CIS

Kevin R. Fall
Institution Visiting Scholar

MBL/WHOI Library

Rosemary G. Davis
Information Systems Associate II-Library Archives
Ann W. Devenish
Information Systems Associate II-Library Computer
Colleen D. Hurter
Information Systems Associate III-Systems Library
Lisa M. Raymond
Information Systems Associate II-Library Manager
Margaret A. Rioux
Information Systems Associate III-Systems Library

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Director of Board Relations

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Executive Assistant to Vice President Marine Facilities and Operations
Leman Hadway
Security Officer
Deborah F. Hamel
Administrator, Office of Vice President for Finance and Administration and Chief Financial Officer
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Director Government Relations (LOA)
Molly M. Lumping
Executive Assistant to Acting President and Director
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Special Assistant for Strategic Planning
Karen P. Rauss
Ombuds
Peggy A. Rose
Executive Assistant to Acting Director of Research
Terrence R. Schaff
Director of Government Relations
Timothy R. Stark
Chief Investment Officer & Manager Treasury Operations
Cindy L. Tobey
Executive Assistant to Vice President for Finance and Administration and Chief Financial Officer

Applied Ocean Physics & Engineering

John M. Reilly
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Shirley J. Barkley
Administrative Associate I
Marlene B. Bender
Administrative Associate I
Dolores H. Chausse
Administrative Associate I
Susan M. Grieve
Administrative Associate I
Sheila K. Hurst
Administrative Associate I
Gretchen McManamin
Administrative Associate I
Karen Schwamb
Administrative Associate I

Biology

Janis M. Umschlag
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Tracey I. Crago
Sea Grant Communicator
Sheri D. Derosa
Administrative Associate I
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Center Administrator II
Mary Jane Tucci
Administrative Associate II

Geology & Geophysics

Maryanne F. Ferreira
Department Administrator
Andrew T. Daly
Administrative Associate I
Susan K. Handwork
Center Administrator II

Tom Kleindinst, WHOI

It took a small parade of scientists, engineers, students, and staff to hoist the full extent of the plastic tubing that will line the steel barrels of the new WHOI long corer—designed and built to extract deeper samples of deep-sea sediments.

Marine Chemistry & Geochemistry

Susan A. Casso
Department Administrator
Sheila A. Clifford
Administrative Associate I
Donna M. Mortimer
Administrative Associate I
Mary Zawoysky
Administrative Associate I

Physical Oceanography

Maryanne H. Wray
Department Administrator
Penny C. Foster
Administrative Associate I
Mary Ann Lucas
Administrative Associate II
Ruthanne Molyneaux
Administrative Associate I
Hazel Salazar
Administrative Associate I
Deborah A. Taylor
Administrative Associate I
Patricia A. White
Administrative Associate I

Marine Policy Center

Ellen M. Gately
Center Administrator II

Operational Science Services/*Alvin*

Richard S. Chandler
Submersible Ops Coordinator
K.I. Faith Hampshire
Center Administrator I
Terrence M. Rioux
Diving Safety Officer

Marine Operations

Jonathan C. Alberts
Marine Operations Coordinator
Michael P. Brennan
Marine Personnel Coordinator
Elizabeth A. Caporelli
Marine Operations Coordinator
John R. Dyke
Marine Resource Coordinator
Larry D. Flick
Marine Operations Administrator
Michael A. Gagne
Marine Electronics Shop Supv
Kerry E. Heywood
Administrative Associate I
Theophilus Moniz III
Marine Engineer
Albert F. Suchy
Ship Operations Manager
Ernest C. Wegman
Port Engineer

Academic Programs Office

Valerie J. Caron
Administrative Associate I
Christine S. Charette
Executive Assistant to Vice President for Academic Programs and Dean
Janet A. Fields
Administrative Associate I
Marsha Gomes
Associate Registrar
Katherine A.C. Madin
Curriculum Coordinator
Andrea L. Thorrold
COSEE Program Coordinator
Julia G. Westwater
Registrar/Graduate/Undergraduate Program Administrator

Communications, Graphics and Media Relations

Frederic R. Heide
Director of Communications
Michael J. Carlowicz
Science Writer/Editor
Shelley M. Dawicki
Media Relations Director
Jayne H. Doucette
Manager of Graphic Services
Laurence S. Lippsett
Managing Editor
Sandra E. Murphy
Administrative Associate I
Stephanie A. Murphy
Manager Internal Communications
Amy E. Nevala
Science Writer/Editor
Kathleen Patterson
Exhibit Center Manager

Computer & Information Services (CIS)

Arthur S. Gaylord
CIS Director
Christine L. Hammond
Assistant Director of CIS
Hartley Hoskins
Network Group Leader
Eileen R. Wicklund
Center Administrator I

Controller's Office

David Stephens
Controller
Deborah A. Aimone
Senior Accountant II
Linda L. Church
Accountant III
Cheryl C. Daniels
Accountant III
Dana Fernandez
Manager, Budget/General Accounting
Penelope Hilliard
Property Administrator
Patricia A. Lake
Accounts Receivable Manager
Laura A. Murphy
Assistant Controller
Dena Richard
Payroll Manager

Development

Peggy A. Daly
Department Administrator
Dina M. Dicarlo
Administrative Associate I
David G. Gallo
Director of Special Communications Projects
Wendy T. Henley
Development Officer
Alison Tilghman Kline
Development Officer
Donna L. Lamonde
Administrative Associate I
Peter J. Mollo
Director, Regional Advancement
Jane B. Neumann
Director of Principal Gifts
James Rakowski
Director of Major Gifts
Lesley M. Reilly
Director of Planned Giving and Annual Fund
Audrey M. Rogerson
Director of Foundation Relations
Marcella R. Simon
Administrative Associate II

Distribution Services

Stephen P. Senior
Distribution Manager
Debra A. Snurkowski
Assistant Distribution Manager

Environmental Health & Safety Office

Ronald H. Reif
Environmental/Health & Safety Manager
Kathleen R. Driscoll
Safety & Health Officer

Scientific & Technical Staff

Facilities Group

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Facilities Manager

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Assistant Facilities Manager

Paul S. Avery
Facilities Engineer

Richard E. Galat
Facilities Engineer

William E. McKeon
Director of Shore Operations & Technology Transfer

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Manager of Grants & Contracts

Susan P. Ferreira
Senior Grants Administrator

Bonnie J. Griffin
Grants Administrator II

Steven M. Murphy
Grants Administrator II

Human Resources

Kathleen P. LaBernz
Human Resources Manager

Marion Andrews
Foreign National Advisor

Emily M. Beaton
Human Resources Generalist

Tina A. Calisto-Betti
Employment Services Specialist

Susan M. Cina
Benefits Manager

Donna R. Hyman
Benefits Specialist

Pamela J. Reine
Employment Services Specialist

Emily H. Schorer
Compensation/Employee Services Manager and Assistant Human Resources Manager

Linda S. Snow
Benefits Specialist

June E. Sullivan
Retirement Benefits Administrator

Management Information Systems (MIS)

John M. Lombardi
MIS Manager

Nancy E. Barry
Business Analyst

Hilary C. Davis
NT Administrator/Developer

Karen E. Flaherty
Business Analyst

Kenneth R. Friend, II
NT Administrator/Developer

Joseph C. Messina III
NT Developer/DBA

Jayne Doucette, WHOI

Staff and students relax and enjoy a lunchtime cookout on Paul's Mall on a beautiful August day.

MBL/WHOI Library

Catherine N. Norton
Library Director

Office of Applied Oceanography

Wallace C. Stark
Contracts & Licensing Specialist

Procurement

Dennis J. Fox
Procurement Manager

Veta M. Green
Procurement Representative II

Beth A. Rizzo
Procurement Representative II

Sandra A. Sherlock
Procurement Systems Coordinator

Mary Ann White
Procurement Representative II/ Travel Coordinator

John A. Wood, Jr.
Marine Procurement Representative

Departmental Assistants

Applied Ocean Physics & Engineering

Rachel M. Allen
Laboratory Assistant I

Tyler M. Andrade
Engineering Assistant I

Trevor Andrew Ball
Laboratory Assistant I

Andrew S. Billings
Engineering Assistant III

Alberto Collasius. Jr.
Engineering Assistant III

Thomas Crook
Senior Engineering Assistant II

Jack Dellibovi
Engineering Assistant III

Andrew R. Desnoyers
Engineering Assistant I

Betsey G.P. Doherty
Research Assistant III

James M. Dunn
Engineering Assistant III

Stephen M. Faluotico
Senior Engineering Assistant I

Alan T. Gardner
Engineering Assistant III

Andrew P. Girard
Engineering Assistant III

Levi Gorrell
Research Assistant II

Matthew R. Gould
Engineering Assistant III

Craig E. Johnson
Engineering Assistant III

John N. Kemp
Senior Engineering Assistant II

Olga I. Kosnyreva
Research Assistant III

Amy Kukulya
Engineering Assistant III

Christopher Lumping
Engineering Assistant II

Casey R. Machado
Laboratory Assistant II

Marguerite K. McElroy
Senior Research Assistant II

Neil M. Mcphee
Senior Engineering Assistant II

Stephen D. Murphy
Senior Engineering Assistant I

Kristopher W. Newhall
Engineering Assistant III

Gregory Packard
Senior Engineering Assistant I

Marjorie J. Parmenter
Research Assistant II

James R. Ryder
Senior Engineering Assistant I

Eric R. Savery
Engineering Assistant I

David S. Schroeder
Engineering Assistant II

William J. Sellers
Senior Engineering Assistant II

John D. Sisson
Senior Research Assistant II

Gary N. Stanbrough
Engineering Assistant III

Max O. von der Heydt
Engineering Assistant II

Karlen A. Wannop
Senior Engineering Assistant I

Biology

Molly D. Allison
Research Assistant III

Kimberly A. Amaral
Research Assistant III

Andrea Bogomolni
Research Assistant II

Scott R. Cramer
Senior Research Assistant I

Anthony V. Dispezio
Information Systems Assistant I

Lara K. Gulmann
Research Assistant II

Amanda J. Hansen
Research Assistant III

George F. Heimerdinger
Research Assistant III

Brittan L. Hlista
Research Assistant II

David M. Kulis
Senior Research Assistant II

Katherine Libera
Research Assistant I

Linda A.R. McCauley
Research Assistant III

Emily Miller
Research Assistant I

Dawn M. Moran
Research Assistant III

Kerry A. Norton
Research Assistant II

Melissa Patrician
Research Assistant II

Pamela A. Polloni
Research Assistant III

Daniel W. Smith
Research Assistant III

Nancy Y. Trowbridge
Research Assistant II

Sara K. Trowbridge
Laboratory Assistant I

Geology & Geophysics

Rebecca A. Belastock
Senior Research Assistant I

Victor H. Bender
Senior Engineering Assistant I

Chanda J. Bertrand
Research Assistant III

L. Susan Brown-Leger
Senior Research Assistant I

Joshua Burton
Research Assistant II

David L. Dubois
Senior Research Assistant I

Anne S. Edwards
Research Assistant II

Jesse M. Galdston
Information Systems Assistant I

Maya L. Gomes
Research Assistant I

Robert E. Handy
Engineering Assistant III

Marleen H. Jeglinski
Research Assistant III

Mary C. Lardie
Research Assistant II

Patricia Long
Senior Engineering Assistant I

Julianne Palmieri
Research Assistant III

Summer Praetorius
Research Assistant II

Ellen Roosen
Senior Research Assistant I

Luping Zou
Research Assistant III

Marine Chemistry & Geochemistry

Tracy L. Atwood
Research Assistant III

Katie Barott
Research Assistant II

Scot P. Birdwhistell
Senior Research Assistant I

Kevin Cahill
Research Assistant III

Tyler J. Goepfert
Research Assistant III

Joanne E. Goudreau
Senior Research Assistant II

Paul Henderson
Research Assistant III

Byron Pedler
Research Assistant II

Adam P. Rago
Research Assistant I

Gillian C. Smith
Laboratory Assistant II

Margaret M. Sulanowska
Senior Research Assistant II

Physical Oceanography

Paul R. Bouchard
Senior Engineering Assistant I

Kenton M. Bradshaw
Engineering Assistant III (LOA)

Margaret F. Cook
Senior Research Assistant II

Lawrence P. Costello
Engineering Assistant III

Jane A. Dunworth-Baker
Senior Information Systems Assistant I

Paul M. Fraser
Engineering Assistant III

Brian J. Guest
Senior Engineering Assistant I

Brian P. Hogue
Engineering Assistant II

Mark Lambton
Engineering Assistant II

Jeffrey B. Lord
Senior Engineering Assistant II

Thomas A. Maddigan
Engineering Assistant II

Theresa K. Mckee
Senior Information Systems Assistant II

William M. Ostrom
Senior Engineering Assistant I

Devin M. Ruddick
Engineering Assistant I

Jason C. Smith
Senior Engineering Assistant I

Robert D. Tavares
Engineering Assistant III

Laishona Vitelli, WHOI

Summer Student Fellows (left to right) Michael Squibb, Jeff Kaeli, Carly Buchwald, Jeff Marlow, and Ben Tully ham it up during a cruise aboard R/V *Tioga* to learn sampling and navigational techniques.

W. David Wellwood
Research Assistant III

Sean P. Whelan
Engineering Assistant II

Scott E. Worrilow
Senior Engineering Assistant II

Sarah L. Zimmermann
Research Assistant III

Marine Policy

Mary E. Schumacher
Research Assistant III

Operational Science Services/*Alvin*

Lukas Bradley
Engineering Assistant I

James P. Brennan, II
Engineering Assistant II

C. Hovey Clifford
Senior Engineering Assistant I

Oya Erez
Engineering Assistant III

Christopher M. Griner
Engineering Assistant II

Sean R. Kelley
Engineering Assistant II

Robert S. Laird
Engineering Assistant III

Thomas M. Lanagan
Engineering Assistant I

Michael K. McCarthy
Engineering Assistant II

Patrick L. Rowe
Engineering Assistant III

Amy M. Simoneau
Engineering Assistant III

David Sims
Engineering Assistant III

Andrew C. Waterbury
Engineering Assistant II

Anton L. Zafereo
Engineering Assistant II

Marine Operations

Matthew J. Yorston
Engineering Assistant I

Computer Information Services

Nicholas A. Brigham
Information Systems Assistant III

Bruce R. Cole
Senior Information Systems Assistant II

Edward F. Dow, Jr.
Senior Information Systems Assistant I

Timothy J. Gage
Information Systems Assistant III

David A. Gaylord
Information Systems Assistant I

Jason H. Johnson
Information Systems Assistant III

Dennis E. Ladino
Information Systems Assistant III

James MacConnell
Information Systems Assistant II

Alicia M. Rose
Information Systems Assistant II

Development Office

Ronald L. Timm
Information Systems Assistant III

MBL/WHOI Library

Ellen Levy
Information Systems Assistant III

Support Staff

Patrick Rowe, WHOI

Oceanus marine crew members Diego Mello (foreground) and Ken Rand work on deck during an April cruise to the Gulf Stream.

