OCEAN OBSERVATORIES INITIATIVE

$31,000,000
-$23,980,000/ -43.6%

Ocean Observatories Initiative

(Dollars in Millions)

FY 2016 Actual	FY 2017 (TBD)	FY 2018 Request	Change over FY 2016 Actual Amount	Change over FY 2016 Actual Percent
$54.98	-	$31.00	-$23.98	-43.6%

The Ocean Observatories Initiative (OOI) began in FY 2009 as a Major Research Equipment and Facilities Construction (MREFC) project. In FY 2016, OOI transitioned from the MREFC construction effort to the management and operation 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. The OOI delivers all data/metadata and education tools to the public via the internet at www.oceanobservatories.org.

The overarching scientific themes of the OOI span 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 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 being 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 OOI Management & Operation (M&O) budget for FY 2016 was $54.98 million.

The planned FY 2018 budget is $31.0 million. The scope of OOI activities at this funding level will be determined through the ongoing re-competition for a new management and operations award as described below in the Renewal/Recompetition/Termination section. The solicitation requests submission of proposals which include the costs for all parts, labor, equipment, ship time, and cyberinfrastructure to manage, operate, and maintain the OOI. Planned OOI Program adjustments include suspension of all Global Array operations and streamlined cyberinfrastructure and management oversight. Deployed Coastal OOI instruments are visited and replaced twice per year.

Total Obligations for OOI

(Dollars in Millions)

	FY 2016 Actual	FY 2017 (TBD)	FY 2018 Request	ESTIMATES[1] FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Operations & Maintenance	$55.00	-	$31.00	$31.00	$31.00	$31.00	$31.00	$31.00

[1] Outyear funding estimates are for planning purposes only.

The Consortium for Ocean Leadership (COL) is the current awardee for OOI operations and maintenance, but has publicly announced they will not be part of the recompetition. COL has major sub-awardees on the 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 operates the Coastal Endurance Array. Woods Hole Oceanographic Institution operates the Pioneer Coastal Array as well as the Global Arrays at the four OOI Global sites. Rutgers University manages the OOI data as well as the cyberinfrastructure and Education and Public Outreach. Raytheon Corporation 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 the Directorate for Geosciences (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 Ocean Leadership 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.
- Reviews: In December 2016, NSF conducted a review of the OOI Cyberinfrastructure component. NSF is considering a management and operations review in calendar year 2017 before the award end date of December 31, 2017.

Operations Costs

Management and operations 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 (ICER) from FY 2015-FY 2017 (now completed). 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 infrastructure provides an education portal to enable undergraduate level tools for education. The internal OOI Science Oversight Committee actively conducts outreach activities regarding the ocean science datasets to researchers, public and education users.

Renewal/Recompetition/Termination

The OOI management and operation cooperative agreement with COL ends December 31, 2017. A re-competition for the award was initiated in FY 2016 and is planned for completion by December 31, 2017.