

WOODS HOLE OCEANOGRAPHIC INSTITUTION



An Introduction



WHOI scientists travel the world for investigations that range from shallow harbors to underwater mountain ranges to deep seafloor trenches.

OCEAN PLANET

Wherever you live, the ocean affects your life. Yet while the oceans cover 70 percent of Earth's surface, they remain largely unexplored, only beginning to reveal their secrets. The oceans play a critical role in creating the weather patterns that allow our crops to grow. They spawn natural disasters from floods and droughts to hurricanes and waterborne epidemics. The oceans are a major source of oxygen, food, energy, and minerals. The diversity of marine organisms, not yet fully known, holds potential for important discoveries with medical and biotechnological applications.



*WHOI researchers study creatures such as the jelly, *Salpa aspera*, both for their own natural history and for an understanding of their role in the wider ocean environment.*

The Woods Hole Oceanographic Institution (WHOI) is a private, nonprofit research and education organization whose scientists, engineers, and students explore the frontiers of knowledge about our planet. In an atmosphere that nurtures innovation, WHOI investigators collaborate to answer questions about dynamic ocean and Earth systems. They develop theories, test ideas, build sea-going instruments, collect data in harsh marine environments—from the steaming tropics to polar ice—and analyze the resulting observations. Their work helps to sustain our environment and improve the quality of life for current and future generations.



John Hayes

The deep submergence vehicle Alvin is recovered after a trip to the “Lost City,” a hydrothermal vent field near the Mid-Atlantic Ridge.



It's a rare moment when all three WHOI research vessels are in port. Clockwise from foreground are Knorr, Oceanus, and Atlantis.

WHOI FACILITIES

Shore-based facilities are located in the village of Woods Hole, Massachusetts, and on the nearby Quissett Campus overlooking Nantucket Sound. The staff of roughly one thousand includes scientists, engineers, technicians, graduate students, postdoctoral scholars, and visiting investigators.

Our ships carry investigators around the globe for diverse studies that range from tracking large and small currents and investigating coastal pollution to studying the volcanic plumbing beneath the seafloor and examining marine animals from whales to microbes.



Tom Kleindinst

Computed tomography equipment assists investigators with studies of a white-sided dolphin that was stranded.

WHOI offers many specialized laboratories with state-of-the-art equipment. The National Ocean Sciences Accelerator Mass Spectrometry facility helps scientists determine the age of marine specimens through radiocarbon dating. The Northeast Regional Ion Microprobe facility offers the capacity to extract information from rocks about geological events that occurred millions or even billions of years ago.

Doug Weisman



Tom Kleindinst

The WHOI accelerator mass spectrometer is part of a national facility used by scientists from all over the world.



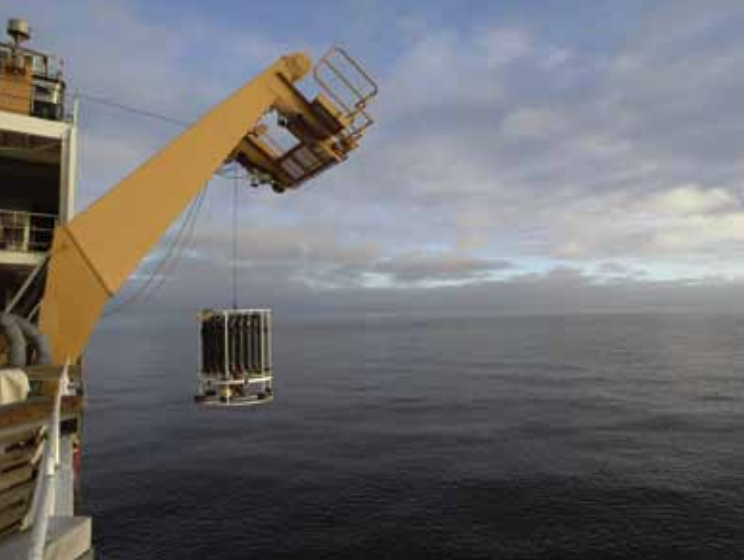
Tom Kleindinst

The Seafloor Samples Laboratory houses thousands of sediment cores, rocks, and other samples collected over the past century.



Mike Carlowitz

The Martha's Vineyard Coastal Observatory collects a wide range of data on sea and atmospheric conditions, and will soon play an integral role in the national Ocean Observatories Initiative.



The conductivity-temperature-depth rosette, or CTD, is the first tool scientists use to assess water properties and currents and to look for plumes from hydrothermal vents.

