

REGIONAL CLASS RESEARCH VESSELS (RCRV)**\$5,000,000****Appropriated and Requested MREFC Funds
for the Regional Class Research Vessel Project**

(Dollars in Millions)

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021 Request	FY 2022 Request	FY 2023 Request	Total Project Cost
Previous Authorized Total Project Cost	\$121.88	\$105.00	\$127.09	-	-	-	-	\$353.97
Current Authorized Total Project Cost (COVID-19)	-	-	-	-	-	-	-	-
Preliminary Estimate of COVID-19 Impact	-	-	-	-	-	5.00	15.00	20.00
Estimate prior to Rebaseline	-	-	-	-	-	\$5.00	\$15.00	\$373.97

Brief Description

Prior to the COVID-19 pandemic, the RCRV project had been planned within an NSB-authorized Total Project Cost (TPC) of \$365.0 million. In FY 2017, \$121.88 million was appropriated to facilitate the construction of three vessels followed by \$105.0 million in FY 2018 and \$127.09 million in 2019. To date, the measurable impacts of COVID-19 on the RCRV project have been relatively small, but future impacts are likely. In December 2020, the NSF Director increased the authorized Total Project Cost from the NSB-authorized value of \$365.0 million to \$375.0 million to prepare for COVID-19 impacts that reduced the efficiency of the construction effort and increased the time to completion. The FY 2022 Request of \$5.0 million to account for pandemic impacts would increase the total appropriated RCRV funds to \$358.97 million, which is still \$16.03 million below the authorized TPC.¹ This narrative provides a history and project status.

Scientific Purpose

The 2015 National Academies of Sciences, Engineering, and Medicine (the National Academies) report, *Sea Change: 2015-2025 Decadal Survey of Ocean Sciences*,² described eight high-priority science questions that will be supported by the RCRVs in U.S. coastal waters:

1. What are the rates, mechanisms, impacts, and geographic variability of sea level change?
2. How are the coastal and estuarine ocean and their ecosystems influenced by the global hydrologic cycle, land use, and upwelling from the deep ocean?
3. How have ocean biogeochemical and physical processes contributed to today's climate and its variability, and how will this system change over the next century?
4. What is the role of biodiversity in the resilience of marine ecosystems and how will it be affected by natural and anthropogenic changes?
5. How different will marine food webs be at mid-century? In the next 100 years?
6. What are the processes that control the formation and evolution of ocean basins?
7. How can risk be better characterized and the ability to forecast geohazards like mega-earthquakes, tsunamis, undersea landslides, and volcanic eruptions be improved?
8. What is the geophysical, chemical, and biological character of the seafloor environment and how does it affect global elemental cycles and understanding of the origin and evolution of life?

The RCRV was designed to support research in each of those topics and to meet the needs of researchers for work in coastal zones in support of biological, chemical, physical, and geological oceanography. The vessels will be capable of precise station-keeping for water column and sediment sampling, as well as supporting the use of remotely operated and autonomous vehicles. They will also enable virtual

¹ The funding profile for RCRV may change, pending possible allocation of American Rescue Plan funds.

² The National Academies. *Sea Change: 2015-2025 Decadal Survey of Ocean Sciences*, 2015. www.nap.edu/read/21655/chapter/1

participation of shore-based scientists using telepresence/data presence technology, greatly expanding the potential user base.

RCRV is the NSF-supported contribution to right-sizing and modernization of the U.S. Academic Research Fleet (ARF). It is expected that an ARF that includes three RCRVs will have sufficient usage to support efficient operation, while meeting regional demands. Each RCRV is expected to operate approximately 200-250 days per year, which is consistent with the optimal utilization for comparable ships in the ARF. Coordination of ARF scheduling is supported by the University National Oceanographic Laboratory System (UNOLS).

Baseline History

The RCRV project is a major component in the plan for modernizing the ARF.³ In 2001, a report from the Federal Oceanographic Facilities Committee documented the need for Regional Class vessels. In 2004, NSF and the Naval Sea Systems Command (NAVSEA) entered into an interagency agreement that resulted in two candidate designs for Regional Class ships. In 2007, the Federal Oceanographic Fleet Status Report identified the need for NSF-built Regional Class vessels to meet future science demand. In 2009, another National Academies report, *Science at Sea*, described the desirable characteristics of a modern Regional Class vessel. These characteristics and other science community factors were considered by the review panel when the preferred NAVSEA design was later down selected. In 2012, NSF issued a solicitation for the refreshed design and potential construction of RCRV. Oregon State University (OSU) was selected and received the award in 2013. Input from external review panels, the University-National Oceanographic Laboratory System, and the National Academies Sea Change report was received during the period 2013 to 2015 and informed the final decision to pursue construction. Sea Change recommended constructing only two of the originally planned three RCRV vessels, but Congress ultimately appropriated funding to build all three.