Administrative Assistants

Board Relations

Judith A. Thrasher
Senior Administrative Assistant II

Applied Ocean Physics & Engineering

Linda Ann Cannata
Senior Administrative Assistant II
Cheryl Nedd
Senior Administrative Assistant II
Dawn Quattlebaum
Senior Administrative Assistant II
Judith A. Rizoli White
Senior Administrative Assistant II
Linda M. Skiba
Administrative Assistant I
Susan K. Stasiowski
Senior Administrative Assistant II
Ann E. Stone
Senior Administrative Assistant II

Biology

Ellen M. Bailey
Senior Administrative Assistant II
Marjorie K. Clancy
Senior Administrative Assistant I
Bonnie A. Cormier
Senior Administrative Assistant II
Erin Dupuis
Senior Administrative Assistant I
Ethel F. Lefave
Staff Assistant III (LOA)
Olimpia L. McCall
Senior Administrative Assistant I
Susan F. Tomeo
Senior Administrative Assistant I

Geology & Geophysics

Katherine W. Brown
Senior Administrative Assistant I
Maria C. Cuellar-Palcic
Senior Administrative Assistant I
Pamela V. Foster
Senior Administrative Assistant II
C. Frances Halbrooks
Senior Administrative Assistant I
Janet M. Johnson
Senior Administrative Assistant I
Diane B. Pencola
Senior Administrative Assistant II
Lynette A. Stellrecht
Senior Administrative Assistant II
Elaine A. Tulka
Senior Administrative Assistant II

Marine Chemistry and Geochemistry

Lauren Ledwell
Senior Administrative Assistant II

Physical Oceanography

Eleanor M. Botelho
Administrative Assistant II
Shirley C. Cabral McDonald
Senior Administrative Assistant II
Maureen E. Carragher
Senior Administrative Assistant II
Anne Doucette
Senior Administrative Assistant I
Jeanne A. Fleming
Senior Administrative Assistant I

Marine Operations

Barbara L. Costello
Senior Administrative Assistant II
Jennifer Griffin
Senior Administrative Assistant I
Marjorie M. Holland
Senior Administrative Assistant II

Academic Programs

Laishona M. Vitelli
Senior Administrative Assistant II

Communications, Graphics and Media Relations

Ann M. Dunnigan
Exhibit Center Assistant
Kittie E. Elliott
Administrative Assistant II
Jane A. Hopewood
Senior Administrative Assistant I
Robin Lynn Hurst
Senior Administrative Assistant I
Stephen Roberts
Exhibit Center Assistant
Joanne E. Tromp
Senior Administrative Assistant II
Melanie Winsor
Exhibit Center Assistant
Edmund Zmuda
Exhibit Center Assistant

Controllers Office

Julie L. Fawkes
Accountant II
Stacey MacDonald
Senior Administrative Assistant I
Wendy L. Sandner
Senior Payroll Practitioner
Maeve Thurston
Property Officer

Development

Annamarie H. Behring
Senior Administrative Assistant II
Diane Mirlicourtois
Senior Administrative Assistant II
Mildred Teal
Senior Administrative Assistant II

Environmental Health & Safety Office

Laura Tutino
Senior Administrative Assistant II

Facilities Group

M. Joan Watring
Senior Administrative Assistant II

Grant & Contract Services

Sandra L. Sherlock
Senior Administrative Assistant I

Human Resources

Michelle A. Slattery
Senior Administrative Assistant II

Procurement

Pierrette M. Ahearn
Procurement Representative I
Suzanne M. Bolton
Senior Administrative Assistant II
Barbara G. Callahan
Senior Stockroom Services Representative
Paula Cloninger
Procurement Representative I
Glenn R. Enos
Procurement Representative I
Joanna F. Ireland
Procurement Representative I
Samuel J. Lomba
Stockroom Supervisor
Richard C. Lovering
Facilities Procurement Representative
Michelle Ann Oliva
Procurement Representative I
Diane Rieger
Administrative Assistant I

Facilities & Services

Computer & Information Services

Linda Benway
Telecommunications Coordinator

Isabel M. Penman
Senior Telecommunications Operator/Dispatcher/Receptionist

Clara Y. Pires
Telecommunications Operator/ Dispatcher/Receptionist

Brenda M. Rowell
Telecommunications Operator/ Dispatcher/Receptionist

Distribution and Shipping

Walter D. Albaugh III
Distribution Assistant

Christopher Alferes
Distribution Assistant

John Brinckerhoff
International & Domestic Shipping Coordinator

Linda M. Cataldo
Distribution Assistant

John A. Crobar
Distribution Supervisor-Warehouse

Eric Drange
Distribution Assistant

Dana G. Hackett
Distribution Assistant

Patrick J. Harrington
Distribution Supervisor-Mail

Troy Kelley
Vehicle Mechanic

Jay R. Murphy
Distribution Supervisor-Services

George Quattlebaum
Distribution Assistant

Lewis J. Saffron
Senior Distribution Assistant - Building Services (LOA)

Facilities Group

Steven W. Allsopp
Assistant Plant Mechanic

Christopher L. Arruda
Shop Services Assistant

Michael K. Ayer
Senior Machinist

Micheal J. Blakesley
Security Guard (LOA)

Thomas A. Bouche
Senior Electrician

James Brown
Machinist

John J. Cartner
Senior Security Guard (LOA)

Gary S. Caslen
Security Guard

Clayton W. Chauvin
Welder

Thomas N. Colon
Senior Carpenter

William B. Cruwys
Security Guard

Rowland N. Cummings
Carpenter

Peter P. Delorey
Senior Carpenter

Richard Edwards, Jr.
Mechanic

Geoffrey K. Ekblaw
Lead Welder

John Fetterman
Lead Machinist

Scott D. Formisani
Security Guard

Stephen G. Gagnon
Electrical Shop Supervisor

Damon E .Gayer
Senior Carpenter

David Seth Hamblin
Senior Machinist

Douglas Handy
Mechanic

Craig T. Henderson
Carpenter Shop Supervisor

Robert W. Hendricks
Senior Security Guard

Paul Keith
Welder

Fred W. Keller
Plant Supervisor

Bernard L. Kellogg
Senior Electrician

Casey King
Shop Services Assistant

Remmert H.B. Kokmeyer
Senior Machinist

Bruce A. Lancaster
Senior Carpenter

Donald C. Leblanc
Senior Electrician

Robert A. McCabe
Mechanical Shop Supervisor

Carlos A. Medeiros
Assistant Mechanical Shop Supervisor

Samuel H. Moore
Shop Services Assistant

Richard Moquin
Lead Mechanic

Jose S. Mota
Senior Security Guard

John R. Murphy, Jr.
Senior Plant Mechanic

Richard F. Murphy
Security Guard

Charles A. Olson
Senior Plant Mechanic

Vasco Pires
Senior Security Guard

Christopher M. Rheaume
Shop Services Assistant

Jayne Doucette, WHOI

Dan Stuermer, Vice President, External Relations, works the grill at the annual WHOI summer family picnic.

Doyal L. Richerson
Security Guard

John Richerson
Security Guard

Robert C. Sanker
Painter

Timothy M. Smith
Machinist

William F. Sparks
Night Services Supervisor

Robert G. Spenle
Painter

Mark L. St. Pierre
Experimental Machinist

Charles S. Sumner
Security Guard

Kevin D. Thompson
Assistant Plant Supervisor

Matthew P. Winalski
Senior Plant Mechanic

Graphic Services

Matthew G. Barton
Audio-Visual Technician

James J. Canavan
Graphic Designer

John E. Cook
Graphic Designer

David L. Gray
Senior Photographer

Mark V. Hickey
Reproduction Supervisor

Katherine Spencer Joyce
Graphic Designer

Thomas N. Kleindinst
Senior Photographer

E. Paul Oberlander
Illustrator

Jeannine M. Pires
Graphic Designer

Timothy M. Silva
Multi-Media Technician

Tom Kleindinst, WHOI

Biologists Mike Neubert and Carin Ashjian celebrate ten years at WHOI during the Employee Recognition festivities.

Support Staff

Tom Kleindinst, WHOI

The Jingle Bell Joggers run through the WHOI Rigging Shop during their annual holiday jog around the Institution.

Housekeepers

Mary Andrews
Housekeeper II (Procurement)

Lynne M. Ellsworth
Housekeeper II (Academic Programs)

Part-Time Helpers

Hannah Martha Allen
Peter Michael Bratton
Sophie R. Buchanan
Zachary C. Carman
Maxwell S. Cohen
Francis David Elder
Sarah Fackler
Neil T. Forrester
Brandy Lee Joyce
Olivia Kurz
Justin A. Ladner
Ben Mann
John T. Moakley
Emily E. Nelson
Derek A. Newhall
Stephanie Pommrehn
Grace Rago
Daniel Roberts
Shaughnessy F. Rogers
Eric C. Schmitt
Stephen Schmitt
Gregory A. Toltin
Molly von der Heydt

Marine Crew

Licensed Officers

William S. Bank
Mate, R/V Tioga

Richard C. Bean
Third Mate, R/V Atlantis

Lawrence T. Bearse
Master, R/V Oceanus

Derek P. Bergeron
Second Mate, R/V Knorr *(LOA)*

Paul F. Carty
Third Mate, R/V Oceanus

Gary B. Chiljean
Master, R/V Atlantis

Carl H. Christensen
Second Mate, R/V Oceanus

Arthur D. Colburn III
Master, R/V Atlantis

Margaret M. Crane
Chief Mate, R/V Atlantis

Craig D. Dickson
Second Mate, R/V Atlantis

Deidra L. Emrich
Chief Mate, R/V Knorr

Jacob M. Flemming
Third Mate, R/V Atlantis

Tawnya R. Floyd
Corpsman, R/V Knorr

Monica K. Hill
Second Assistant Engineer, R/V Atlantis

Kenneth E. Houtler
Master, R/V Tioga

Peter T. Leonard, Jr.
Second Mate, R/V Atlantis

Jeffrey Little
Chief Engineer, R/V Atlantis

Timothy P. Logan
Communication Officer, R/V Atlantis

Piotr Marczak
Second Assistant Engineer, R/V Knorr *(LOA)*

Todd Drew Meeker
Second Assistant Engineer, R/V Atlantis

Anthony Diego Mello
Chief Mate, R/V Oceanus

Michael Merrill
Chief Engineer, R/V Oceanus

Patrick S. Mone
First Assistant Engineer, R/V Knorr

Christopher D. Morgan
Chief Engineer, R/V Atlantis

Richard F. Morris
Chief Engineer, R/V Oceanus

Michael Mulkern
Third Mate, R/V Knorr

John W. Porter
Communication Officer, R/V Atlantis

James Alfred Schubert
First Assistant Engineer, R/V Atlantis

Adam B. Seamans
Chief Mate, R/V Knorr *(LOA)*

Kent D. Sheasley
Master, R/V Knorr

George P. Silva
Master, R/V Atlantis

Anthony Skinner
Communication Officer, R/V Knorr *(LOA)*

Michael L. Spruill
Third Assistant Engineer, R/V Atlantis

Keith L. Strand
Third Assistant Engineer, R/V Knorr

Linwood J. Swett, Jr.
Communication Officer, R/V Knorr

Wayne A. Sylvia
First Assistant Engineer, R/V Knorr

Michael Thorwick
Chief Engineer, R/V Oceanus *(LOA)*

Allison Tunick
Third Mate, R/V Knorr

Paul A. Vinitsky
Third Assistant Engineer, R/V Atlantis

Stephen A. Walsh
Chief Engineer, R/V Knorr

Nicolas M. Williams
Second Mate, R/V Oceanus

Support Personnel

Russell P. Adams, Jr.
Marine Electrician

Lorna R. Allison
Boatswain (LOA)

Jose Andrade
Ordinary Seaman

Robert V. Arthur
Ordinary Seaman

Wayne A. Bailey
Boatswain

Linda J. Bartholomee
Mess Attendant

Steven F. Berry
Able Body Seaman

Nelson L. Botsford
Junior Engineer

Kevin D. Butler
Able Body Seaman

Pimenio C. Cacho
Boatswain

Todd A. Carter
Oiler

Kyle L. Covert
Oiler (LOA)

Albert P. Da Lomba
Steward (LOA)

Michael R. Doherty
Oiler

Francis J. Doohan
Ordinary Seaman

William J. Dunn, Jr.
Able Body Seaman

Daniel R. Eident
Ordinary Seaman

William Paul Eident
Ordinary Seaman

Leo Fitz
Able Body Seaman

Michael Flaherty
Oiler

Michael P.J. Gaylord
Oiler

Andrew Gillen
Oiler

Tom Kleindinst, WHOI

Scientist Emeritus Sandy Williams (left) talks to participants at the Ocean Science and Technology Conference held in May. About 150 individuals from across New England gathered for talks by engineers and for demonstrations of cutting-edge marine technology.

Lauren Mullineaux, WHOI

Alvin Expedition Leader Pat Hickey (blue sweatshirt) celebrates his 600th *Alvin* dive with (l to r) Sigrid Katz, University of Vienna; Carly Strasser, MIT/WHOI Joint Program student; Andreas Thurnherr, Lamont-Doherty Earth Observatory; and Andy Billings, WHOI. Hickey has made more dives than any pilot in the sub's four-decade history.

