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2009 Annual Report: Ocean Observatories Initiative (OOI)

In 2009, staff from WHOI's Physical Oceanography and Applied Ocean Physics and Engineering departments began work on the National Science Foundation's (NSF's) new Ocean Observatories Initiative (OOI). The project is intended to provide cutting-edge ocean observing infrastructure for the ocean science community.

WHOI, the lead contractor on the Coastal and Global Scale Nodes (CGSN) component of the OOI, has been planning the project since it was awarded in 2007. WHOI is assisted by partners at Oregon State University and Scripps Institution of Oceanography and by Raytheon Integrated Defense Systems.

The successful Final Design Review of the OOI effort occurred in March 2009. The availability of funds from the American Recovery and Reinvestment Act of 2009 brought the start of the project forward from the planned date of July 2010 to September of 2009.

The early start enabled significant planning and preparation in 2009. This was done along with completion of a revised program of preliminary design and development work intended to advance the project between the design review and the start of the project, called a Major Research Equipment and Facilities Construction, or MREFC. The team at WHOI has worked with the support of the WHOI administration to build a sound foundation for the OOI effort—putting in place the staff, and obtaining space at a leased facility on Carlson Lane in Falmouth, Mass. to be used beginning in January 2010. Our partners at OSU and SIO have also worked to set up the teams to support the 5-year period of the MREFC in which the designs are completed, the infrastructure built, and the initial deployments carried out.

A fiber and copper cable on the seafloor on the Juan de Fuca plate off Washington provides bandwidth and power for the Regional Scale Node (RSN) component of the OOI, which will design and field a cabled seafloor and water column observatory. The RSN effort is led by the University of Washington. The CGSN and RSN observatories data will be collected, stored, and made freely available to users by the Cyber Infrastructure (CI) component of the OOI led by the University of California, San Diego. The Consortium for Ocean Leadership is the overall project lead for the OOI.

Coastal and Global Scale Nodes

The CGSN component includes two coastal observatories and four global observatories (Figure 1). The two coastal observatories, the Endurance Array off Oregon and Washington (Figure 2) and the Pioneer Array in the mid-Atlantic Bight (Figure 3), combine moorings and autonomous vehicles. At the Endurance Array and at the Pioneer Array, ocean gliders, which change their buoyancy and 'glide' forward as they rise and fall through the water column, provide the ability to sample across their respective geographic regions. They also may be tasked to specific sampling patterns in response to different events, such as the passage of an eddy through their ocean regions over the passage of a storm across the sea surface. The gliders move slowly, about 1/2 knot, and will be used to sample the regions spanning the moored arrays. At the Pioneer Array, powered autonomous underwater vehicles (AUVs) will also be used to sample, between and close by the moorings of the moored array.

The Endurance Array has two sets of moorings—one set of 6 aligned east-west off Newport, Oregon, with a pair of moorings at 25 m, 80m, and 500m depth; and a similar set off Gray's Harbor, Washington. Each pair has a surface mooring and a subsurface mooring. The subsurface moorings and benthic packages at the 500m and 80m Newport sites are attached to the fiber and copper cable of the RSN.

The Pioneer Array has 10 moorings, a mix of surface moorings and profiling moorings. At the base of some moorings of both the Endurance and Pioneer Arrays structures will be installed on the seafloor to serve as platforms for mounting sensors and, at the Pioneer Array, to provide a place for the AUVs to dock to exchange data and obtain power.

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FIGURE 2. Overview map of the National Science Foundation's Ocean Observatories Initiative (OOI), showing the four global sites and the two coastal sites of the WHOI-led Coastal and Global Scale Nodes (CSGN) component of OOI. (Image courtesy Center for Environmental Visualization, University of Washington)

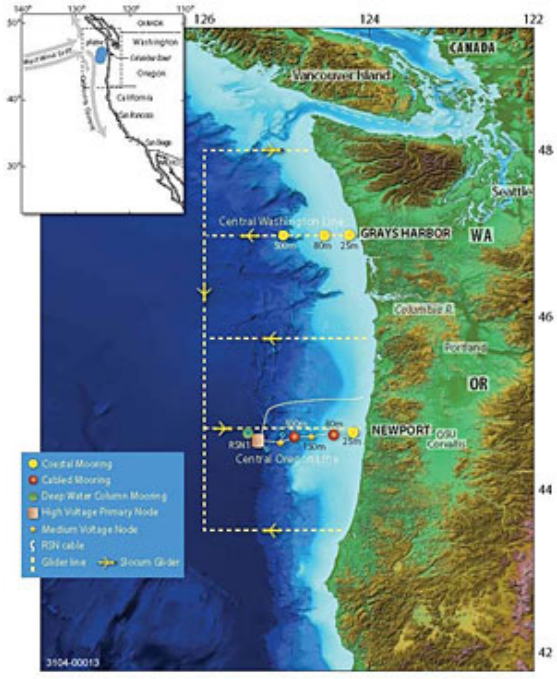

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FIGURE 2. The Endurance Array spans the continental shelf on the west coast off Oregon and Washington, sampling both north and south of the mouth of the Columbia River. A line of moorings at Newport, Oregon and a line of moorings at Gray's Harbor, Washington will be complemented by three ocean gliders. (Illustration courtesy College of Oceanic and Atmospheric Sciences, Oregon State University)

Two of the four global observatories will be deployed in the northern hemisphere: one in the Irminger Sea southeast of Greenland, and one in the Gulf of Alaska in partnership with NOAA's Pacific Marine Environmental Laboratory (PMEL). The other two global observatories will be deployed in the southern hemisphere, one off southern Chile and one in the Argentine Basin.