OCEANOGRAPHIC RESEARCH

Applied Ocean Physics and Engineering

Activities include investigations into environmental fluid mechanics and ocean acoustics, engineering and development of submersible vehicles, observatory systems and sensors, and engineering services.

Biology

Marine biologists study a wide range of organisms, from viruses and bacteria to whales. WHOI's strengths include the distribution, behavior, and ecology of plankton; genomics of marine species; effects of pollutants on marine animals; and the anatomy and behavior of marine mammals.

Geology and Geophysics

Marine geologists and geophysicists study volcanism, the structure and evolution of ocean basins and their margins, earthquakes, hydrothermal processes on the seafloor, and the role of the oceans in past climate change.

Marine Chemistry and Geochemistry

Investigations include chemical exchanges across the boundaries where ocean meets land, seafloor, and atmosphere. Researchers seek insights into ocean processes driven by natural cycles and human-induced changes to our planet.

Physical Oceanography

Physical oceanographers focus on processes that govern the properties and state of the ocean, as well as the interaction of the ocean with the solid earth and atmosphere. Activities in the department include data interpretation, theory development, numerical modeling, laboratory simulation, and development of new observational tools.

Multidisciplinary Efforts

A fertile area of research lies at the interface between disciplines. The **Coastal Ocean Institute** examines issues and questions from rivers to the continental shelf break. The **Deep Ocean Exploration Institute** studies processes that shape the planet's surface, regulate the chemistry of its oceans, and impact its inhabitants. The **Ocean and Climate Change Institute** pursues greater understanding of the ocean's role in shaping the weather and the atmosphere. The **Ocean Life Institute** fosters research on key questions in biology, conservation, and ecology.

At the **Marine Policy Center**, economists and social scientists conduct research that integrates economics, policy analysis, and law with the Institution's basic research. The **Cooperative Institute for Climate and Ocean Research**, a joint venture between WHOI and the National Oceanic and Atmospheric Administration, focuses on the ocean's role in climate variability. The **Woods Hole Center for Oceans and Human Health** explores the risks and remedies posed by the sea.



From assessing ice thickness to measuring the currents flowing under the ice caps, WHOI researchers have pioneered many studies of the waters at both Poles.

EXPLORING THE DEEP



* *DSV Alvin*
Human occupied
submersible
Depth: 14,764 feet
(4,500 meters)



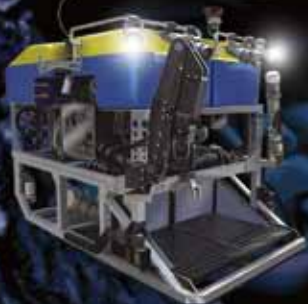
* *ABE*
Autonomous
Benthic Explorer
Depth: 14,764 feet
(4,500 meters)



Sentry
Autonomous
underwater
vehicle
Depth: 16,404 feet
(5,000 Meters)



* *Jason*
Remotely operated
vehicle (ROV)
Depth: 21,325 feet
(6,500 meters)



* Operated by the
National Deep
Submergence Facility.

Autonomous and Hybrid Vehicles

REMUS

Remote Environmental
Monitoring UnitS

Original Depth: 328 feet (100 meters)

Newer REMUS-based vehicles dive as deep
as 19,685 feet (6,000 meters)



Glider

Autonomous underwater vehicle

Depth: 656 feet (200 meters)



SeaBED

Autonomous underwater vehicle

Depth: 6,562 feet
(2,000 meters)



Puma

Autonomous underwater vehicle

Depth: 16,404 feet
(5,000 Meters)



Jaguar

Autonomous underwater vehicle

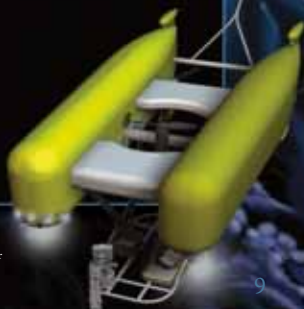
Depth: 16,404 feet
(5,000 Meters)



Nereus

Hybrid remotely
operated vehicle

Depth: 36,089 feet
(11,000 meters)
(in development)





The 274-foot (84-meter) R/V Atlantis is specially outfitted for the vehicles of the National Deep Submergence Facility. It can accommodate 59 people at sea for up to 60 days.

RESEARCH VESSELS AND TOOLS



Knorr, a 279-foot (85-meter) vessel, can take 58 people to sea for up to 60 days.

Tom Kleindinst



Oceanus, at 177 feet (54-meters), is a mid-size research vessel designed to take 31 people to sea for up to 30 days.

Dave Gray



Designed for day trips to coastal waters, 60-foot (18-meter) Tioga has a range of 350 miles. It accommodates ten people on day trips.