Jerry M. Graham
Able Body Seaman

Jacob H. Greenberg
Ordinary Seaman

Edward R. Grossman
Marine Electrician

Cecile S. Hall
Able Body Seaman

Ian Gerald Hanley
Crew Member, R/V Tioga

Patrick J. Hennessy
Boatswain

Jennifer Hickey
Able Body Seaman (LOA)

Patrick Hogan
Ordinary Seaman

Alan J. Hopkins
Able Body Seaman (LOA)

Lawrence F. Jackson
Cook

Karen I. Johnson
Cook

Richard Jones
Ordinary Seaman

Connor A. Kadlec
Junior Engineer

Thidiane Kanoute
Marine Electrician

Tom Keller
Oiler

Orville B. Kenerson
Able Body Seaman

Peter J. Liarikos
Boatswain

Henry L. Long II
Ordinary Seaman

Eduwiges R. Martinez
Able Body Seaman

James M. Mcgill
Boatswain

Mirth N. Miller
Steward (LOA)

Christopher Moody
Steward

Matthew Munroe
Wiper

Hamilton Mussenden
Ordinary Seaman

Patrick L. Neumann
Ordinary Seaman

Mark P. Nossiter
Cook

Edward S. Popowitz
Able Body Seaman

Kenneth W. Rand
Able Body Seaman

Anthony Reveira
Mess Attendant (LOA)

Ricardo Rios
Steward

Paul Ruh, Jr.
Oiler

Bankole N. Salami
Ordinary Seaman

Steven R. Sanderson
Ordinary Seaman

Christopher Schlatter
Mess Attendant

Michael Stewart
Ordinary Seaman

James P. Taylor
Ordinary Seaman

Giles K. Threadgold
Ordinary Seaman

Brendon M. Todd
Mess Attendant

Philip M. Treadwell
Oiler (LOA)

Susan Van Apeldoorn
Able Body Seaman

I. Sacha Wichers
Marine Electrician

Omunn J. Williams
Ordinary Seaman

Lance E. Wills
Ordinary Seaman

Carl O. Wood
Steward

David J. Ziskin
Electronics Tech

2006 Retirees

Courtenay Barber, III
Leonard A. Boutin
Albert M. Bradley
Gail Caldeira
Vicky Cullen
Stacey Brudno Drange
Annda W. Flynn
Dudley B. Foster
Nelson M. Frew
Edward F. Graham, Jr.
Billy Joe Guest
Nelson Hogg
James D. Irish
Raymond G. Kimball
Gail McPhee
George A. Meier
John B. Waterbury

Tom Kleindinst, WHOI

A well-wisher offers a goodbye wave as *Atlantis* departs Woods Hole in April for *Alvin* and *Sentry* sea trials.

2006 Degree Recipients

Massachusetts Institute of Technology/Woods Hole Oceanographic Institution
Joint Program in Oceanography/Applied Ocean Science and Engineering

Doctor of Philosophy

Mea Young Sohn Cook
Field: Paleoceanography
Dissertation: The Paleoceanography of the Bering Sea During the Last Glacial Cycle

Donald P. Eickstedt
Field: Oceanographic Engineering
Dissertation: Adaptive Sampling in Autonomous Marine Sensor Networks

Kristin Gribble
Field: Biological Oceanography
Dissertation: The Ecology, Life History, and Phylogeny of the Marine Thecate Heterotrophic Dinoflagellates Protoperidinium *and Diplopsalidaceae* (Dinophyceae)

Qiao Hu
Field: Oceanographic Engineering
Dissertation: Application of Statistical Learning Theory to Plankton Image Analysis

Jason Hyatt
Field: Physical Oceanography
Dissertation: Wind, Sea Ice, Inertial Oscillations and Upper Ocean Mixing in Marguerite Bay, Western Antarctic Peninsula: Observations and Modeling

Shinichiro Kida
Field: Physical Oceanography
Dissertation: Overflows and Upper Ocean Interaction: A Mechanism for the Azores Current

Tin Klanjscek
Field: Biological Oceanography
Dissertation: Dynamic Energy Budgets and Bioaccumulation: A Model for Marine Mammals and Marine Mammal Populations

Gareth Lawson
Field: Biological Oceanography
Dissertation: Distribution, Patchiness, and Behavior of Antarctic Zooplankton, Assessed Using Multi-Frequency Acoustic Techniques

Joint Program Degree Statistics

	2006	1968-'06
WHOI Ph.D.	0	4
Joint Program Ph.D.	18	497
Joint Program Sc.D.	0	32
Joint Program Eng.	0	57
Joint Program S.M.	10	160
Joint Program M.Eng.	0	4
Total degrees granted	28	754

Weichang Li
Field: Electrical and Oceanographic Engineering
Dissertation: Estimation and Tracking of Rapidly Time-Varying Broadband Acoustic Communication Channels

David C. Lund
Field: Paleoceanography
Dissertation: Gulf Stream Temperature, Salinity and Transport During the Last Millennium

Matthew C. Makou
Field: Paleoceanography
Dissertation: Geochemical Tools and Paleoclimate Clues: Multi-Molecular and Isotopic Investigations of Tropical Marine Sediments and Alpine Ice

Eric Montie
Field: Biological Oceanography
Dissertation: Approaches for Assessing the Presence and Impact of Thyroid Hormone Disrupting Chemicals in Delphinid Cetaceans

Sheri L. Simmons
Field: Biological Oceanography
Dissertation: Geobiology of Marine Magnetotactic Bacteria

Jared Jeffrey Standish
Field: Marine Geology
Dissertation: The Influence of Ridge Geometry on Lithospheric Accretion at Ultraslow-Spreading Rates Between 9°-25° E on the Southwest Indian Ridge: Basalt Compositional Sensitivity to Local Tectonomagmatic Processes

James Thomson
Field: Physical Oceanography
Dissertation: Infragravity Waves Over Topography: Generation, Dissipation, and Reflection

Helen Kirsty White
Field: Marine Geochemistry
Dissertation: Isotopic Constraints on the Sources and Associations of Organic Compounds in Marine Sediments

Joshua D. Wilson
Field: Oceanographic Engineering
Dissertation: Quantifying Hurricane Wind Speed with Undersea Sound

Rachel J. Wisniewski
Field: Chemical Oceanography
Dissertation: Relating the Biogeochemistries of Zinc, Cobalt, and Phosphorous to Activities in the Sea

Master of Science

Allison May Berg
Field: Oceanographic Engineering
Dissertation: The Feasibility of SODAR Wind Profile Measurements from an Oceanographic Buoy

Colleen Marie Bowers
Field: Oceanographic Engineering
Dissertation: Seafloor Ripples Created by Waves from Hurricane Ivan on the West Florida Shelf

Peter A. Canovas
Field: Chemical Oceanography
Dissertation: The Redox and Iron-Sulfide Geochemistry of Salt Pond and the Thermodynamic Constraints on Native Magnetotactic Bacteria

Benjamin Aaron Jones
Field: Oceanographic Engineering
Dissertation: Acoustic Scattering of Broadband Echolocation Signals from Prey of Blainville's Beaked Whales: Modeling and Analysis

Matthew Robert Mazloff
Field: Physical Oceanography
Dissertation: Production of a Southern Ocean State Estimate

Mark A. Rapo
Field: Oceanographic Engineering
Dissertation: Estimating Reynolds Stress Using an ADCP in an Energetic Ocean State

Tatiana A. Rykova
Field: Physical Oceanography
Dissertation: Evolution of the Irminger Current Anticyclones in the Labrador Sea from Hydrographic Data

Kjetil Vaage
Field: Physical Oceanography
Dissertation: Winter Mixed-Layer Development in the Central Irminger Sea: The Effect of Strong, Intermittent Wind Events

Ariane Verdy
Field: Physical Oceanography
Dissertation: Influence of Circulation on Temperature and Zooplankton Variability in the Southern Ocean

Matthew Nicholas Watts
Field: Oceanographic Engineering
Dissertation: Emulating the Fast-Start Swimming Performance of the Chain Pickerel (Esox niger) *Using a Mechanical Fish Design*

Students, Fellows, & Visitors

MIT/WHOI Joint Program 2006/2007 Fall Term

Diane K. Adams
University of California, Santa Barbara

Alex A. Apotsos
Duke University

Claudia A. Augusto Martins
College of Science of the University of Lisbon (Portugal)

Alexander Bahr
University of the Saarland (Germany), Vordiplom
Aachen Technical University (Germany), Diplom

Erin Banning
Syracuse University
University of South Florida

Jennifer Benoit
Oglethorpe University

Jessica Benthuysen
University of Washington

Erin M. Bertrand
Bates College

Maya P. Bhatia
Queens University of Canada
University of Alberta (Canada), MS

Ballard J. Blair
Cornell University
Johns Hopkins University, MS

Jonathan N. Blythe
University of California, Santa Barbara

Jennifer C. Braff
New York University

Michelle R. Bringer
University of Chicago

Michael Brosnahan
Dartmouth College

Kate L. Buckman
Smith College

Andrea Burke
Williams College

Regina P. Campbell-Malone
State University of New York, Buffalo

Phoebe D. Chappell
Amherst College

Walter W. Cho
Harvard University

Kevin L. Cockrell
University of California, San Diego

Alysia D. Cox
Arizona State University

Paul R. Craddock
University of Southampton (UK)
University of Leeds (UK)

Holly J. Dail
University of Washington
University of California, San Diego, MS

Rebecca W. Dell
Harvard University

Brian J. deMartin
Georgia Institute of Technology, BS, MS

Kathryn P. D'Epagnier
United States Naval Academy

Stacy L. DeRuiter
St. Olaf College

Gregory C. Dietzen
United States Naval Academy

John H. Doherty
United States Naval Academy

Nicholas J. Drenzek
Rensselaer Polytechnic Institute

Alexis J. Dumortier
Universite des Sciences de Reims, Diplome
Ecole Nationale Superieure d'Ingenieurs du Mans, Diplome
Georgia Institute of Technology, MS

Paula Echeverri
Massachusetts Institute of Technology, BS, MS

Lynne J. Elkins
Smith College
University of New Mexico, MS

James R. Elsenbeck
Georgia Institute of Technology

Patricia A. Engel
University of Notre Dame

Helen C. Esch
University of North Carolina, BS, MS

Dennis Evangelista
Massachusetts Institute of Technology, BS, M.Eng.
Naval Postgraduate School, MS

John T. Farrar
University of Oklahoma, BA, BS

David E. Farrell
United States Naval Academy

Vicente Fernandez
California Institute of Technology

Melanie R. Fewings
Western Washington University
Cornell University, MS

Caitlin H. Frame
Harvard University

Abigail J. Fusaro
University of Rhode Island

Gregory P. Gerbi
Amherst College
California Institute of Technology, MS

Fern T. Gibbons
University of Chicago

Nathalie F. Goodkin
Harvard College

Patricia M. Gregg
University of Missouri, Rolla

Joanna Gyory
Cornell University
State University of New York, Stony Brook, MS

Laura R. Hmelo
Carleton College

Sharon S. Hoffmann
Columbia University

Michael Holcomb
University of Idaho

Rachel M. Horwitz
Williams College

Hristina G. Hristova
Polytechnic School of France
Polytechnic School of Montreal (Canada), MS

Annette M. Hynes
University of Nebraska, Lincoln

Legena A. Jack
Howard University

Matthew G. Jackson
Yale University

Michael V. Jakuba
Massachusetts Institute of Technology

Harold F. Jensen III
Pacific Lutheran University
Columbia University

Seth G. John
Carleton College

Alexander Kalmikov
Hebrew University (Israel)
Tel-Aviv University (Israel), MS

Yohai Kaspi
Hebrew University (Israel)
Weizman Institute of Science (Israel), MS

Hyun Joe Kim
Seoul National University (South Korea), BA, MA

Petra Klepac
University of Zagreb (Croatia)

Jessie Kneeland
California Institute of Technology

Michael J. Krawczynski
Brown University, BS, BA

Whitney B. Krey
Texas A&M University

Clayton G. Kunz
Stanford University, BS, MS

Peter Lamb
Harvey Mudd College

Daniel P. Lane
Cornell University

Cara E. LaPointe
United States Naval Academy
Oxford University (UK), M Phil
Massachusetts Institute of Technology, SM

Joy M. Lapseritis
Simons Rock College
Smith College, BA, MS

Karin L. Lemkau
Wesleyan University

Naomi Levine
Princeton University

Stephen C. Licht
Yale University

Andrea Llenos
Brown University, BS, BA

Evgeny A. Logvinov
Moscow Institute of Physics & Technology

Wenyu Luo
Ocean University of Qingdao (PRC)
Institute of Acoustics, CAS, MS

Matthew R. Mazloff
University of Vermont, BS, MS
MIT/WHOI Joint Program, SM

Andrew M. McDonnell
University of California, Los Angeles

Kelton W. McMahon
Bates College

Luc M. Mehl
Carleton College
University of California, Santa Barbara, MS

Evelyn M. Mervine
Dartmouth College

Anna P. Michel
Massachusetts Institute of Technology

Christian A. Miller
University of Saskatchewan (Canada), BS, BA, MS

Christine M. Mingione
University of Notre Dame

Carlos F. Moffat
University of Concepcion (Chile), BS, Prof, MS

Andrew D. Mosedale
Harvard University
Cooper Union, BE
Rutgers University, MS

Christopher A. Murphy
Franklin W. Olin College of Engineering

Rajesh R. Nadakuditi
Lafayette College

Maxim A. Nikurashin
Moscow Institute of Physics & Technology (Russia), BS, MS

Abigail E. Noble
Haverford College

Richard H. Oates, Jr.
Georgia Institute of Technology

Elizabeth Orchard
Cornell University

Sarah E. Pacocha Preheim
Carnegie Mellon University

Joseph C. Papp
Worcester Polytechnic Institute

Maria A. Parra-Orlandoni
United States Naval Academy

Vera L. Pavel
California Institute of Technology

Beatriz Pena-Molino
University of Las Palmas de Gran Canaria (Spain)

Colleen M. Petrik
University of Miami Florida

Desiree L. Plata
Union College

Students, Fellows, & Visitors

Camilo Ponton
Santa Fe Community College
Florida International University, BS, MS

Travis L. Poole
Luther College

Kelly C. Rakow
Tufts University
University of South Alabama, MS

Mark A. Rapo
Bowdoin College
MIT/WHOI Joint Program, SM

Eoghan Reeves
University of Wales, Bangor (UK)
University of Leeds (UK), MS

Virginia Rich
University of California, Berkeley

Kevin P. Richberg
California Institute of Technology

Adam R. Rivers
New College of University of Florida

Daniel Rogers
University of Connecticut, BS, MS

Emily C. Roland
Colorado School of Mines

Tatiana A. Rykova
Moscow Institute of Physics & Technology (Russia)
MIT/WHOI Joint Program, SM