Each global array (Figure 4) combines the use of four moorings and three ocean gliders. The four moorings include a surface mooring, an adjacent mooring with two profiling instrument packages—one that moves from about 200 m depth to the surface and one that moves from 200 m depth to near the sea floor—and two taut subsurface moorings. The moorings will form a four-sided moored array whose sampling will be complemented by sampling done by three ocean gliders. These gliders will also use acoustic modems to collect data from the subsurface moorings and make it available in near-real time, along with data to be telemetered from the surface mooring and the adjacent profiler mooring.

Across the CGSN observatories the sampling is designed to provide data from the full water column, from the sea surface to the sea floor. More than 680 sensors will be deployed across the CGSN sites, making observations of air-sea exchanges and physical, chemical, biological, and geological variability and processes. As much as possible, data will be made available in near-real time; and all data will be collected by the CI group for public access.

The initial deployments of the CGSN observatories are now scheduled. Deployment times are chosen to provide the wind and wave conditions most conducive for work at sea and to accommodate the planned 12-month turn around schedule for global arrays and 6-month turn around schedules for coastal moorings. Coastal gliders will be serviced every three months.

The gliders of the Endurance and Pioneer Arrays will be deployed first, in mid-2012. The Pioneer Array moorings would be added in 2013 to complete that observatory. Additional elements of the Endurance Array are deployed in turn, the un-cabled moorings of the Newport Oregon line, the Washington mooring line, and finally the cabled elements of the Newport line. The Endurance Array will be completed in 2014; the Argentine Basin observatory will be deployed in the winter of 2012-2013; the Gulf of Alaska and Irminger Sea observatories will be deployed in the summer of 2013; and the observatory off southern Chile will be deployed in the winter of 2013-2014.

Last updated: March 18, 2010

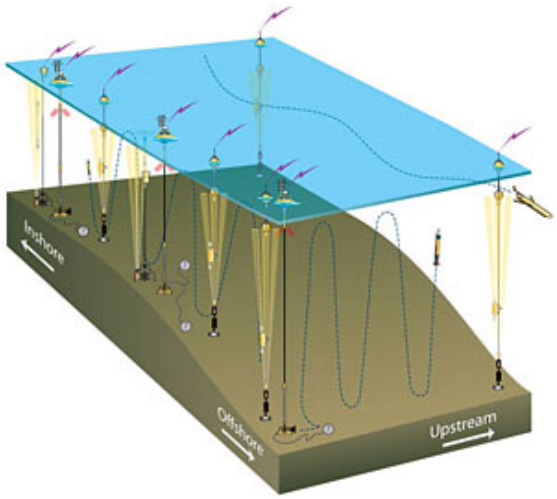

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FIGURE 3. The Pioneer Array, to be deployed in the Mid-Atlantic Bight, will combine moorings, ocean gliders and AUVs to sample a region spanning the continental shelf where depth falls off quickly, changing from 100 m to 500 m deep across the array of 10 moorings. Some of the buoys will generate power and provide that power to AUV docking stations on the sea floor. (Illustration by Jack Cook, Woods Hole Oceanographic Institution)

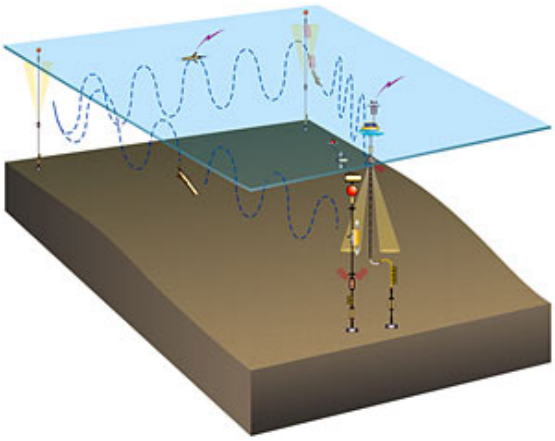

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FIGURE 4. Schematic of the array of four moorings and three gliders to be deployed at the global OOI sites. The surface mooring supports power generation, sampling of surface meteorology and of air-sea exchanges, hardware for data telemetry, and deployment of ocean instruments close to the surface. The profiler mooring will be located about 10 km from the surface mooring and has two profilers: one sampling from below a subsurface float at about 200m to the sea floor, and one that winches itself up to the sea surface from 200 m. The far corners of the moored array, about 50 km away from the surface mooring, have taut subsurface moorings with instruments attached along the mooring lines. The gliders will sample between and around the moorings and will acoustically collect data from the subsurface moorings. (Illustration by Jack Cook, Woods Hole Oceanographic Institution)

Related Links

» Ocean Observatory Initiative (OOI) Web Site

» Woods Hole Oceanographic Institution Will Lead Coastal and Global Observatories Effort
Partnership Moves Closer to Implementation of

Ocean Observatories Initiative
WHOI News Release
September 2, 2009

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