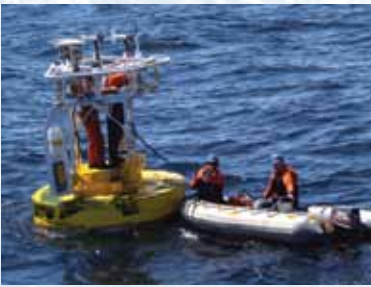
Tom Kleindinst

The success of oceanographers is directly dependent on the tools they use to take measurements and gather samples in this sometimes unpredictable and hostile environment. WHOI's engineers and technicians, like its scientists, are world-renowned for their excellence and innovation. Oceanographers around the globe use instruments developed here.



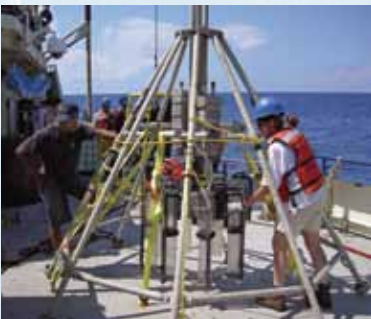
Tom Kleindinst

WHOI researchers developed the electronic hardware and software for the FlowCytobot, which can measure and count the smallest phytoplankton in situ in the ocean.



Patrick Rowe

WHOI mooring specialists not only design, build, and deploy instrument platforms, they return for at-sea house calls and repairs.



Dan McConkle

Processes at the water-sediment interface are measured with this bottom "lander," which collects sediment cores and processes water samples extracted from sediments.



WHOI

The video plankton recorder developed by WHOI biologists offers a window on the environment and behavior of tiny marine animals.



For students, learning extends from the classroom to educational cruises and work at sea.

EDUCATION

Education is an important part of the Institution's mission. A joint graduate degree program with the Massachusetts Institute of Technology enrolls about 140 students working toward master's and doctoral degrees. Postdoctoral scholars come to Woods Hole early in their careers to conduct research with experts in their fields. Summer student and minority fellowships are awarded to undergraduates and recent college graduates to introduce them to oceanographic research. Guest students work with individual researchers in the laboratory or at sea. The Institution also participates in many other projects that benefit K-12 students and their teachers.



WHOI guest students collect samples at a long-term study site for the effects of oil spills on the coastal environment.



Student fellows and visitors don't just observe research; they conduct it and report on it under the watchful eyes of world leaders in ocean sciences.



In the Rinehart Coastal Research Laboratory, students study fluid mixing properties at a rotating table used for geophysical fluid dynamics experiments.



The village of Woods Hole and WHOI research fleet in 1949.

WHOI HISTORY AND HERITAGE

It wasn't until the late 19th century that the name "oceanography" was applied to the science of the sea. The great European research expeditions of the 1800s measured the depths of the ocean and the salinity and temperature of different water masses. These expeditions also recorded the surprising diversity of marine life and characteristics of seafloor rocks and sediments.

In 1929, a National Academy of Sciences committee concluded that it was time to "consider the share of the United States of America in a worldwide program of oceanographic research." The committee's recommendation for establishing a permanent, independent research laboratory on the East Coast to "prosecute oceanography in all its branches" led to the founding in 1930 of the Woods Hole Oceanographic Institution.



The ketch-rigged Atlantis, the Institution's first open-ocean research vessel, sailed more than 640,000 miles for oceanography from 1931 to 1964.

A \$2.5-million grant from the Rockefeller Foundation supported the summer work of a dozen scientists, construction of a laboratory building, and commissioning of a research vessel, the 142-foot ketch *Atlantis*, whose profile still forms the Institution's logo.

WHOI grew substantially to support significant defense-related research during World War II, and later began a steady growth in staff, research fleet, and scientific stature. Over the years, WHOI scientists have made seminal discoveries about the ocean that have contributed to improving our commerce, health, national security, and quality of life.



While working at WHOI, Athelstan Spilhaus developed the rapid temperature measurement device known as the bathythermograph. It was later used during World War II to help U.S. submarines avoid detection.



Beginning with his 1950s work on western boundary currents such as the Gulf Stream, Henry Stommel was one of the world's foremost physical oceanographers. He was a long-time WHOI staff member and scientific associate.

All photos from WHOI Archives

Learn more about WHOI at www.whoi.edu, by visiting the Information Office and Ocean Science Exhibit Center, and by becoming an Associate through a contribution to support research (www.whoi.edu/associates).

Information Office

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Ocean Science Exhibit Center

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Oceanus Magazine

www.whoi.edu/oceanus

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