Casey P. Saenger
Bates College

James Saenz
Boston University

Cara M. Santelli
University of Wisconsin

Jared Severson
Colorado School of Mines

Vikrant P. Shah
University of Texas, Austin

Ari D. Shapiro
Boston College

Alexey Shmelev
Moscow State University

Joseph Sikora
Rensselaer Polytechnic Institute

Katherine Silverthorne
Southwestern University

Kristin Smith
Bates College

Rachel Stanley
Massachusetts Institute of Technology

Carly A. Strasser
University of San Diego

Peter J. Sugimura
University of California, Berkeley

Ratsirin Supcharoen
Bowdoin College

David A. Sutherland
University of North Carolina, Wilmington

Lorraine M. Thomas
Harvey Mudd College

Anne W. Thompson
Middlebury College

Kjetil Vaage
University of New Brunswick (Canada)
MIT/WHOI Joint Program, SM

Emily M. Van Ark
Northwestern University

Ariane Verdy
Polytechnic School of Montreal (Canada)
MIT/WHOI Joint Program, SM

Jacob R. Waldbauer
Dartmouth College

Matthew R. Walter
University of Illinois

Benjamin D. Walther
University of Texas, Austin, BA, BS

Jinbo Wang
Lanzhou University
Peking University, MS

Jessica M. Warren
University of Cambridge (UK), BA, MS

Stephanie N. Waterman
Queen's University (Canada)
California Institute of Technology, MS

Christopher Waters
University of New Hampshire

Kristen E. Whalen
University of North Carolina, Wilmington

Clare M. Williams
University of Leeds (UK)

Christie L. Wood
Massachusetts Institute of Technology

Jonathan D. Woodruff
Tufts University
MIT/WHOI Joint Program, SM

Cimarron Wortham
Reed College

Louie L. Wurch
Humboldt State University

Min Xu
University of Science and Technology of China, BS, MS

Jinshan Xu
Ocean University of Qingdao (PRC), BS, MS

Shaoyu Yuan
Ocean University of Qingdao (PRC), BS, MS

Yu Zhang
Ocean University of Qingdao (PRC)

Postdoctoral Scholars/Fellows

Andrew D. Ashton
Duke University
United States Geological Survey Postdoctoral Scholar

Heather M. Benway
Oregon State University
Comer-Steele Postdoctoral Scholar

Sébastien L. Bertrand
University of Liège
Belgian American Educational Foundation Postdoctoral Fellow/European Union Marie Curie Postdoctoral Fellow

Sebastien Bigorre
Florida State University
CLIMODE Postdoctoral Fellow

John Breier
The University of Texas at Austin
National Science Foundation Ridge 2000 Postdoctoral Fellow

Anders E. Carlson
Oregon State University
Coastal Ocean Institute Postdoctoral Scholar

Clara S. Chan
University of California, Berkeley
National Science Foundation Ridge 2000 Postdoctoral Fellow

Jason D. Chaytor
Oregon State University
United States Geological Survey Postdoctoral Scholar

Ricardo De Pol-Holz
Universidad de Concepción
Cooperative Institute for Climate and Ocean Research Postdoctoral Scholar

Julie C.A. Deshayes
Université Pierre et Marie Curie
NOAA/UCAR Climate and Global Change Postdoctoral Scholar

Stéphanie Desprat
Bordeaux I University
Comer Postdoctoral Scholar

Angela F. Dickens
University of Washington
National Ocean Sciences Accelerator Mass Spectrometry Facility Postdoctoral Scholar

Henrieta Dulaiova
Florida State University
Postdoctoral Scholar

Theodore S. Durland
University of Hawaii
Ocean and Climate Change Institute Postdoctoral Scholar

Travis S. Elsdon
University of Adelaide
Ocean Life Institute Postdoctoral Scholar

Helena Lofstedt Filipsson
Göteborg University
Fulbright/Swedish Research Council Postdoctoral Fellow

Rinat I. Gabitov
Rensselaer Polytechnic Institute
Rensselaer Polytechnic Institute-Ocean and Climate Change Institute Postdoctoral Fellow

Irene Garcia Berdeal
University of Washington
Physical Oceanography-Biological Oceanography Interdisciplinary Research Postdoctoral Fellow

Jared V. Goldstone
MIT/WHOI Joint Program
NIH-NRSA Postdoctoral Fellow

Breea Govenar
The Pennsylvania State University
Deep Ocean Exploration Institute Postdoctoral Fellow

Sachin Goyal
University of Michigan
Postdoctoral Scholar

Nancy S. Grumet Prouty
Stanford University
Cooperative Institute for Climate and Ocean Research Postdoctoral Scholar

Jeremiah D. Hackett
University of Iowa
Cooperative Institute for Climate and Ocean Research Postdoctoral Scholar

Chad R. Hammerschmidt
University of Connecticut
Postdoctoral Scholar

Maria C. Hansson
Lund University
Postdoctoral Scholar

Benjamin A. Hodges
Scripps Institution of Oceanography
Postdoctoral Scholar

Jens Holtvoeth
University of Bremen
DFG Postdoctoral Fellow

Michael Hugler
Universität Freiburg, Germany
Postdoctoral Scholar

Peter J. Huybers
Massachusetts Institute of Technology
NOAA/UCAR Climate and Global Change Postdoctoral Scholar

Patrick Ryan Jackson
University of Illinois at Urbana-Champaign
Postdoctoral Scholar

Stéphanie Jenouvrier
Université Pierre et Marie Curie
UNESCO-L'Oreal Postdoctoral Fellow

Eva Maria E. Jonsson
Stockholm University
Swedish Research Council Postdoctoral Fellow

Phoebe J. Lam
University of California, Berkeley
Postdoctoral Scholar

Samuel R. Laney
Oregon State University
Ocean Life Institute Postdoctoral Scholar

Weichang Li
MIT-WHOI Joint Program
Office of Naval Research Ocean Acoustics Postdoctoral Fellow

Ying-Tsong Lin
National Taiwan University
Postdoctoral Scholar

Cornelis Johannes Lissenberg
University of Ottawa
Netherlands Organization for Scientific Research Postdoctoral Fellow

Rowena B. Lohman
California Institute of Technology
Postdoctoral Scholar

Candace O. Major
Columbia University
Comer Postdoctoral Scholar

Joanne Muller
James Cook University
Sir Keith Murdoch/Comer Postdoctoral Fellow

Maria Del Mar Nieto Cid
University of Vigo
Spanish Ministry of Education and Sciences Fulbright Postdoctoral Fellow

Anna Nikolopoulos
Stockholm University
Swedish Research Council Postdoctoral Fellow

Alison N. Olcott
University of Southern California
Postdoctoral Scholar

Gwenn Peron-Pinvidic
Louis Pasteur University of Strasbourg
Université Louis Pasteur-Total Postdoctoral Fellow

Speranta-Maria Popescu
University Cl. Bernard-Lyon 1
Fulbright Postdoctoral Fellow

Pascale F. Poussart
Harvard University
National Ocean Sciences Accelerator Mass Spectrometry Facility Postdoctoral Scholar

Giora Kahan Proskurowski
University of Washington
Deep Ocean Exploration Institute Postdoctoral Fellow

Luc Rainville
Scripps Institution of Oceanography, University of California, San Diego, Postdoctoral Scholar

David K. Ralston
University of California, Berkeley
Postdoctoral Scholar

Nathalie B. Reyns
North Carolina State University
Ocean Life Institute Postdoctoral Scholar

Justin B. Ries
Johns Hopkins University
Ocean and Climate Change Institute Postdoctoral Scholar

Karyn L. Rogers
Washington University in St. Louis
Deep Ocean Exploration Institute Postdoctoral Scholar

Andrew L. Rose
The University of New South Wales
Australian Research Council Postdoctoral Fellow

Enno Schefuss
University of Utrecht
DFG Emmy-Noether Postdoctoral Fellow

Malcolm E. Scully
The College of William and Mary, School of Marine Science
WHOI - Beacon Institute for Rivers and Estuaries Postdoctoral Scholar

Amanda Searby
University of Montpellier II
Postdoctoral Scholar

Timothy M. Shanahan
University of Arizona
NOAA/UCAR Climate and Global Change Postdoctoral Scholar

Andrey Y. Shcherbina
Scripps Institution of Oceanography, University of California, San Diego, Postdoctoral Scholar

Alena Strojsova
University of South Bohemia
Fulbright Postdoctoral Fellow

Ann M. Tarrant
University of Hawaii, Manoa
National Institutes of Health Postdoctoral Fellow

William G. Thompson
Lamont Doherty Earth Observatory of Columbia University
Ocean and Climate Change Institute Postdoctoral Scholar/Comer Postdoctoral Scholar

Brandy M. Toner
University of California, Berkeley
NRC/ORAU/NASA Astrobiology Institute Research Associateship Postdoctoral Fellowship

Tim A.G. Verslycke
Ghent University
Ocean Life Institute Postdoctoral Scholar/Belgian American Educational Foundation Postdoctoral Fellow

Antje H.L. Voelker
Christian-Albrechts-Universitaet zu Kiel
Portuguese Foundation for Science and Technology Postdoctoral Fellow

Rhian G. Waller
Southampton Oceanography Centre
USGS Postdoctoral Fellow/ Cross-Institute Postdoctoral Fellow

Zhengrong Wang
California Institute of Technology
Deep Ocean Exploration Institute Postdoctoral Scholar

Brian L. White
Massachusetts Institute of Technology
Coastal Ocean Institute Postdoctoral Scholar

Geophysical Fluid Dynamics (GFD) Seminar Fellows

Devin Conroy
University of California, San Diego

Ian Eisenmann
Harvard University

Daniel Goldberg
New York University

Shane Keating
University of California, San Diego

Takahide Okabe
University of Texas, Austin

Robert Style
University of Cambridge, U.K.

Victor Tsai
Harvard University

Dominic Vella
University of Cambridge, U.K.

Rachel Zammett
University of Oxford

GFD Staff and Visitors

Sridhar Anandakrishnan
Penn State University

James Anderson
Stevens Institute of Technology

Neil J. Balmforth
University of British Columbia

Andrew Belmonte
Penn State University

Robert Bindschadler
NASA Goddard Space Flight Center

Goran Bjork
Göteborg University

Tim Boyd
Oregon State University

Kelly Brunt
University of Chicago

Eliza Calder
University of Buffalo

Mac Cathles
University of Chicago

Colm-cille Caufield
University of Cambridge

Claudia Cenedese
WHOI

Gregory Dash
University of Washington

Charles Doering
University of Michigan

Predrag Cvitanovic
Georgia Institute of Technology

Paul Dellar
Imperial College

Petri Fast
Lawrence Livermore National Laboratory

Daniel Feltham
University College, London

Andrew Fowler
University of Oxford

Karl Helfrich
WHOI

Richard Hindmarsh
British Antarctic Survey

Louis Howard
Massachusetts Institute of Technology

Lam Hui
Columbia University

Bror Johnson
Boston University

Joseph B. Keller
Stanford University

Young-Jin Kim
University of Chicago

Norman R. Lebovitz
University of Chicago

Doug MacAyeal
University of Chicago

Amala Mahadevan
Boston University

Lakshminarayanan Mahadevan
Harvard University

Willem V.R. Malkus
Massachusetts Institute of Technology

Shreyas Mandre
University of British Columbia

Doug Martinson
Lamont Doherty Earth Observatory

James MacElwaine
University of Cambridge

Miles McPhee
McPhee Research Corporation

Keith Moffatt
University of Cambridge

Jamie Morison
University of Washington

Richard Moritz
University of Washington

Philip J. Morrison
University of Texas at Austin

Jerome Neufeld
Yale University

Thomas Neumann
University of Vermont

Sophie Nowicki
University of Oxford

Marcel Oliver
International University, Bremen

Michael Patterson
Yale University

Students, Fellows, & Visitors

Don Perovich
Cold Regions Research and Engineering Laboratory
Antonello Provenzale
Istituto di Scienze Dell'Atmosfera
Charles Raymond
University of Washington
Alan Rempel
University of Oregon
Claes G. Rooth
University of Miami
Bert Rudels
Finnish Institute of Marine Research
Roiy Sayag
Harvard University
Peter Schlosser
Columbia University
Christian Schoof
University of British Columbia
Tiffany Shaw
University of Toronto
Edward Spiegel
Columbia University
Mary-Louise Timmermanns
WHOI
Martin Truffer
University of Alaska, Fairbanks
Norbert Untersteiner
University of Washington
George Veronis
Yale University
John Walsh
University of Alaska, Fairbanks
Andrew Wells
University of Cambridge
Matthew Wells
University of Toronto
John Wettlaufer
Yale University
John Whitehead
WHOI
Dale Winebrenner
University of Washington
Grae Worster
University of Cambridge
Jun Zhang
New York University

Minority Fellows

Nicholas Jachowski
Stanford University
Deanna McCadney
Western Kentucky University
Ryo Saotome
Trinity College

Summer Student Fellows

Gina Applebee
College of Charleston
Anne Brock
Northwestern University
Carolyn Buchwald
Massachusetts Institute of Technology
Sophie Clayton
University of Wales, Bangor (United Kingdom)
Nadine Eisenkolb
University of Hawaii at Hilo
Juliana Gay
University of Oklahoma
Jennifer Glass
University of Washington
Maiana Hanshaw
Duke University
Cara Hotchkin
University of Rhode Island
Jeffrey Kaeli
Virginia Tech
Amy Koid
Franklin and Marshal College
Kira Krumhansl
St. Lawrence University
Margaret Lynch
Stanford University
Jeffrey Marlow
Washington University in St. Louis
Nathaniel Miller
Virginia Tech
Abitha Murugeshu
Louisiana State University
Taryn Noble
University of Chicago
Noah Planavsky
Lawrence University
Jared Singer
University of Utah
Michael Squibb
Johns Hopkins University
Nika Staglicic
University of Split, Department for Marine Studies (Croatia)
Karen Thurston
University of East Anglia (United Kingdom)
Benjamin Tully
Rutgers University
Wilken-Jon von Appen
International University Bremen (Germany)
Christopher Ward
Carleton College
Maya Yamato
Princeton University