In 2015, the National Science Board authorized inclusion of funds to initiate construction for the RCRV project in future budget requests at the NSF Director's discretion. The Final Design Review was conducted in December 2016 and the panel recommended to NSF that the project was ready to advance to the construction stage. OSU subsequently awarded a contract for construction to Gulf Island Shipyards, Houma, LA for the first vessel with options for two more. NSF plans to fund the operations of the RCRVs within the overall projected budget for the ARF, leveraging savings from fleet rightsizing through the retirement of older and less capable vessels.

Project Status

OSU is managing the construction and transition to operations through a cooperative agreement with NSF, which encompasses the entire project, including tests and trials. The project is divided into four distinct phases, each to be funded through separate cooperative support agreements, with award of each phase contingent upon successful completion of the prior phase. These phases are:

Phase I: Project Refresh - **Complete**

Phase II: Shipyard Selection - **Complete**

Phase III: Construction – **In progress**

Phase IV: Transition to Operations – **Estimated Fall 2022**

The project completed Phase II in CY 2017, during which bids for construction of RCRV were solicited

³ National Ocean Council. Federal Oceanographic Fleet Status Report, 2013. obamawhitehouse.archives.gov/sites/default/files/federal_oceanographic_fleet_status_report.pdf

and evaluated from U.S. shipyards. The project is now in Phase III construction. Keel-laying for the first RCRV, named R/V *Taani*, was completed in November 2018, for the second RCRV, name to be determined, in May 2019, and for the third RCRV, named R/V *Gilbert R. Mason*, in March 2020.

The RCRV project includes up to one year of sea trials and science equipment testing/trials for each vessel after delivery from the shipyard to ensure readiness to conduct science operations safely and efficiently before entry into the ARF. This will mark the beginning of Phase IV Transition to Operations. R/V *Taani*, the first ship in the Class, is currently scheduled to be delivered in Fall 2022 and will likely begin operations in Fall 2023. The project is planning a six-month stagger between vessel deliveries, with the projection that the second RCRV will enter the ARF in early 2024 and R/V *Gilbert R. Mason* will enter in late 2024.

Summary of COVID-19 Impacts

The realized impacts to the project cost, scope, and duration resulting from COVID-19 during 2020 include a delay in delivery of the first vessel, R/V *Taani*, and slightly lesser delays for the other two vessels. In October 2020, OSU estimated likely COVID-19-specific impacts through 2021 for the entire three-ship build of \$14.05 million and six months. Depending on the magnitude of the impacts in 2021, NSF may further adjust the TPC, as necessary.

Governance Structure and Partnerships

NSF Governance Structure

The RCRV project is overseen by the Division of Ocean Sciences (OCE) as part of the Ship Acquisition and Upgrade Program. OCE provides overall interdisciplinary science community guidance and oversight, while the administrative location of the RCRV project in the Integrative Programs Section promotes science facilities support expertise and coordination. Within NSF, RCRV project oversight is managed by a dedicated Program Officer with support from a secondary Program Officer who has experience with other OCE facilities. Cross-Foundation coordination is provided by an Integrated Project Team (IPT). The IPT includes staff from the Large Facilities Office, Cooperative Support Branch, Division of Institution and Award Support, Office of the Director, Office of the General Counsel, Office of the Assistant Director for Geosciences, and Office of Legislative and Public Affairs.

External Governance Structure

The RCRV project is funded through a series of agreements with OSU to manage the design refresh (conceptual, preliminary, and final designs), construction, testing and trials, and eventual operation of the first RCRV for the scientific community. The Principal Investigator for the award is the Project Manager (PM), who reports directly to the OSU Dean of the College of Earth, Ocean, and Atmospheric Sciences. The PM interacts directly with the NSF Program Officer and manages the RCRV administrative staff. The project scientist is a co-principal investigator for the award. The PM manages the RCRV project team including the risk manager, earned value management and schedule specialists, contracting officer, and OSU shipyard representative (SR). The SR in turn manages the naval architect and engineering contract and oversees the OSU shipyard staff and marine science technical advisors. The RCRV Science Oversight Committee (SOC), with regional representation, multidisciplinary expertise, and independent science representatives conducting research in mission areas supported by federal stakeholders (e.g., NSF, Office of Naval Research, and National Oceanic and Atmospheric Administration) will be active through all project phases. The SOC provides guidance to the OSU RCRV project team through the PM and/or the NSF Program Officer.

