The processes that shape the Earth and impact society must be investigated over the space and time scales at which they occur. New technologies are needed to provide long-term, high-resolution observations of critical environmental parameters. The Ocean Observatories Initiative (OOI) will build a 25–30 year laboratory on the seafloor, in the water column, and at the ocean surface. It will make available novel platforms for oceanographic discovery and facilitate cutting-edge oceanographic investigations. Ocean measurements from the observatories will be made available in near real time to the world via the web. The National Science Foundation (NSF) funds OOI.

The Endurance Array is under construction now and is expected to be fully operational by the year 2015. The array is operated by Oregon State University and its partner organizations (University of California San Diego, University of Washington, Woods Hole Oceanographic Institution, and Consortium for Ocean Leadership).

The sustained data streams and data products of the OOI will belong to you, whether you are an ocean user, a scientist, a student, an educator, or an interested citizen.
The Ocean Observatories Initiative (OOI) will construct a global, networked infrastructure of science-driven sensor systems to measure the physical, chemical, geological, and biological variables in the ocean and seafloor. Greater knowledge of these variables is vital for improved detection and forecasting of environmental changes and their effects on biodiversity, coastal ecosystems, and climate.

The OOI is a multi-scale observatory, comprising three levels of marine observations (coastal, regional, and global) integrated by an overarching cyberinfrastructure. OOI observatories and subsystems include:

- **Marine Observatories:** Coastal, regional, and global.
- **Cyberinfrastructure:** Systems are integrated through cyberinfrastructure, which provides connectivity to scientists and classrooms and allows the OOI to function as a single, secure integrated network, implemented and operated by University of California, San Diego.
- **Program Management and Integration:** The Consortium for Ocean Leadership in Washington, D.C., is leading the implementation of OOI.

Just as the U.S. academic research fleet is accessible to all investigators, the OOI will begin building an openly accessible network of ocean observatories to facilitate the collection of long time-series data sets needed to understand the dynamics of biological, chemical, geological and physical processes.
The Pacific Northwest coastal observatory, operated by Oregon State University’s College of Earth, Ocean, and Atmospheric Sciences, will place a series of long-term moorings off the Northwest coast called Endurance Array.

The observatory will include a network of long-term moorings, cabled sensors, and autonomous gliders that can be programmed to patrol the near-shore waters. The array will collect a variety of data that will be made available to researchers, educators, and the public.

The Endurance Array will provide a new view into oceanographic phenomena that are key to Pacific Northwest coastal zones and the world. These include:

• River influence upon the coastal zone
• Sustainable marine ecosystems
• Harmful algal blooms (HABs)
• Low-oxygen and dead zones
• Methane seeps and hydrates
• Air–sea exchange and climate variability
• Ocean acidification

Two lines of sensors running from Newport, Oregon, and Grays Harbor, Washington, will each be made up of three fixed platform sites at 25, 80, and 500 m water depth. The 80- and 500-m sites are cabled on the Newport Line; the remaining Endurance Array sites are uncabled. These experiment platforms will support surface moorings, water column profilers and benthic boundary layer sensors and be supplemented by six autonomous gliders.
Data Collection Network

The OOI networked sensor grid will collect ocean and seafloor data at high sampling rates over years to decades. Researchers will make simultaneous, interdisciplinary measurements to investigate a spectrum of phenomena including episodic, short-lived events (tectonic, volcanic, biological, and meteorological), and more subtle, longer-term changes and emergent phenomena in ocean systems (circulation patterns, climate change, ocean acidity, and ecosystem trends).

Coastal Dynamics. The mechanisms creating coastal filaments and jets are complex and not completely understood. The figure above is from Barth et al., 2005.

Ecosystem Dynamics. The shelf ecosystem is influenced by the upwelling of low pH water that is corrosive to skeletons and shells of marine organisms. The figure above is from Feely et al., 2008.

OOI Sensor Distribution by Discipline

The charts below show sensor distribution by primary disciplines of biology, chemistry, physics, chemistry, geology, physics, and engineering. Below-left: how an estimated 48 sensor types will be distributed across disciplines. Below-right: how an estimated 655 individual sensors will be distributed.
Ocean Observatories Initiative

Benefits & Timeline

The goal of the OOI is to install transformational technology in ocean observatories to provide information to ocean users, researchers, policymakers and the public.

Implementation of OOI is the culmination of many years of work by many contributors. Initial deployments will begin in 2013. The OOI is expected to be fully operational by mid-2015. For the most up to date schedule, please visit www.oceanobservatories.org/about/construction-schedule.

Photos. Below, from top: Teachers use images and data to talk about ocean conditions in the K-12 classroom. Policy makers use the data to show long-term trends and make decisions on policy affecting the ocean. Researchers use the data and can apply to use the array for experiments.

Commercial fishermen use the data to fish effectively and monitor ocean conditions. Photo courtesy of Oregon Sea Grant.

Patricia Andersson, Oregon Sea Grant

Pat Kight, Oregon Sea Grant

Paul Olin, California Sea Grant

OOI personnel and Research Vessel Wecoma crew prepare to deploy a test mooring just south of Yaquina Head. Photo by Craig Risien
The College of Earth, Ocean, and Atmospheric Sciences (CEOAS) is a national leader in the study of coastal zones and ocean processes. With over 50 years’ experience in field experiments, theoretical investigations and numerical modeling and simulations, we study all aspects of ocean, land, and atmosphere processes and interactions.

The Hatfield Marine Science Center (HMSC) is Oregon State University’s campus for research, education, and outreach in marine and coastal sciences. Through its partnerships, HMSC improves scientific understanding of marine systems, coastal processes, and resources, and applies this knowledge to social, economic, and environmental issues.

Photos below, clockwise from upper right: R/V Oceanus, the 185-foot research vessel owned by NSF and operated by OSU. Hatfield Marine Science Center, Newport, Oregon. The OSU Ocean Observing Center. Historic CEOAS Administration Building. R/V Elakha, a 54-foot vessel owned by OSU.
Implementing Organizations

The Consortium for Ocean Leadership has selected “implementing organizations” to lead the development, installation, and initial operation of the individual OOI network components.

Coastal and Global Scale Nodes

Woods Hole Oceanographic Institution
Pioneer & Global Arrays

Oregon State University, College of Earth, Ocean, and Atmospheric Sciences
Endurance Array

Scripps Institution of Oceanography, a part of University of California, San Diego
Global Arrays

Regional Scale Nodes

University of Washington, School of Oceanography and Applied Physics Laboratory

Cyberinfrastructure Component

Scripps Institution of Oceanography, a part of University of California, San Diego

Education and Public Engagement

Rutgers, The State University of New Jersey

Funding and Management

National Science Foundation
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Consortium for Ocean Leadership
The Consortium for Ocean Leadership is a Washington, DC-based nonprofit organization that represents 97 of the leading public and private ocean research education institutions, aquaria and industry with the mission to advance research, education and sound ocean policy.

For Further Information

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OOI, Ocean Observatories Initiative
Web: www.oceanobservatories.org