Guest Students

Kay Achenbach
University of Wyoming, Laramie
Amalia Aruda
Georgetown University
Nicholas Beaird
Colby College
Lars Behrendt
University of Hamburg (Germany)
Kari Sire Berner
University of Oslo (Norway)
Dondra Biller
University of California, San Diego
Ramananda Chakrabarti
University of Rochester
Jennifer Culbertson
Boston University
Kara Dodge
University of New Hampshire
Michela De Dominicis
University of Rome, La Sapienza (Italy)
Roman de Jesus
Scripps Institution of Oceanography
Jared DeMello
University of Connecticut
Melanie Durth
University of Paris (France)
Valentina Dore
University of Rome, La Sapienza (Italy)
Steve Eberbach
Duke University
Raphealle Escoube
Université Pierre et Marie Curie (France)
Gabriele Ferri
Scuola Superiore Sant' Anna (Italy)
Tim Fischer
University of Kiel (Germany)
Ester Garcia
Independent University of Barcelona (Spain)
Robert Geis
Massachusetts Institute of Technology
Margaret Goldman
Duke University, Nicholas School
Mark Hamilton
University of the Witwatersran (South Africa)
Paul Heslinga
Falmouth Academy
Jen Hua Tai
Institute of Oceanography (Taiwan)
Brendan Hurley
Duke University
Doroteaciro Iovino
University of Naples (Italy)
Yuki Iwashina
James Cook University
Michael Johnsen
Western Washington University
Erol Karchner
Cape Cod Academy
Kathryn Katcher
Wells College
Michael Kentris
Ohio State University
Bethany Kirpalani
Northeastern University
Dane Klinger
Bard College
Jessie Kneeland
California Institute of Technology
Inga Koszalka
Politecnico di Torino (Italy)
Katherine Libera
Mount Holyoke College
Hannah Longworth
University of Southampton, National Oceanography Centre (United Kingdom)
Nadine Lysiak
Boston University
Merrielle Macleod
Brown University
Michelangelo Mariani
University of Rome, La Sapienza (Italy)
Kyle Martin
Boston University
Louise McGarry
Cornell University
Eric Mittelstaedt
University of Hawaii
Tobias Mohr
University of Bremen (Germany)
Elizabeth Mollo-Christensen
Colby College
Paul Morris
University of Southampton, National Oceanography Centre (United Kingdom)
Colleen Mouw
University of Rhode Island
Nicole Ngo
University of California, Irvine
Rodrigo Orrego
University of Conception (Chile)
Deborah Osborn
Bucknell University
Emily Peacock
Boston University
James Pelowski
Stony Brook University
Stephanie Petillo
University of Maryland
Summer Praetorius
Portland State University
John Rapaglia
State University of New York at Stony Brook

Mindy Richlen
Boston University

Natalie Roberts
University of Oxford (United Kingdom)

Daniel Sheahan
Florida Atlantic University

Haiwei Shen
University of Rhode Island

Theresa Smith
University of Rhode Island

Elizabeth Sosik
Northeastern University

Crighton Thornton
Cape Cod Academy

Michael Toomey
Pomona College

Zachariah David Vincent
University of Cape Town (South Africa)

Emily Walsh
Bridgewater State College

Bryn Warren
Northeastern University

Dustin Whipple
Florida Atlantic University

Charles White
University of North Carolina

Jessica Whiteside
Columbia University, Lamont-Doherty Earth Observatory

Eric Willard
Northeastern University

Maria Wilson
University of Aarhus (Denmark)

Louie Wurch
MIT/WHOI Joint Program

Elizabeth Yranski
Northeastern University

Weifeng (Gordon) Zhang
Rutgers University

Zhuqi Zhang
Peking University (People's Republic of China)

Jian (Jasmine) Zhu
Peking University (People's Republic of China)

Dennis Zimmermann
Ludwigs-Maximilians University (Germany)

Chris Linder, WHOI

MIT/WHOI graduate students and faculty explored a bubbling, sulfur-encrusted hot spring in June 2006 on a field trip to Iceland. The trip capped WHOI's Geodynamics Program, a semester of weekly seminars by invited scientists on the cutting edge of research. This year's program focused on all things cryological: ice sheets, glaciers, sea ice, and subglacial life. Program sponsors included the Institution's Academic Programs Office and the Deep Ocean Exploration Institute.

Report from Carolyn A. Bunker, Vice President for Finance and Administration

We are pleased to present the 2006 financial statements of the Woods Hole Oceanographic Institution (WHOI) and to describe some of the new reporting requirements that impacted the statements. WHOI completed 2006 in good financial condition largely because of the strong returns of the endowment and the support of organizations and individuals who recognize the long term benefits of basic research.

Statement of Financial Position:

WHOI continues to have a strong balance sheet. On December 31, 2006, WHOI's total assets were $515 million, total liabilities were $107.6 million and total net assets were $407.4 million, an increase of $42.2 million. Net assets represent the accumulated financial strength of a not-for-profit organization and are an important gauge of its ability to carry out its mission.

Included in the liabilities is the Massachusetts Health and Educational Facilities Authority bond debt of $54.9 million.

The endowment represents 85% of the total net assets. Its growth from $306 million in 2005 to $347 million in 2006 accounts for most of the increase in total net assets.

Statement of Activities:

WHOI's total operating revenues increased by $10.3 million: from $140.5 million in 2005 to $150.8 million in 2006. Contributions and gifts amounted to $20.5 million. The NSF budget fell in 2005, and WHOI reflected that reduction in 2006 with a slight decrease in government-funded research: from $70.2 million in 2005 to $69.9 million in 2006.

A total of $14.4 million of endowment income and appreciation was distributed to operations as follows:

- Education $6.0 million
- Research $5.6 million
- Unrestricted $2.8 million

The Institution had overhead costs of $59.4 million, and approximately 88% of that amount, $52.3 million, was recovered from the government. The remainder was an Institutional expense.

WHOI paid $1.9 million in interest during 2006. Principal payments on the $54.9 million of debt will begin in 2008. The Federal Government allows us to include interest and depreciation in our overhead rates, and we will be reimbursed for these expenses.

New Reporting Requirements:

The Financial Standards Accounting Board (FASB) and the American Institute of Certified Public Accountants (AICPA) have issued new guidelines and interpretations on topics such as the proper valuation of assets, internal controls and the appropriate recording of postretirement liabilities.

Tom Kleindinst, WHOI

Carolyn Bunker (blue shirt) with members of her Finance and Administration staff. Clockwise from left: Cindy Tobey, executive assistant to CFO; Ron Reif, environmental health and safety manager; Ernie Charette, facilities manager; Deb Hamel, administrator for F&A; Dave Stephens, controller; John Lombardi, MIS manager; and Dennis Fox, procurement manager.

Valuation of Assets:

In both 2005 and 2006, the AICPA issued guidance with respect to the existence and valuation of investments where a readily determinable market value does not exist. As a result, additional controls and due diligence were established and documented. The new requirements were presented to the Audit Committee and to the Investment Committee.

Internal Controls:

The AICPA recently amended professional standards and now requires auditors to report and classify any internal control weaknesses. Internal controls have been a major focus of regulatory bodies and auditors for several years, and WHOI strives to continually improve its policies and procedures.

Recording of Postretirement Liabilities:

On September 29, 2006, the FASB issued Statement 158 that includes a requirement to recognize the over or under funded status of postretirement benefit plans in the balance sheet. This is effective for nonpublic entities in 2007 and, had WHOI implemented this new requirement in 2006, the estimated effect, as reported in Footnote 8, would have been a decrease in unrestricted net assets of approximately $34 million and a corresponding increase in the pension and postretirement medical benefits liabilities.

Summary:

In 2006, we were again faced with making reductions to our overhead budget. We eliminated ten positions in administrative areas, eliminated two holidays, and made other budget cuts virtually across the board. We're in the process of evaluating our administrative requirements with regard to the strategic plan and aligning resources to support Institutional goals and science priorities. The good news is substantial investment returns; ongoing control of operating expenses and a reenergized effort to diversify funding sources have provided the financial strength to allow us to advance WHOI's strategic goals.

Statement of Financial Position

December 31, 2006 (with summarized information as of December 31, 2005)

	2006	2005
Assets		
Cash, unrestricted	$ 16,923,603	$ 21,360,187
Cash, restricted	1,295,112	1,027,019
Reimbursable costs and fees		
Billed (net of allowance for doubtful accounts of $113,910 for 2006 and $210,351 for 2005)	3,473,723	2,056,178
Unbilled	5,766,906	6,865,329
Receivable for investments sold	194,440	-
Interest and dividends receivable	671,182	328,632
Other receivables	750,846	771,182
Pledges receivable, net	13,231,894	4,807,837
Inventory	1,435,985	1,171,878
Deferred charges and prepaid expenses	1,434,441	651,835
Investments, pooled (Note 3)	343,217,764	307,996,468
Investments, nonpooled (Note 3)	7,137,628	5,070,498
Deposits with trustees for construction	1,063,695	3,038,552
Deposits with trustees for debt service	118,986	1,898,102
Prepaid postretirement benefit cost	788,826	788,826
Supplemental retirement	7,173,633	6,585,207
Intangible pension asset	-	13,674,720
Other assets	9,196,523	9,155,667
Deferred financing costs	1,182,978	1,225,865
	415,058,165	388,473,982
Property, plant and equipment		
Land, buildings and improvements	121,110,015	113,546,891
Vessels and dock facilities	7,391,436	7,180,241
Laboratory and other equipment	24,444,600	21,098,120
Construction in process	973,754	3,253,157
	153,919,805	145,078,409
Accumulated depreciation	(65,285,849)	(58,641,890)
Net property, plant and equipment	88,633,956	86,436,519
Remainder trusts (Note 5)	11,311,983	10,390,619
Total assets	$ 515,004,104	$ 485,301,120
Liabilities		
Accounts payable and other liabilities	$ 9,251,502	$ 14,445,771
Accrued payroll and related liabilities	5,241,173	5,166,992
Payable for investments purchased	506,007	32,435
Deferred fixed rate variance	1,685,926	3,121,743
Accrued supplemental retirement benefits	7,173,633	6,585,207
Accrued pension liability	21,374,109	28,795,900
Deferred revenue and refundable advances	7,517,056	7,115,866
Bonds and loans payable	54,850,000	54,850,000
Total liabilities	107,599,406	120,113,914

	Unrestricted	Temporarily Restricted	Permanently Restricted		
Net Assets					
Undesignated and plant	$ 41,775,293	$ -	$ -	41,775,293	43,158,823
Pension	(21,384,575)	-	-	(21,384,575)	(14,039,903)
Designated	5,229,974	8,042,379	-	13,272,353	11,834,399
Pledges and other	-	13,598,380	10,765,122	24,363,502	15,689,445
Education	-	2,420,555	-	2,420,555	2,846,933
Endowment and similar funds	80,788,042	204,450,605	61,718,923	346,957,570	305,697,509
Total net assets	$ 106,408,734	$ 228,511,919	$ 72,484,045	407,404,698	365,187,206
Total liabilities and net assets				$ 515,004,104	$ 485,301,120

Statement of Activities

Year ended December 31, 2006 (with summarized information as of December 31, 2005)

	Unrestricted					
	Operating	Sponsored Research	Temporarily Restricted	Permanently Restricted	2006	2005
Operating revenues						
Fees	$ 657,159				$ 657,159	$ 232,291
Sponsored research						
Government		$ 69,878,315			69,878,315	70,174,037
Subcontract and nongovernment		17,647,222	$ 5,247,872		22,895,094	21,162,173
Ships and subs operations		21,851,478			21,851,478	20,895,382
Sponsored research assets released to operations	114,477,724	(109,377,015)	(5,100,709)		-	-
Education						
Joint program income	3,924,277				3,924,277	3,773,444
Endowment income	4,060,618		1,858,882		5,919,500	5,628,845
Gifts					-	209,503
Education funds released from restriction	2,541,156		(2,541,156)		-	-
Investment return designated for current operations	3,738,766		-		3,738,766	3,464,870
Contributions and gifts, net of releases from restrictions of $1,020,108 and $737,803 in 2006 and 2005, respectively	9,561,435		9,766,621	$ 1,204,680	20,532,736	12,812,343
Contributions in kind	186,854				186,854	622,183
Rental income	773,049				773,049	743,687
Communication and publications	175,980				175,980	252,830
Other	316,085				316,085	533,062
Total revenues	140,413,103	-	9,231,510	1,204,680	150,849,293	140,504,650
Expenses						
Sponsored research						
National Science Foundation	40,577,466				40,577,466	42,551,224
United States Navy	13,618,180				13,618,180	12,094,074
Subcontracts	10,587,315				10,587,315	10,174,343
National Oceanic & Atmospheric Administration	11,054,410				11,054,410	10,480,622
Department of Energy	729,007				729,007	521,065
United States Geological Survey	1,054,337				1,054,337	1,469,623
National Aeronautics & Space Administration	1,065,550				1,065,550	980,943
Ships Operations	16,505,047				16,505,047	15,307,124
Submersible and ROV operations	5,346,431				5,346,431	5,588,258
Privately funded grants	4,275,110				4,275,110	4,323,674
Other	9,664,871				9,664,871	8,918,468
Education						
Faculty expense	3,688,362				3,688,362	3,583,387
Student expense	4,466,502				4,466,502	4,175,946
Postdoctoral programs	342,510				342,510	413,616
Other	674,412				674,412	721,291
Rental expenses	579,731				579,731	538,897
Communication, publications and development	2,304,657				2,304,657	2,628,541
Fundraising expenses	2,145,717				2,145,717	2,620,896
Unsponsored programs	8,456,654				8,456,654	6,182,535
Other expenses	2,288,862				2,288,862	1,284,272
Total expenses	139,425,131	-	-	-	139,425,131	134,558,799
Change in net assets from operating activities	987,972	-	9,231,510	1,204,680	11,424,162	5,945,851
Nonoperating income						
Investment return in excess of amounts designated for sponsored research, education and current operations	8,308,083		28,242,344		36,550,427	12,275,300
Net realized/unrealized gains (losses) on interest swap	888,848				888,848	(640,157)
Change in split interest agreements	(13,918)		31,829	881,843	899,754	378,137
Contributions and gifts			15,000		15,000	5,000
Net assets released from restriction	15,000		(15,000)		-	
Nonoperating expenses						
Other nonoperating expenses	(99,976)				(99,976)	(99,976)
Net periodic pension costs	(7,300,134)				(7,300,134)	(4,389,971)
Redesignation of gifts	(280,000)		130,369	33,580	(116,051)	(1,493,268)
Change in net assets from nonoperating activities	1,517,903	-	28,404,542	915,423	30,837,868	6,035,065
Change in net assets from operating and nonoperating activities	2,505,875	-	37,636,052	2,120,103	42,262,030	11,980,916
Change in additional pension minimum liability (Note 8)	(44,538)	-	-	-	(44,538)	14,055,206
Total change in net assets	2,461,337	-	37,636,052	2,120,103	42,217,492	26,036,122
Net assets at beginning of year	103,947,397	-	190,875,867	70,363,942	365,187,206	339,151,084
Net assets at end of year	$106,408,734	$ -	$ 228,511,919	$ 72,484,045	$407,404,698	$ 365,187,206