Partnerships and Other Funding Sources

NSF is the sole sponsor of RCRV construction to provide three ships for inclusion in the ARF. ARF vessels support the needs of all federal stakeholders who conduct oceanographic research, particularly NSF, the National Oceanic and Atmospheric Administration and the Office of Naval Research. Other users are

Major Research Equipment and Facilities Construction

granted access to ARF ships for research purposes, and all users pay the same daily rates. NSF is expected to support approximately 70 percent of RCRV utilization. NSF intends to make separate awards to each RCRV-operating institution.

Cost and Schedule

Total Funding Requirements for RCRV

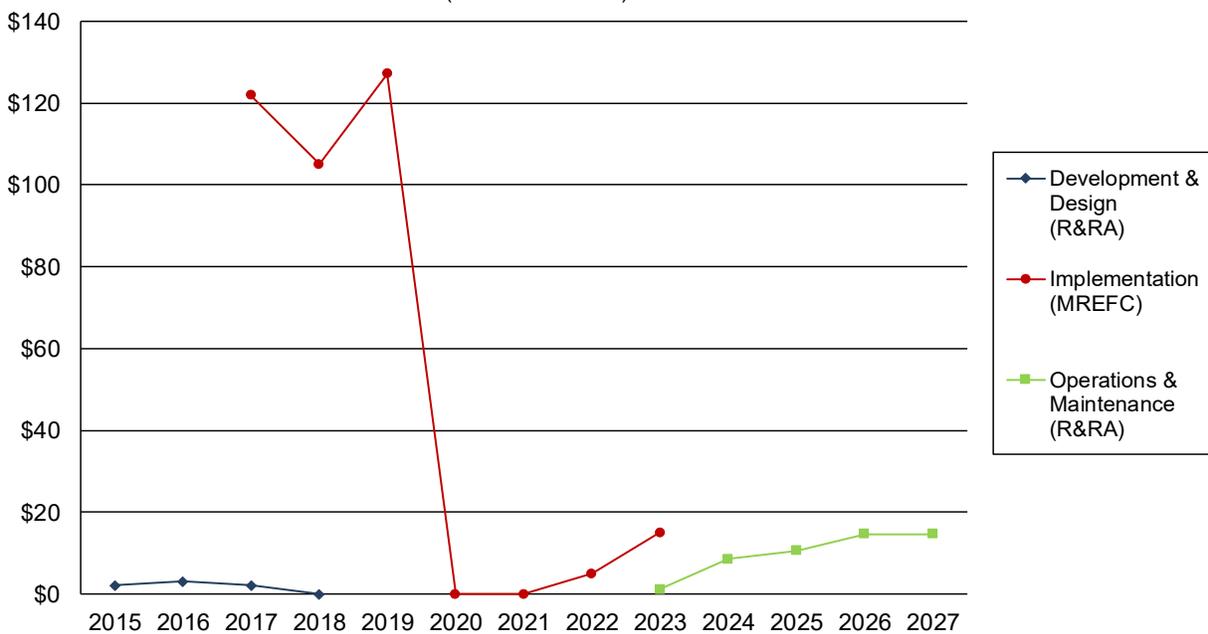
(Dollars in Millions)

	Prior Years	FY 2020 Actual	FY 2021 Estimate	FY 2022 Request	ESTIMATES				
					FY 2023	FY 2024	FY 2025	FY 2026	FY 2027
R&RA:									
Development & Design	\$11.39	-	-	-	-	-	-	-	-
Operations & Maintenance		-	-	-	1.23	8.58	10.58	14.70	14.70
Subtotal, R&RA	\$11.39	-	-	-	\$1.23	\$8.58	\$10.58	\$14.70	\$14.70
MREFC:									
Implementation ¹	\$353.97	-	-	\$5.00	\$15.00	-	-	-	-
Subtotal, MREFC	\$353.97	-	-	\$5.00	\$15.00	-	-	-	-
TOTAL REQUIREMENTS	\$365.36	-	-	\$5.00	\$16.23	\$8.58	\$10.58	\$14.70	\$14.70

¹ Includes \$11.0 million carried forward into FY 2021. Outyear estimates are for planning purposes only.

RCRV Funding, by Stage

(Dollars in Millions)



Total R&RA funding from FY 2017 to FY 2019 for RCRV design was \$11.39 million. Total MREFC funding appropriated to support construction is currently \$353.97 million.

