

OCEAN OBSERVATORIES INITIATIVE (OOI)

\$40,000,000
+\$39,660,000 / 11638.8%

Ocean Observatories Initiative Funding

(Dollars in Millions)

| FY 2017 | FY 2018 | FY 2019 | Change over | |
|---------|---------|---------|----------------|---------|
| | | | FY 2017 Actual | Percent |
| Actual | (TBD) | Request | Amount | Percent |
| \$0.34 | - | \$40.00 | \$39.66 | 11639% |

The Ocean Observatories Initiative began in FY 2009 as a MREFC construction project. In FY 2016, OOI transitioned from the MREFC construction effort to the management and operations phase and is now referred to as the OOI Program.

OOI is a networked ocean-focused research observatory with arrays of instrumented buoys, profilers, gliders, and autonomous vehicles within different open-ocean and coastal regions, as well as a cabled array of instrumented platforms and profilers on or above the seafloor over the Juan de Fuca tectonic plate. This networked system of instruments, platforms, and arrays enables researchers to examine complex, interlinked physical, chemical, biological, and geological processes operating throughout the coastal regions and to investigate a spectrum of phenomena and processes including episodic, short-lived events (meteorological, tectonic, volcanic, geological, geophysical, and ecological), and more subtle, long-term changes and emergent phenomena in ocean systems (circulation patterns, climate change, ocean acidity, geophysical events, and ecosystem trends).

The OOI facility provides the public, educators, students, and researchers with: (1) OOI long-term time series data sets (raw data and metadata are processed via conventional algorithms and quality control methods); (2) an in-situ ocean laboratory capability to allow OOI users to submit proposals for development and application of new technologies by connecting their instruments or concepts to the OOI network; and (3) OOI tools that will support undergraduate classroom applications of the OOI, as well as public outreach through informal education. Currently, the OOI delivers data/metadata and education tools to the public via the internet at www.oceanobservatories.org.

As originally conceived, the overarching scientific themes of the OOI spanned six multi-disciplinary domains, and each theme incorporates a multitude of research questions.

- *Ocean-Atmosphere Exchange.* Quantifying the air-sea exchange of energy and mass, especially during high winds, is critical to providing estimates of energy and gas exchange between the surface and deep ocean, and improving the predictive capability of storm forecasting and climate-change models.
- *Climate Variability, Ocean Circulation, and Ecosystems.* As both a reservoir and distributor of heat and carbon dioxide, the ocean modifies climate, and is also affected by it. Understanding how climate variability will affect ocean circulation, weather patterns, the ocean’s biochemical environment, and marine ecosystems is a compelling driver for multidisciplinary observations.
- *Turbulent Mixing and Biophysical Interactions.* Mixing occurs over a broad range of scales and plays a major role in transferring energy, materials, and organisms throughout the global ocean. Mixing has a profound influence on primary productivity, plankton community structure, biogeochemical processes (e.g., carbon sequestration) in the surface and the deep ocean, and the transport of material to the deep ocean.
- *Coastal Ocean Dynamics and Ecosystems.* Understanding the spatial and temporal complexity of the coastal ocean is a long-standing challenge. Quantifying the interactions between atmospheric and terrestrial forcing, and coupled physical, chemical, and biological processes, is critical to elucidating the role of coastal margins in the global carbon cycle, and developing strategies for managing coastal

Major Multi-User Research Facilities

resources.

- *Fluid-Rock Interactions and the Subseafloor Biosphere.* The oceanic crust contains the largest aquifer on Earth. Thermal circulation and reactivity of seawater-derived fluids modifies the mineralogy of oceanic crust and sediments, leads to the formation of hydrothermal vents that support unique micro- and macro-biological communities, and concentrates methane to form massive methane gas and methane hydrate reservoirs. The role that transient events (e.g., earthquakes, volcanic eruptions, and slope failures) play in these fluid-rock interactions and in the dynamics of benthic and sub-seafloor microbial communities remain largely unknown.
- *Plate-Scale, Ocean Geodynamics.* Lithospheric movements and interactions at plate boundaries at or beneath the seafloor are responsible for short-term events such as earthquakes, tsunamis, and volcanic eruptions. These tectonically active regions are also host to the densest hydrothermal and biological activity in the ocean basins. The degree to which active plate boundaries influence the ocean from a physical, chemical, and biological perspective are largely unexplored.