Statement of Cash Flows

Year ended December 31, 2006 (with summarized information as of December 31, 2005)

	2006	2005
Cash flows from operating activities		
Total change in net assets	$ 42,217,492	$ 26,036,122
Adjustments to reconcile increase in net assets to net cash (used in) provided by operating activities		
Depreciation and amortization	7,476,043	5,882,972
Change in split interest agreements	(899,754)	(378,137)
Allowance for uncollectible pledges	676,945	75,098
Discount on pledges	569,641	(127,932)
Net realized and unrealized (gain) loss on investments	(41,707,373)	(24,591,314)
Unrealized (gain) loss on interest swap	(1,110,370)	227,302
Change in additional minimum pension liability	44,538	(14,055,206)
Contributions to be used for long-term investment	(3,289,386)	(2,395,237)
Gift in kind	(2,497,104)	-
(Increase) decrease in assets		
Restricted cash	(268,093)	(644,598)
Interest and dividends receivable	(342,550)	(52,502)
Reimbursable costs and fees		
Billed	(1,417,545)	1,279,187
Unbilled	1,098,423	(406,399)
Other receivables	20,336	2,199,348
Pledges receivable	(9,670,643)	2,124,187
Inventory	(264,107)	61,868
Deferred charges and prepaid expenses	(396,804)	750,522
Other assets	(40,856)	8,228,770
Prepaid pension cost	-	(149,529)
Supplemental retirement	(588,426)	(47,286)
Increase (decrease) in liabilities		
Accrued pension liability	6,208,391	4,478,979
Accounts payable and other liabilities	(1,865,132)	(5,837,128)
Accrued payroll and related liabilities	74,181	(124,222)
Deferred revenue and refundable advances	401,190	376,634
Accrued supplemental retirement benefits	588,426	47,286
Deferred fixed rate variance	(1,435,817)	2,992,243
Net cash (used in) provided by operating activities	(6,418,354)	5,951,028
Cash flows from investing activities		
Capital expenditures		
Additions to property and equipment	(9,759,668)	(26,175,431)
Short-term investments		
Purchase of investments	(2,000,000)	-
Endowment		
Receivable for investments sold	(194,440)	-
Payable for investments purchased	473,572	(14,816)
Proceeds from the sale of investments	110,531,930	95,045,755
Purchase of investments	(104,112,983)	(91,006,910)
Change in construction fund	1,974,857	21,239,529
Change in debt service funds	1,779,116	1,256,248
Net cash (used in) provided by investing activities	(1,307,616)	344,375
Cash flows from financing activities		
Contributions to be used for long-term investment	3,289,386	2,395,237
Net cash provided by financing activities	3,289,386	2,395,237
Net (decrease) increase in cash and cash equivalents	(4,436,584)	8,690,640
Cash and cash equivalents, beginning of year	21,360,187	12,669,547
Cash and cash equivalents, end of year	$ 16,923,603	$ 21,360,187
Supplemental disclosures		
Cash paid for interest	$ 2,078,593	$ 2,184,971
Noncash activity		
Construction in process additions remaining in accounts payable	-	2,240,377
Change in intangible pension asset	(13,674,720)	13,674,720
Gift in kind	2,497,104	-

Financial Statements

Report of Independent Auditors

To the Board of Trustees of Woods Hole Oceanographic Institution

In our opinion, the accompanying statement of financial position and the related statements of activities and cash flows present fairly, in all material respects, the financial position of Woods Hole Oceanographic Institution (the "Institution") at December 31, 2006, and the changes in its net assets and its cash flows for the year then ended in conformity with accounting principles generally accepted in the United States of America. These financial statements are the responsibility of the Institution's management. Our responsibility is to express an opinion on these financial statements based on our audit. The prior year summarized comparative information has been derived from the Institution's 2005 financial statements, and in our report dated April 24, 2006, we expressed an unqualified opinion on those financial statements. We conducted our audit of these statements in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements, assessing the accounting principles used and significant estimates made by management, and evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

PricewaterhouseCoopers LLP

June 25, 2007

Notes to Financial Statements

1. Background

Woods Hole Oceanographic Institution (the "Institution") is a private, independent not-for-profit research and educational institution located in Woods Hole, Massachusetts. Founded in 1930, the Institution is dedicated to working and learning at the frontier of ocean science and attaining maximum return on intellectual and material investments in oceanographic research.

The Institution is a qualified tax-exempt organization under Section 501(c)(3) of the Internal Revenue Code as it is organized and operated for education and scientific purposes.

2. Summary of Significant Accounting Policies

Basis of Presentation

The accompanying financial statements have been prepared on the accrual basis and in accordance with the reporting principles of not-for-profit accounting.

The financial statements include certain prior-year summarized comparative information, but do not include sufficient detail to constitute a presentation in conformity with accounting principles generally accepted in the United States of America. Accordingly, such information should be read in conjunction with the Institution's audited financial statements for the year ended December 31, 2005, from which the summarized information was derived.

Net assets, revenues, and realized and unrealized gains and losses are classified based on the existence or absence of donor-imposed restrictions and legal restrictions imposed under Massachusetts State law. Accordingly, net assets and changes therein are classified as follows:

Permanently Restricted Net Assets

Permanently restricted net assets are subject to donor-imposed stipulations that they be maintained permanently by the Institution. Generally the donors of these assets permit the Institution to use all or part of the income earned and capital appreciation, if any, on related investments for general or specific purposes.

Temporarily Restricted Net Assets

Temporarily restricted net assets are subject to donor-imposed stipulations that may or will be met by actions of the Institution and/or the passage of time. Unspent gains on permanent endowment are classified as temporarily restricted until the Institution appropriates and spends such sums in accordance with the terms of the underlying endowment funds and in accordance with Massachusetts law, at which time they will be released to unrestricted revenues.

Unrestricted Net Assets

Unrestricted net assets are not subject to donor-imposed stipulations. Revenues are reported as increases in unrestricted net assets unless use of the related assets is limited by donor-imposed restrictions. Expenses are reported as decreases in unrestricted net assets. Gains and losses on investments and other assets or liabilities are reported as increases or decreases in unrestricted net assets unless their use is restricted by explicit donor stipulations or law. Expirations of temporary restrictions on net assets, that is, the donor-imposed stipulated purpose has been accomplished and/or the stipulated time period has elapsed, are reported as reclassifications between the applicable classes of net assets. Amounts received for sponsored research (under exchange transactions) are reflected in unrestricted sponsored research and released to operations when spent for the appropriate purpose, or as deferred revenue if expenditures have yet to be incurred.

Contributions

Contributions, including unconditional promises to give, are recognized as revenues in the period received. Contributions subject to donor-imposed stipulations that are met in the same reporting period are reported as unrestricted support. Promises to give that are scheduled to be received after the balance sheet date are shown as increases in temporarily restricted net assets and are reclassified to unrestricted net assets when the purpose or items' restrictions are met. Certain releases from temporarily restricted amounting to $1,020,108 and $737,803 for the years ended December 31, 2006 and

2005, respectively, are netted against contributions and are included in unrestricted sponsored research. Promises to give, subject to donor-imposed stipulations that the corpus be maintained permanently, are recognized as increases in permanently restricted net assets. Conditional promises to give are not recognized until they become unconditional, that is, when the conditions on which they depend are substantially met. The Institution has received $3,405,000 in conditional pledges as of December 31, 2006. Contributions other than cash are generally recorded at market value on the date of the gift (or an estimate of fair value), although certain noncash gifts, for which a readily determinable market value cannot be established, are recorded at a nominal value until such time as the value becomes known. Contributions to be received after one year are discounted at the appropriate rate commensurate with risk. Amortization of such discount is recorded as additional contribution revenue in accordance with restrictions imposed by the donor on the original contribution, as applicable. Amounts receivable for contributions are reflected net of an applicable reserve for collectibility.

The Institution reports contributions in the form of land, buildings, or equipment as unrestricted operating support at fair market value when received.

Dividends, interest and net gains on investments of endowment and similar funds are reported as follows:

- as increases in permanently restricted net assets if the terms of the gift require that they be added to the principal of a permanent endowment fund;
- as increases in temporarily restricted net assets if the terms of the gift or relevant state law impose restrictions on the current use of the income or net realized and unrealized gains; and
- as increases in unrestricted net assets in all other cases.

Operations

The statement of activities report the Institution's operating and nonoperating activities. Operating revenues and expenses consist of those activities attributable to the Institution's current annual research or educational programs, all gifts received except those received for property, plant and equipment purposes and a component of endowment income appropriated for operations (Note 3). Unrestricted endowment investment income and gains over the amount appropriated under the Institution's spending plan are reported as nonoperating revenue as investment return in excess of amounts designated for sponsored research, education and current operations. Nonoperating revenue also includes the change in value of split interest agreements, contributions restricted for property, plant and equipment purposes, gains or losses on disposals of fixed assets, net realized/unrealized gains (losses) on interest swaps and the net periodic pension cost on the noncontributory defined benefit pension plan that is not reimbursed by the employee benefit fixed rate. Additionally, nonoperating activities includes redesignation of donor gifts and depreciation on certain government-funded facilities.

Cash and Cash Equivalents

Cash and cash equivalents consist of cash, money market accounts, certificates of deposit and overnight repurchase agreements with initial maturities of three months or less when purchased which are stated at cost and approximates market value.

Included in restricted cash at December 31, 2006 and 2005 is $1,041,361 and $782,927, respectively, representing advances received from the United States Navy and other U.S. Government and state agencies. Such amounts are restricted as to use for research programs. Interest earned on unspent funds is remitted to the federal government.

Also included in restricted cash at December 31, 2006 and 2005 is $253,751 and $244,092, respectively, representing cash restricted by the Massachusetts Department of Public Health. Interest earned on unspent funds is reinvested within the restricted cash account.

In addition, cash and cash equivalents include uninvested amounts from each classification of net assets (e.g., endowment).

Investments

Investment securities are carried at market value determined as follows: securities traded on a national securities exchange are valued at the last reported sales price on the last business day of the year; securities traded in the over-the-counter market and listed securities for which no sales prices were reported on that day are valued at closing bid prices. The value of publicly traded securities is based upon quoted market prices and net asset values. Other securities, such as private equity funds, venture capital funds and hedge funds for which no such quotations or valuations are readily available, are carried at fair value as estimated by management using values provided by external investment managers. The Institution reviews and evaluates the valuations provided by investment managers and believes that these valuations are a reasonable estimate of fair value as of December 31, 2006 and 2005 but are subject to uncertainty and, therefore, may differ from the value that would have been used had a ready market for the investments existed and such differences could be material.

Purchases and sales of investment securities are recorded on a trade date basis. Realized gains and losses are computed on a specific identification method. Investment income, net of investment expenses, is distributed on the unit method.

Investment Income Unitization

The Institution's investments are pooled in an endowment fund and the investments and allocation of income are tracked on a unitized basis. The Institution distributes to operations for each individual fund an amount of investment income earned by each of the fund's proportionate share of investments based on a total return policy.

The Board of Trustees has appropriated all of the income and a specified percentage of the net appreciation (depreciation) to operations as prudent considering the Institution's long- and short-term needs, present and anticipated financial requirements, expected total return on its investments, price level trends, and general economic conditions. Under the Institution's current endowment spending policy, which is within the guidelines specified under state law, between 4% and 5.5% of a 36-month average market value of qualifying endowment investments is appropriated. This amounted to $14,351,257 and $13,562,503 for the years ending December 31, 2006 and 2005, respectively, and is classified in operating revenues (research, education, and operations).

Deposits with Trustees

Deposits with trustees consists principally of investments in United States Government obligations and have been deposited with trustees as required under certain loan agreements. At Decem-

ber 31, 2006 and 2005, respectively, the amounts consist of $118,986 and $1,898,102 for debt service and $1,063,695 and $3,038,552 for construction purposes. Interest income on debt service amounted to $55,590 in 2006 and $61,265 in 2005 and is reflected in the statement of activities within other income. Interest income on construction funds amounted to $49,855 and $248,171 in 2006 and 2005, respectively, and is reflected in the statement of activities within other income.

Inventories

Inventories are stated at the lower of cost or market. Cost is determined using the first-in, first-out method.

Contracts and Grants

Revenues earned on contracts and grants for research are recognized as related costs are incurred.

The Institution received approximately 89% and 90% of its sponsored research revenues from government agencies including 50% and 55% of its operating revenues from the National Science Foundation and 14% and 11% from the United States Navy in fiscal years 2006 and 2005, respectively. Although applications for research funding to federal agencies historically have been funded, authorizations are subject to annual Congressional appropriations and payment.

Deferred Financing Costs

Costs incurred in connection with the placement of the Massachusetts Health and Educational Facilities Authority, Variable Rate Revenue Bonds, Woods Hole Oceanographic Institution Issue, Series 2004, have been deferred and are being amortized over the term of the obligation on a straight line basis.

Interest Rate Swap

The Institution has entered into an interest rate swap agreement on the Massachusetts Health and Educational Facilities Authority, Variable Rate Revenue Bonds, Woods Hole Oceanographic Institution Issue, Series 2004 Bonds in order to convert a portion of the variable rate debt to fixed rate, thereby economically hedging against changes in the cash flow requirements of the Institution's variable rate debt obligations.

