National Science Foundation (NSF) Program Plan
American Recovery and Reinvestment Act of 2009

Major Research Equipment and Facilities Construction (MREFC) Recovery Plan

CFDA Number: 47.082

Objectives

Program Purpose

The Major Research Equipment and Facilities Construction (MREFC) Program aims to build a new national telescope: the Advanced Technology Solar Telescope (ATST); build a new multipurpose research ship to operate in seasonal sea ice and open ocean waters in the Bering Sea and the Gulf of Alaska: the Alaska Region Research Vessel (ARRV); and create an integrated observatory network to study the complex, interlinked physical, chemical, biological, and geological processes operating throughout the global ocean: the Ocean Observatories Initiative (OOI).

The **ATST** will enable the study of solar activity in unprecedented detail. Determining the role of magnetic fields in the outer regions of the Sun is crucial to understanding the solar dynamo, solar variability, and solar activity, including flares and mass ejections that can affect civil life on Earth. The telescope will also contribute to our improved understanding of space weather, which is critical to the safety of astronauts in space, or on the Moon, and it will also enhance greatly our understanding of the activity and variability of solar-type stars.

The **ARRV**, which will replace the R/V *ALPHA HELIX*, is the first new NSF ship built since the early 1980s and is a major federal contribution to academic fleet renewal. The anticipated operational lifetime of the ARRV is at least 30 years. This 242-foot, multipurpose research ship is designed specifically to operate in seasonal sea ice and open ocean waters near Alaska, including the Chukchi, Beaufort, and Bering Seas as well as the eastern Arctic. To do so, the hull will be ice-strengthened to American Bureau of Shipping (ABS) ice classification standards. The ARRV will provide a much needed, technologically-advanced oceanographic platform to enable multidisciplinary teams to conduct field research at the ice edge and in seasonal sea ice up to 3.9 feet thick. It is designed to have a minimal influence on its own environment, including low underwater radiated noise (URN) for fisheries and acoustics research, and reduced stack emissions to enable atmospheric research.

OOI is an integrated observatory network that will provide the first major new way of studying the oceans since environmental satellites were launched. Deployed in critical parts of the U.S. and global coastal ocean, its 24/7 telepresence will capture climate, carbon, ecosystem, and geodynamic changes on the time scales on which they occur,

rather than when research vessels are able to be in the area. The OOI will dramatically alter ocean science by providing the means to collect unique, sustained, time-series data sets that will enable researchers to study complex, interlinked physical, chemical, biological, and geological processes operating throughout the global ocean. The three elements of the OOI are: deep-sea buoys with designs capable of withstanding harsh conditions deployed in the Gulf of Alaska, the Irminger Sea, the Southern Ocean, and the Argentine Basin; regional electro-optical cabled nodes at sites where extensive methane venting creates gas hydrates and/or sustains chemosynthetic vent communities off the Pacific Northwest coast; and an expanded network of fixed and relocatable coastal observatories off the East and West coasts. A cutting edge, open access, user-enabling cyberinfrastructure will link the marine components and facilitate experimentation using assets from the entire OOI network.

Public Benefits

ATST: As a national facility, ATST would enable training of the next generation of solar physicists and instrument builders at the undergraduate and graduate levels. ARRA funding for ATST will support a larger project team (staff retentions and new hires) at the National Solar Observatory and the issuance of large contracts for the construction of the telescope and its building, support facilities, as well as the procurement of components for its complex optical systems and instruments. As the first new large solar telescope constructed in nearly 30 years and because of the new range of scientifically compelling questions that ATST can address, its construction, which still requires National Science Board approval, is expected to help rejuvenate the solar research community in U.S. universities.

ARRV: The vessel will provide a technologically-advanced, safe, and highly effective oceanographic platform to enable multidisciplinary teams to conduct field research at the ice edge and in seasonal sea ice. The Bering Sea and the Gulf of Alaska sustain more than half of the total annual national fish catch and supports one of the most productive marine ecosystems in the world, as well as rich and varied marine mammal populations. The Alaska region is also seeing significant impacts from climate change. Perennial sea ice has been estimated to be decreasing by about nine percent per decade, potentially leading to a summer ice-free Arctic Ocean by the end of the century or even sooner. The ARRV will provide scientific access to these remote and inhospitable waters surrounding Alaska that are of such great national and international importance. The ARRV will have many advanced capabilities including a modern suite of satellite communications to link the ship to educational facilities ashore giving them virtual access to the Arctic. With 26 dedicated science berths, the ARRV will be able to accommodate over 500 researchers and students annually while spending as many as 300 days at sea.

OOI: Recent science advances have highlighted the role of the ocean in climate change, the impact of carbon cycling on ocean acidification and ocean carbon sequestration, and the degradation of coastal marine ecosystems. These advances and the national attention they have garnered emphasize the multiple stakeholders in OOI. Additionally, the magnitude and mechanisms of air-sea exchange, the fundamental processes that control

turbulent ocean mixing on all scales and the biophysical consequences thereof, and the impact of plate tectonics on the sea floor and society underpin these topics. These science drivers are also part of a national ocean research effort, the Ocean Research Priorities Plan, which provides a framework for research investments to advance our understanding of critical ocean processes that tie to societal need. The OOI will also include educational infrastructure that will support "free choice" learning in a variety of both physical and virtual settings with a focus on raising public awareness about ocean science, climate change, and enabling technology, while also supporting online post-secondary career, technical, and educator training programs.