Current Status

The OOI infrastructure is operating, transmitting ocean data to storage, and incrementally delivering processed datasets and data products via the website. Refurbishment and redeployments of the moorings, instruments, and platforms are planned and executed. Data quality management is maturing and the OOI science team is conducting outreach to the science community on the quality assurance/quality control (QA/QC) methods and procedures being used.

The FY 2017 budget of \$340,000 reflected only the incremental support necessary to enable the potential transition of managing institutions associated with the competition for a new operation and management award of the OOI. Operating and managing the OOI currently costs \$50.0 million annually, and was reduced to \$44.0 million during the current recompetition expected to be completed by the end of FY 2018. In FY 2018, NSF decommissioned and removed the Global Array in the Argentine Basin. The Global Array in the Southern Ocean was partially removed and planning is ongoing with an international partner to complete the removal of the remaining components and reinstall the Surface Mooring at their cost in Fall 2018. Operations plans at the FY 2019 Request level of \$40.0 million will be developed in partnership with the awardee and research community to maximize the scientific return of the facility.

Total Obligations for OOI

(Dollars in Millions)

| | FY 2017 | FY 2018 | FY 2019 | ESTIMATES | | | | |
|--------------------------|---------|---------|---------|-----------|---------|---------|---------|---------|
| | Actual | (TBD) | Request | FY 2020 | FY 2021 | FY 2022 | FY 2023 | FY 2024 |
| Operations & Maintenance | \$0.34 | - | \$40.00 | \$40.00 | \$40.00 | \$40.00 | \$40.00 | \$40.00 |

The Consortium for Ocean Leadership (COL) is the current awardee for OOI operations and maintenance. COL has major sub-awardees on the OOI program team to operate and maintain the marine infrastructure, manage the scientific data, and operate the cyberinfrastructure. The University of Washington operates the OOI Cabled Array. Oregon State University currently operates the Coastal Endurance Array. Woods Hole Oceanographic Institution operates the Pioneer Coastal Array as well as the Global Arrays at the two remaining (in FY 2018) OOI global sites. Rutgers University currently manages the OOI data as well as the cyberinfrastructure and education and public outreach. Raytheon Corporation currently provides project management support, systems engineering, and software services for the OOI cyberinfrastructure.

Management and Oversight

- **NSF Structure:** The Division of Ocean Sciences (OCE) in GEO manages OOI operations located within the Integrative Programs Section. The oversight includes the review of observatory metrics and data quality management, as well as integration of the OOI with any new science or infrastructure proposals.

- **External Structure:** The OOI Program has a Science Oversight Committee (SOC) which provides input and guidance internally to COL for OOI infrastructure planning and management. In FY 2017, NSF established the nine member “Ocean Observatories Initiative Facility Board’ (OOIFB) to provide input and guidance regarding the management and operation of the OOI. The OOIFB is independent of the SOC and held several formal meetings during FY 2017 and FY 2018.
- **Reviews:** In December 2017, NSF conducted a review of the OOI Glider Operations Program component. NSF is considering an Operations and Management review in calendar year 2018 before the planned closeout of the COL cooperative agreement in September 2018.

Operations Costs

Operations and Management in support of scientific research began in FY 2013 with the deployment of the first OOI instruments. The associated costs have been and will continue to be supported by OCE, with temporary support from the GEO’s Division of Integrative and Collaborative Education and Research from FY 2015-2017. Support for research utilizing observatory data will be through the standard NSF proposal submission process to existing science programs in OCE, however, because the data is freely available over the internet, researchers around the world will have access to the unique data sets OOI is producing regardless of the source of their support.

Education and Outreach

The OOI website and cyberinfrastructure provides an education portal to enable undergraduate level tools for education. The internal OOI SOC actively conducts outreach activities regarding the ocean science datasets to researchers, public, and education users.

Renewal/Recompetition/Termination

The OOI Operations and Management cooperative agreement with COL has been extended until September 30, 2018. A re-competition for the award was initiated in FY 2016 and is planned for completion by September 30, 2018.