Net payments or receipts (difference between variable and fixed rate) under the swap agreement along with the change in fair value of the swap are recorded in nonoperating activities as net realized/unrealized gains (losses) on interest swap.

Property, Plant and Equipment

Property, plant and equipment are stated at cost. Depreciation is provided on a straight-line basis at annual rates of 12 to 39 years on buildings and improvements, 10 to 15 years on vessels and dock facilities and 5 to 10 years on laboratory and other equipment. Depreciation expense on property, plant, and equipment purchased by the Institution in the amounts of $7,333,180 and $5,740,108 in 2006 and 2005, respectively, has been charged to operating activities. Depreciation on certain government-funded facilities (the Laboratory for Marine Science and the dock facility) amounting to $99,976 in 2006 and in 2005 has been charged to nonoperating expenses as these assets were gifted by the Government.

Construction commitments totaled $177,464 and $2,264,844 at December 31, 2006 and 2005, respectively.

During fiscal 2005, the Institution capitalized interest of $716,427. The Institution did not capitalize any interest in fiscal 2006.

Conditional Asset Retirement Obligations

The Institution implemented Financial Accounting Standards Board Interpretation No. 47, Accounting for Conditional Asset Retirement Obligations during 2005. The effects of implementing this interpretation in 2005 were immaterial.

Use of Estimates

The preparation of the financial statements in accordance with accounting principles generally accepted in the United States of America requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and the disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the period. Actual results could differ from those estimates.

Reclassifications

Certain amounts have been reclassified in the prior year financial statements to conform with current year classification.

3. Investments

The cost and market value of pooled investments held at December 31 are as follows:

	2006		2005	
	Cost	Market	Cost	Market
US treasury bonds	$ 25,200,000	$ 26,572,667	$ 27,200,000	$ 27,650,867
Corporate bonds	14,267,726	14,087,327	17,330,371	17,194,079
International bond funds	9,706,165	9,298,994	9,619,483	9,070,163
Private equity funds	23,548,495	43,422,205	35,438,353	52,271,102
Hedge funds	51,920,000	63,357,787	39,545,000	43,752,216
Domestic equities	60,951,427	73,147,399	53,578,718	63,344,351
International equities	61,438,755	79,847,542	54,023,352	67,964,025
Venture capital	29,621,866	33,437,150	28,375,188	26,702,972
Other	46,693	46,693	46,693	46,693
Total investments	$ 276,701,127	$ 343,217,764	$ 265,157,158	$ 307,996,468

Included in bonds and equities are alternative investment vehicles including commingled funds with a market value of $61,591,215 and $49,274,056 at December 31, 2006 and 2005, respectively, whose holdings are bonds and equities. Total alternative investments (as described in the American Institute of Certified Public Accountants document, "A Practice Aid for Auditors: Alternative Investments - Audit Considerations) included in the above categories at December 31, 2006 and 2005, respectively, were $201,808,357 and $172,000,346.

The nonpooled investments with a cost of $7,200,020 and $5,200,020 and a market value of $7,137,628 and $5,070,498 at December 31, 2006 and 2005, respectively, are invested in a common/collective trust fund investing in bonds.

The following schedule summarizes the investment return on pooled and nonpooled investments and its classification in the statement of activities:

	Unrestricted	Temporarily restricted	2006 Total	2005 Total
Dividend and interest income	$ 9,745,924	$ 1,858,882	$ 11,604,806	$ 3,758,281
Investment management costs	(1,855,614)	-	(1,855,614)	(2,069,753)
Net realized gains	4,176,667	13,794,620	17,971,287	16,890,020
Change in unrealized appreciation	4,040,490	19,695,596	23,736,086	7,701,294
Total return on investments	16,107,467	35,349,098	51,456,565	26,279,842
Investment return designated for				
Sponsored research	-	(5,247,872)	(5,247,872)	(4,910,827)
Education	(4,060,618)	(1,858,882)	(5,919,500)	(5,628,845)
Current operations	(3,738,766)	-	(3,738,766)	(3,464,870)
Total distributions to operations	(7,799,384)	(7,106,754)	(14,906,138)	(14,004,542)
Investment return in excess of amounts designated for sponsored research, education and current operations	$ 8,308,083	$ 28,242,344	$ 36,550,427	$ 12,275,300

Investment return distributed to operations includes $554,881 and $442,039 earned on non-endowment investments for the years ended December 31, 2006 and 2005, respectively.

Investment securities are exposed to various risks such as interest rate, market and credit risks. Due to the level of risk associated with certain investments, it is at least reasonably possible that changes in the value of investment securities will occur in the near term and that such changes could materially affect the market values and the amounts reported in the statement of financial position.

Endowment income for pooled investments is allocated to each individual fund based on a per unit valuation. The value of an investment unit at December 31 is as follows:

	2006	2005
Unit value, beginning of year	$ 4.3755	$ 4.1517
Unit value, end of year	4.7179	4.3755
Net change for the year	.3424	.2238
Investment income per unit for the year	.1256	.0173
Total return per unit	$ .4680	$ .2411

4. Pledges Receivable

Pledges that are expected to be collected within one year are recorded at their net realizable value. Pledges that are expected to be collected in future years are recorded at the present value of estimated future cash flows. The present value of estimated future cash flows has been measured utilizing a discount rate equivalent to U.S. Treasury yields of similar maturity (ranging from 2.36% – 4.74%, depending upon the anticipated pledge fulfillment date).

Pledges receivable consist of the following at December 31:

	2006	2005
Unconditional promises expected to be collected in:		
Less than one year	$ 2,341,468	$ 2,127,027
One year to five years	12,664,674	3,208,472
Reserve for uncollectible pledges receivable	(1,050,430)	(373,485)
Unamortized discount	(723,818)	(154,177)
	$ 13,231,894	$ 4,807,837

5. Contribution Receivable from Remainder Trusts

Contributions receivable from remainder trusts balance at December 31, 2006 and 2005 was $11,311,983 and $10,390,619, respectively. The receivable and related revenue is measured at the present value of estimated future cash flows to be received and recorded in the appropriate net asset category based on donor stipulation. During the term of these agreements, changes in the value are recognized based on amortization of discounts and changes in actuarial assumptions.

6. Deferred Fixed Rate Variance

The Institution receives funding or reimbursement from federal government agencies for sponsored research under government grants and contracts. Revenue is recognized as related costs are incurred. The Institution has negotiated fixed rates with the federal government for the recovery of certain fringe benefits and indirect costs on these grants and contracts. Such recoveries are subject to carryforward provisions that provide for adjustments to be included in the negotiation of future fixed rates. The deferred fixed rate variance accounts represent the cumulative amount owed to or due from the federal government. The Institution's rates are negotiated with the Office of Naval Research (ONR), the Institution's cognizant agency.

The composition of the deferred fixed rate variance is as follows:

Deferred Fixed Rate Variance liability, December 31, 2004	$ (129,500)
2005 indirect costs	53,394,255
2004 adjustment	(5,572)
Amounts recovered	(56,380,926)
2005 change	(2,992,243)
Deferred Fixed Rate Variance liability, December 31, 2005	(3,121,743)
2006 indirect costs	60,969,335
2005 adjustment	(135,153)
Amounts recovered	(59,398,365)
2006 change	1,435,817
Deferred Fixed Rate Variance liability, December 31, 2006	$ (1,685,926)

As of December 31, 2006 the Institution has received a cumulative recovery in excess of expended amounts of $1,685,926 which will be reflected as a deduction to future year recoveries. This amount has been reported as liability of the Institution.

7. Bonds Payable

In fiscal 2004, proceeds were received from the offering of the $54,850,000 Massachusetts Health and Educational Facilities Authority (MHEFA) Variable Rate Revenue Bonds, Woods Hole Oceanographic Institution Issue, Series 2004, which were used to repay the MHEFA B Pool loans and are currently being used for campus construction. The bonds contain certain restrictive covenants including limitations on obtaining additional debt, filings of annual financial statements and limitations on the creation of liens. In addition, the Institution agrees that, subject to any governmental restrictions, its fiduciary obligations and limitations imposed by law, it will maintain unrestricted resources at a market value equal to at least 75% of all outstanding indebtedness. The bonds also require a debt service fund to be established. Included in deposits with trust-

ees on the statement of financial position is the market value of the debt service fund of $118,986 and $1,898,102 at December 31, 2006 and 2005, respectively. The Series 2004 Bonds are collateralized by the Institution's unrestricted revenues. The interest rate for the Series 2004 Bonds is variable and set weekly, and at December 31, 2006, the rate was 3.84%. Interest expense for the years ended December 31, 2006 and 2005 was $2,078,593 and $2,184,971, respectively.

The aggregate maturities due on long-term debt at December 31, 2006 are as follows:

Fiscal Year	Principal Amount
2008	$ 1,150,000
2009	1,200,000
2010	1,250,000
2011	1,300,000
2012	1,350,000
Thereafter	48,600,000
	$ 54,850,000

In June 2004, the Institution entered into an interest rate swap agreement, with a term through June 1, 2034. This swap effectively locks in a fixed rate of 3.79% per annum. The agreement has a notional amount of $54,850,000. At December 31, 2006 and 2005, respectively, the market value of the swap agreement amounted to a liability of $1,960,456 and $3,070,826 which is included in accounts payable and other liabilities. The value of the interest rate swap is reflected within accounts payable and other liabilities and nonoperating income/expense in the financial statements. Additionally, the Institution paid interest expense in association with the swap agreement of $221,522 and $867,459 which is reflected as part of the net realized/unrealized gains (losses) on interest swap at December 31, 2006 and 2005, respectively. For internal financial reporting purposes, the realized/unrealized loss on the interest rate swap is reflected in operating expenses, and interest income and interest expense related to the debt is reflected in operating income and operating expenses, respectively.

8. Retirement Plans

The Institution maintains a noncontributory defined benefit pension plan covering substantially all employees of the Institution, a restoration plan for certain senior employees and a supplemental benefit plan for certain other employees. Pension benefits are earned based on years of service and compensation received. The Institution's policy is to fund at least the minimum required by the Employee Retirement Income Security Act of 1974.

The Institution uses a December 31 measurement date for all of its plans.

	Restoration Plan Pension Benefits 2006	2005
Change in benefit obligation		
Benefit obligation at beginning of year	$ 1,640,939	$ 1,319,056
Service cost	-	20,615
Interest cost	70,523	66,098
Plan amendments	-	510,796
Actuarial (gain) loss	68,617	(275,626)
Settlements	(1,746,005)	-
Benefit obligation at end of year	$ 34,074	$ 1,640,939
Funded status	$ (34,074)	$ (1,640,939)
Unrecognized net actuarial loss	44,538	33,773
Unrecognized prior service cost	-	525,887
Net amount recognized	$ 10,464	$ (1,081,279)
Amounts recognized in the statement of financial position consist of		
Accrued benefit liability	$ (34,074)	$ (1,405,839)
Intangible asset	-	324,560
Additional minimum liability	44,538	-
Net amount recognized	$ 10,464	$ (1,081,279)

	Restoration Plan Pension Benefits 2006	2005
Change in net assets attributable to change in additional minimum liability recognition	$ 44,538	$ (98,447)
Information for pension plans with accumulated benefit obligations in excess of plan assets		
Projected benefit obligation	34,074	1,640,939
Accumulated benefit obligation	(34,074)	1,405,828
Fair value of plan assets	-	-
Components of net periodic benefit cost		
Service cost	-	20,615
Interest cost	70,523	66,098
Amortization of prior service cost	-	(44,032)
Recognized actuarial loss	-	46,326
Net periodic benefit cost	$ 70,523	$ 89,007
Weighted-average assumptions used to determine benefit obligations at December 31		
Discount rate	6.00%	5.75%
Rate of compensation increase	4.50%	4.50%
Weighted-average assumptions used to determine net periodic benefit cost for years ended December 31		
Discount rate	5.75%	5.75%
Rate of compensation increase	4.50%	6.00%

As a result of plan amendments made to the Institution's noncontributory defined benefit pension plan in 2005, the Restoration Plan pension benefits had a corresponding change (see qualified plan for a summary of plan amendments).

During fiscal 2006, the main participant in the Restoration Plan terminated employment and elected to receive benefits as a single lump-sum payment. Due to the termination a curtailment of future benefits occurred, which resulted in a curtailment loss of $526,000.

Additionally, as a result of the lump-sum distribution, a settlement loss of $58,000 occurred.

Expected Contributions

The Institution anticipates contributing $34,074 to the Restoration Plan in 2007.

Estimated Future Benefit Payments

The following benefit payments, which reflect expected future service are expected to be paid as follows:

Years	Benefit Payments
2007	$ 34,074

	Qualified Plan Pension Benefits 2006	2005
Change in benefit obligation		
Benefit obligation at beginning of year	$ 214,770,764	$ 177,927,242
Service cost	6,137,340	5,922,793
Interest cost	11,980,814	9,751,495
Plan amendments	-	34,734,251
Actuarial (gain) loss	(483,219)	(3,985,084)
Benefits paid	(16,514,458)	(9,579,933)
Benefit obligation at end of year	$ 215,891,241	$ 214,770,764
Change in plan assets		
Fair value of plan assets at beginning of year	$ 155,921,888	$ 150,616,331
Adjustment to beginning balance for additional fair value of investments	2,605,614	-
Employer contributions	5,242,851	1,927,020
Actual return on plan assets	24,086,255	12,958,470
Benefits paid	(16,514,458)	(9,579,933)
Fair value of plan assets at end of year	$ 171,342,150	$ 155,921,888
Funded status	$ (44,549,091)	$ (58,848,876)
Unrecognized net actuarial loss	7,885,799	27,551,799
Unrecognized prior service cost	15,323,257	17,257,176
Net amount recognized	$ (21,340,035)	$ (14,039,901)
Amounts recognized in the statement of financial position consist of		
Accrued benefit liability	$ (21,340,035)	$ (27,390,061)
Intangible asset	-	13,350,160
Net amount recognized	$ (21,340,035)	$ (14,039,901)
Change in net assets attributable to change in additional minimum liability recognition	$ -	$ (13,956,759)
Information for pension plans with accumulated benefit obligations in excess of plan assets		
Projected benefit obligation	215,891,241	214,770,764
Accumulated benefit obligation	180,744,218	183,311,949
Fair value of plan assets	171,342,150	155,921,888
Components of net periodic benefit cost		
Service cost	6,137,340	5,922,793
Interest cost	11,980,814	9,751,495
Expected return on plan assets	(10,140,183)	(10,689,353)
Amortization of prior service cost	1,933,919	(969,926)
Recognized actuarial loss	2,631,095	2,301,982
Net periodic benefit cost	$ 12,542,985	$ 6,316,991

The Institution has reflected $5,242,851 and $1,927,020 for the years ending December 31, 2006 and 2005, respectively, of the net periodic benefit cost in the operating section of the statement of activities which represents the amount reimbursed through the employee benefit fixed rate as negotiated with the United States Government. The remaining $7,300,134 and $4,389,971 for the years ending December 31, 2006 and 2005, respectively, of net periodic benefit cost is reflected in nonoperating expenses.