Measures

ATST: Keep negative cost and schedule variance to less than 10 percent while monitoring percentage of as built-capacity as compared to the final, construction-ready design.

Explanation:

This measure has two components:

- <10% negative cost and schedule variance. Earned Value Management (EVM), a widely accepted project management tool for measuring progress, is used for this goal.
- Monitoring percentage of as-built capability as compared to the final, construction-ready design. This supplements the EVM target noted above by establishing a formal process for monitoring how much (if any) scope is eliminated from projects in order to adhere to the cost & schedule target. The baseline for this analysis is the scope of the project when the award is initiated following National Science Board approval. This information will be included in monthly reports provided to NSF Senior Management, who will then determine if the eliminated scope jeopardizes the overall viability of the project.

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Schedule and Milestones

Advanced Technology Solar Telescope (ATST)
Annual Safety Review – May 1, 2009
Final Design Review – May 18-22, 2009
Construction Funding Awarded – December 31, 2009
Telescope Mount RFP issued – March 1, 2010
Mirror Blank RFP Issued – April 1, 2010
Annual Safety Review – May 1, 2010
Telescope Mount Contract Placed – September 15, 2010
Mirror Blank Contract Awarded – September 30, 2010
Mirror Polish RFP Issued – September 30, 2010

Alaska Region Research Vessel (ARRV)
Shipyard Inspections: June 22 – July 3, 2009
Shipyard "Best Value" Selection: October 15, 2009
Shipyard Contract Award: NLT December 31, 2009
Complete Design Transfer to Shipyard: March 31, 2010
Begin Construction (Keel Laying): May 1, 2010
Begin Module Assembly: July 1. 2010
Begin Auxilliary System Installations & Noise Treatments: September 1, 2010

Ocean Observatories Initiative (OOI)
Primary Infrastructure Cable Contract Award – September 30, 2009
Education and Public Engagement Implementing Organization (IO) award – December 31, 2009
Semi-annual External Performance Review – April 30, 2010
Medium Voltage Converter (MVC) Readiness Decision – June 30, 2010
Prototype Testing of Extension Cables and Cable Terminations Complete – June

Projects and Activities

ATST: ARRA funds will be used to partially fund the construction of the four-meter telescope designed to study the causes of solar activity The project scope includes the construction of the telescope and its enclosure building, support facilities, and an initial complement of scientific instruments. ARRA funds provide $146M of a projected total cost of $250-270M.

ARRV: ARRA funds will be awarded solely to the University of Alaska, Fairbanks for a single, fixed-price subcontract with a U.S. shipyard for ship construction. The ARRA funds are only $148M of the total project coast of $199.5M, which includes the base shipyard contract price plus change orders during construction.

OOI: ARRA funds provide $106M out of the total project cost of $386.4M, and will include completing the first release of cyberinfrastructure subsystems; awarding the primary infrastructure cable contract, conducting key portions of prototyping activities for the secondary cable infrastructure; developing shore station management systems; conducting key production engineering activities for essential water column components, including hybrid and winched profilers; conducting critical project management, systems engineering, and environmental compliance activities; and supporting implementation of education and public engagement implementing organization.

Review Process

The three projects selected for ARRA funding are subject to the oversight process described in NSF's Large Facilities Manual. (See http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf0738). During construction, NSF exercises oversight of each project through a variety of mechanisms. In addition to normal day-to-day discussions with awardees, each project reports at least monthly to the cognizant NSF Program Officer on its technical and financial status relative to a baseline schedule utilizing earned-value management techniques. NSF program staff conduct site visits throughout the construction period, and periodic external reviews are held at least annually that utilize panels of outside experts to advise NSF on a wide variety of topics. Review topics may include, but are not limited to, technical performance, adherence to cost and schedule baselines, and awardee management. Each project follows a documented change control procedure, and each award contains terms and conditions that require NSF concurrence for major changes to a project's intended scope, budget, or schedule. The progress of each project is closely monitored, and cost and schedule information is compiled and reported monthly to NSF senior management. As an additional mitigation measure, NSF will conduct a review of the business systems of each awardee within the duration of the award period to monitor compliance with administrative requirements for grants and agreements (Chapter 2, Part 215 of OMB Circular A-110).

Cost and Performance Plan

NSF monitors the progress of construction of the MREFC facilities through various mechanisms such as site visits and reviews by external panels of experts. Review topics may include, but are not limited to, technical performance, adherence to cost and schedule baselines, and project management. Each project follows a documented change control procedure, and each award contains terms and conditions that require NSF concurrence for major changes to a project's intended scope, budget, or schedule. The progress of each project is closely monitored, and grantees report to NSF on a monthly basis. NSF will make information from grantees available to the public annually before the end of the first quarter of the subsequent fiscal year. For example, information on progress made during FY 2009 will be made available by December 31, 2009. The information will be made available on NSF's Recovery website. (www.nsf.gov/recovery).

Energy Efficiency Spending Plans: NSF will encourage relevant ARRA award recipients to consider sustainability, energy efficiency, and environmental impact when undertaking major renovations, repairs, and alterations. NSF will point to the energy efficiency and green building requirements (in statute and executive order) for Federal infrastructure as a possible model for the recipient's infrastructure investments.

Program Plan Award Types: Cooperative Agreements or Contracts

Recipient Applicant Type
Other Private Institution/Organizations
Other Public Institution/Organizations

Beneficiary Type: U.S. Citizen