An additional \$5.0 million in FY 2022 MREFC funding is requested for NSF-held management reserve due to known construction delays from COVID-19, which is an unforeseen event that cannot be covered by budget contingency per NSF policy. The out-year funding estimate in FY 2023 is the current estimate of the amount needed to address the remaining impacts due to COVID-19; it will be updated and fully documented as part of the FY 2023 request.

Future Operations Costs

Annual ship operations costs are well understood after several decades of experience with vessels of all classes in the U.S. Academic Research Fleet. OSU developed an estimate for the first year of operations beginning in 2023 assuming a robust but reasonable operating schedule of 200 days per year. OSU estimates each RCRV will cost \$7.0 million to operate in its first full year, resulting in a rate of approximately \$35,000 per day, including technician support. This is comparable to the operating cost of current vessels after applying the appropriate multipliers for size and complexity. NSF supports approximately 70 percent of the use of the ARF, which suggests RCRV is likely to cost NSF approximately \$1.23 million in FY 2023 for three months of operations of the R/V *Taani*. OSU is the selected operator for R/V *Taani*. The ultimate annual cost of approximately \$14.70 million for operating three RCRVs will be balanced by cost savings from vessel retirements elsewhere in the ARF. The East Coast Oceanographic Consortium, whose members include the University of Rhode Island, the Woods Hole Oceanographic Institution, and the University of New Hampshire School of Marine Science and Ocean Engineering, along with 13 associate members, were selected to operate the second RCRV. The Gulf-Caribbean Oceanographic Consortium, whose members include the University of Southern Mississippi, the Louisiana University Marine Consortium, and 15 associate members, were selected to operate the third RCRV (R/V *Gilbert R. Mason*).

Reviews

- **Proposal Review:** In 2012, NSF issued Solicitation 12-558, Construction of Regional Class Research Vessels, which resulted in the selection of OSU as the lead institution for construction and for operation of the first vessel.
- RCRV proceeded through the standard NSF processes that included a Conceptual Design Review (December 2013), Preliminary Design Review (August 2014) and Final Design Review (December 2016). The Final Design Review (FDR) ensured that anticipated project costs remained realistic and that no unforeseen events had arisen prior to the start of construction during FY 2017. The FDR Panel recommended that the project advance to the Construction Stage.
- **Annual Progress Review:** The first construction stage review was conducted in August 2018. Progress towards Design Verification and Transfer and OSU's management of the shipyard contract was evaluated. The review panel expressed confidence that the OSU Team was well qualified, had extensive relevant experience in ship acquisition, had established a positive, professional working relationship with Gulf Island Shipyards, and was capable of delivering up to three RCRVs, within budget and on schedule, that would meet science mission requirements. Quarterly Management Reviews are conducted by OSU at the shipyard with NSF staff in attendance. The February 2020 Annual Construction Review was held at Gulf Island Shipyards, while the February 2021 review was held virtually due to the pandemic. The review panels expressed confidence that the OSU Project Team remains capable of delivering three RCRVs to the Academic Research Fleet despite the current challenges (See Risks below).

Risks

The following principal risks have been identified on OSU's project risk register. Planned mitigation strategies are included here with each identified risk.

- Certain situations could add cost to OSU's management portion of the project. These include delayed appointments of key personnel, contracting issues, lack of management capacity due to optimistic planning, or misunderstanding of requirements. Contingency funds are included to increase OSU management capacity if needed.
- Sonar sensors, science load handling systems, and other vessel sub-systems may not perform as required. Contingency funds are included to ensure performance capabilities are met, given that many warranties are not likely to be performance-based or are otherwise limited contractually with the shipyard.

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- Growth in weight and vertical center of gravity has required design changes, namely lengthening by six feet, to ensure vessel seaworthiness. This is a typical risk for ship construction (and research vessels in particular) that requires active management by OSU and the shipyard, as well as oversight by NSF, such that the ship can operate safely and effectively. This risk has been reduced through the re-design but will not be entirely eliminated until the delivered vessels are evaluated.
- Shipyard's performance, including its subcontractors', will remain a risk throughout construction. Realization of this risk resulted in a pause in construction from January to August 2020, and the use of approximately \$18 million in contingency, which also mitigated future likelihood of occurrence.

Approximately \$34.18 million in contingency has been allocated to date as a result of realizing known risks. A science-prioritized and time-phased scope management plan is in place to minimize impacts to science capabilities in case contingency funds are insufficient to cover realized risks. Scope reductions are not being considered as a means to mitigate cost impacts from the pandemic.