	Qualified Plan Pension Benefits 2006	2005
Weighted-average assumptions used to determine benefit obligations at December 31		
Discount rate	6.00%	5.75%
Rate of compensation increase	4.50%	4.50%
Weighted-average assumptions used to determine net periodic benefit cost for years ended December 31		
Discount rate	5.75%	5.75%
Expected long-term rate of return on plan assets	8.00%	8.00%
Rate of compensation increase	4.50%	-

To develop the expected long-term rate of return on assets assumption, the Institution considered the current level of expected returns on risk-free investments (primarily government bonds), the historical level of the risk premium associated with the other asset classes in which the portfolio is invested and the expectations for future returns of each asset class. The expected return for each asset class was then weighted based on the target asset allocation to develop the expected long-term rate of return on assets assumption for the portfolio, net of expenses expected to be paid. This resulted in the selection of the 8.00% assumption.

Effective December 31, 2004, final average compensation for the Plan was frozen and equal to a participant's final average compensation determined as of December 31, 2004. A one year index of 4.5% will be applied to the frozen December 31, 2004 final average compensation for service performed during 2005. In addition, effective December 31, 2004, the minimum lump-sum benefit was amended to eliminate the 8% pay credit for years after 2005. These changes have been reflected in the liabilities as of December 31, 2004.

Effective January 1, 2006, the Qualified Plan was amended. The lump sum (introduced in 1999) will no longer be available on benefits earned after January 1, 2006. Benefits for service from 25 to 35 years introduced in 1999 will be removed. The lifetime benefit payable upon early retirement has changed from a 6% per year reduction to a 5% per year reduction. Minimum lump sum benefits equal to 5% of final average compensation times service replaces the minimum introduced in 1999 of approximately 8%. The preretirement death benefit has been reduced from 100% of the accrued pension benefit to 50% of the accrued pension benefit but not less than the participant's accrued benefit as of December 31, 2006. The 3-year vesting period (introduced in 1999) will change to a 5-year vesting service for employees hired after December 31, 2005. These changes have been reflected in the intangible asset and in the liability as of December 31, 2005.

Plan Assets

The Institution's pension plan weighted-average asset allocations at December 31, 2006 and 2005, by asset category are as follows:

Asset Category	2006	2005
Domestic equity	31%	33%
International equity	30%	24%
Hedge funds	14%	13%
Private equity and venture capital	12%	10%
Bonds (US treasury, corporate, and international)	13%	20%
	100%	100%

The following target asset allocation is used:

Asset Category	Target Allocation
Domestic equity	30%
International equity	20%
Hedge funds	15%
Private equity and venture capital	20%
Bonds (US treasury, corporate, and international)	15%

The primary financial objectives of the assets of the Plan are to (1) provide a stream of relatively predictable, stable and constant earnings in support of the Qualified Plan's annual benefit payment obligations; and (2) preserve and enhance the real (inflation-adjusted) value of assets, over time, with the goal of meeting the anticipated future benefit obligations of the qualified plan.

The long-term investment objectives of the assets of the Plan are to (1) attain the average annual total return assumed in the Plan's most recent actuarial assumptions (net of investment management fees) over rolling five-year periods; and (2) outperform the custom benchmark.

Expected Contributions

The Institution anticipates contributing $6,000,000 to the Qualified Plan in 2007.

Estimated Future Benefit Payments

The following benefit payments, which reflect expected future service are expected to be paid as follows:

Years	Benefit Payments
2007	$ 14,149,039
2008	14,522,695
2009	14,514,332
2010	14,279,220
2011	14,282,551
2012 - 2016	80,360,563

	Supplemental Plan Pension Benefits 2006	2005
Change in benefit obligation		
Benefit obligation at beginning of year	$ 3,595,900	$ 3,922,283
Service cost	55,341	71,554
Interest cost	168,532	186,266
Actuarial loss	(535,722)	(428,816)
Benefits paid	(170,729)	(193,737)
Plan change	-	38,350
Benefit obligation at end of year	$ 3,113,322	$ 3,595,900
Change in plan assets		
Fair value of plan assets at beginning of year	$ -	$ -
Employer contributions	170,729	193,737
Benefits paid	(170,729)	(193,737)
Fair value of plan assets at end of year	$ -	$ -
Funded status	$ (3,113,322)	$(3,595,900)
Unrecognized actuarial (gain) loss	(557,044)	(59,160)
Unrecognized prior service cost	32,731	39,351
Net amount recognized	$(3,637,635)	$ (3,615,709)
Amounts recognized in the statement of financial position consist of		
Accrued benefit liability	$(3,637,635)	$ (3,615,709)
Information for pension plans with accumulated benefit obligations in excess of plan assets		
Projected benefit obligation	$ 3,113,322	$ 3,595,900
Accumulated benefit obligation	2,919,806	3,277,938
Fair value of plan assets	-	-
Components of net periodic benefit cost		
Service cost	$ 55,341	$ 71,554
Interest cost	168,532	186,266
Expected return on earmarked reserves	(190,256)	(192,649)
Amortization of prior year service cost	6,620	315
Recognized actuarial loss	(47,831)	-
Net periodic benefit cost	$ (7,594)	$ 65,486
Actual return on earmarked reserves	$ 200,249	$ 154,541
Weighted-average assumptions used to determine benefit obligations at December 31		
Discount rate	6.00%	5.75%
Rate of compensation increase	4.50%	4.50%
Weighted-average assumptions used to determine net periodic benefit cost for years ended December 31		
Discount rate	5.75%	5.75%
Expected long-term rate of return on plan assets	8.00%	8.00%
Rate of compensation increase	4.50%	4.50%

The accrued supplemental retirement is matched by a "Rabbi" Trust with $7,173,633 and $6,585,207, respectively, as of December 31, 2006 and 2005. An additional accrual of $3,535,998 and $2,969,498 has been established for the excess of the "Rabbi" Trust assets over the accrued supplemental retirement benefits at December 31, 2006 and 2005, respectively. Income earned on the investments earmarked for the supplemental retirement plan amounted to $200,249 and $154,541 for the years ended December 31, 2006 and 2005, respectively.

Expected Contributions

The Institution does not anticipate contributing to the Supplemental Plan in 2007.

Estimated Future Benefit Payments

The following benefit payments, which reflect expected future service are expected to be paid as follows:

Years	Benefit Payments
2007	$ 404,977
2008	490,490
2009	428,540
2010	498,307
2011	482,032
Years 2012 - 2016	1,531,226

On September 29, 2006, the Financial Accounting Standards Board ("FASB") issued Statement No. 158 (FAS 158) which addressed changes to accounting for pensions and other postretirement benefit plans. One of the key requirements of FAS 158 is that the over or underfunded status of postretirement benefit plans must be recognized on the balance sheet. Another key element of FAS 158 is to eliminate an entity's ability to select a date to measure plan assets and obligations that is prior to its year-end balance sheet date. This new standard is effective for nonpublic entities with fiscal year ending on or after June 15, 2007. If FAS 158 had been adopted by the Institution in fiscal 2006, the estimated effect for the retirement plans and other postretirement benefit plans would have been a decrease to unrestricted net assets of approximately $34,000,000 and a corresponding increase to the pension and postretirement benefit liabilities.

9. Other Postretirement Benefits

In addition to providing retirement plan benefits, the Institution provides certain health care benefits for retired employees and their spouses. Substantially all of the Institution's employees may become eligible for the benefits if they reach normal retirement age (as defined) or elect early retirement after having met certain time in service criteria.

	Other Postretirement Benefits 2006	2005
Change in benefit obligation		
Benefit obligation at beginning of year	$ 25,605,822	$ 26,594,502
Service cost	754,521	693,340
Interest cost	1,591,037	1,385,648
Plan amendment	(241,938)	-
Benefits paid	(1,044,207)	(1,440,682)
Actuarial loss	4,626,528	(1,626,986)
Benefit obligation at end of year	$ 31,291,763	$ 25,605,822
Change in plan assets		
Fair value of plan assets at beginning of year	$ 19,323,651	$ 19,042,401
Employer contributions	884,556	683,853
Actual return on plan assets	2,112,483	1,038,079
Benefits paid	(1,044,207)	(1,440,682)
Fair value of plan assets at end of year	$ 21,276,483	$ 19,323,651
Funded status	$ (10,015,280)	$ (6,282,171)
Unrecognized net actuarial loss	21,105,885	18,497,259
Unrecognized prior service cost (credit)	(10,301,779)	(11,426,262)
Net amount recognized	$ 788,826	$ 788,826
Amounts recognized in the statement of financial position consist of		
Prepaid benefit cost	$ 788,826	$ 788,826
Components of net periodic benefit cost		
Service cost	$ 754,521	$ 693,340
Interest cost	1,591,037	1,385,648
Expected return on plan assets	(1,528,948)	(1,475,831)
Amortization of prior service cost	(1,366,423)	(1,340,156)
Recognized actuarial loss	1,434,365	1,271,325
Net periodic benefit cost	$ 884,552	$ 534,326

The Institution has reflected the net periodic benefit cost in operating expenses, as the amount is reimbursed through federal awards.

Weighted-average assumptions used to determine benefit obligations at December 31		
Discount rate	6.00%	5.75%
Weighted-average assumptions used to determine net periodic benefit cost for years ended December 31		
Discount rate	5.75%	5.75%
Expected long-term rate of return on plan assets	8.00%	8.00%

The plan does not provide prescription drug benefits for post-65 retirees; therefore, there is no anticipated Medicare employer subsidy.

	2006		2005	
	Pre-65	Post-65	Pre-65	Post-65
Assumed health care cost trend rates at December 31				
Health care cost trend rate assumed for next year	9.0%	7.0%	10.0%	7.3%
Rate to which the cost trend rate is assumed to decline (the ultimate trend rate)	5.0%	5.0%	5.0%	4.3%
Year that the rate reaches the ultimate trend rate	2015	2012	2014	2013

Assumed health care cost trend rates have a significant effect on the amounts reported for the health care plan. A one-percentage-point change in assumed health care cost trend rates would have the following effects:

	2006 One-Percentage-Point Increase in Trend	2005 One-Percentage-Point Increase in Trend
Effect on total of service cost and interest cost components	$ 424,894	$ 365,522
Effect on year-end postretirement benefit obligation	4,772,870	3,709,195

	One-Percentage-Point Decrease in Trend	One-Percentage-Point Decrease in Trend
Effect on total of service cost and interest cost components	$ (337,831)	$ (292,004)
Effect on year-end postretirement benefit obligation	(3,890,358)	(3,048,587)

Plan Assets

The Institution's postretirement benefit plan weighted-average asset allocations at December 31, 2006 and 2005, by asset category are as follows:

Asset Category	2006	2005
Equity securities	92%	100%
Debt securities	-	-
Cash	8%	-
	100%	100%

To develop the expected long-term rate of return on assets assumption, the Institution considered the current level of expected returns on risk free investments (primarily government bonds), the historical level of the risk premium associated with the other asset classes in which the portfolio is invested and the expectations for future returns of each asset class. The expected return for each class was then weighted based on the target asset allocation to develop the expected long-term rate of return on assets assumption for the portfolio, net of expenses expected to be paid. This resulted in the selection of the 8.00% assumption.

As of January 1, 2006, the required copayments and other features of the underlying medical benefit plan were updated resulting in a decrease in the obligation of $242,000.

Expected Contributions

The Institution anticipates contributing $900,000 to the Retiree Medical Plan in 2007.

Estimated Future Benefit Payments

The following benefit payments, which reflect expected future service are expected to be paid as follows:

Years	Benefit Payments
2007	$ 1,390,120
2008	1,499,706
2009	1,582,826
2010	1,758,612
2011	10,381,810
Years 2012 - 2016	

10. Commitments and Contingencies

The Defense Contract Audit Agency (DCAA) is responsible for auditing both direct and indirect charges to grants and contracts on behalf of the ONR. The Institution and the ONR have settled the years through 2004. The current indirect cost recovery rates, which are fixed, include the impact of prior year settlements. The DCAA issued an audit report on the completed audit of direct and indirect costs for the year ended December 31, 2005 on October 27, 2006. The 2006 costs remain subject to audit. Any adjustments will be recorded in the years they become known.

The Institution through its pooled investments is committed to invest $23,970,000 in certain venture capital and investment partnerships as of December 31, 2006.

The Institution is a defendant in legal proceedings incidental to the nature of its operations. The Institution believes that the outcome of these proceedings will not materially affect its financial position.

11. Related Party Transactions

In fiscal year 2006, the Institution passed through Federal Awards of approximately $437,000 and $794,000 for the years ended December 31, 2006 and 2005, respectively, to subgrantee organizations in which an individual associated with the subgrantee organization is also a member of the Institution's Board of Trustees or Corporation. The Institution also has other transactions such as legal services and other items with organizations where members of the Board of Trustees or Corporation are affiliated with the organizations. Total expenditures for these legal and other transactions were approximately $1,005,000 and $353,000 for the years ended December 31, 2006 and 2005, respectively.

The Institution has loans due from various employees for education advances and computer purchases. The amounts outstanding are approximately $613,000 and $693,000 at December 31, 2006 and 2005, respectively.

Crew members release tie lines as the research vessel *Atlantis* prepares to leave Woods Hole after a rare visit in 2006.

Tom Kleindinst, WHOI


ATLANTIS
WOODS HOLE


IF FOUND CONTACT
WOODS HOLE OCEANOGRA HI
508-548-1401