

REGIONAL CLASS RESEARCH VESSELS (RCRV)

\$28,700,000

The FY 2019 Request for the Regional Class Research Vessel project is \$28.70 million. The total project cost is \$255.58 million. In FY 2017, P.L. 115-31 appropriated \$121.88 million in funding to facilitate the planning and construction of three vessels. In the context of the President’s overall fiscal goals intended to maintain spending restraint, this Budget Request supports construction of the two vessels.

**Appropriated and Requested MREFC Funds
for the Regional Class Research Vessel Project
(Dollars in Millions)**

	FY 2017	FY 2018	FY 2019	Total
	Actual	Estimate	Request	Project
				Cost
Current Funding Profile	\$121.88	\$105.00	\$28.70	\$255.58

In justification of their recommendation to NSF for the construction of RCRV, the 2015 National Academies of Sciences, Engineering, and Medicine (the National Academies) report, *Sea Change: 2015-2025 Decadal Survey of Ocean Sciences*,⁵ described eight high-priority science questions that will be supported by RCRV 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?

Baseline History

The RCRV project is a major component in the plan for modernizing the U.S. Academic Research Fleet (ARF).⁶ 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 (UNOLS), and the NAS Sea Change report, was received during the period 2013 to 2015 and informed the final decision to pursue construction. In

⁵ The National Academies of Science. *Sea Change: 2015-2025 Decadal Survey of Ocean Sciences*, 2015. www.nap.edu/read/21655/chapter/1

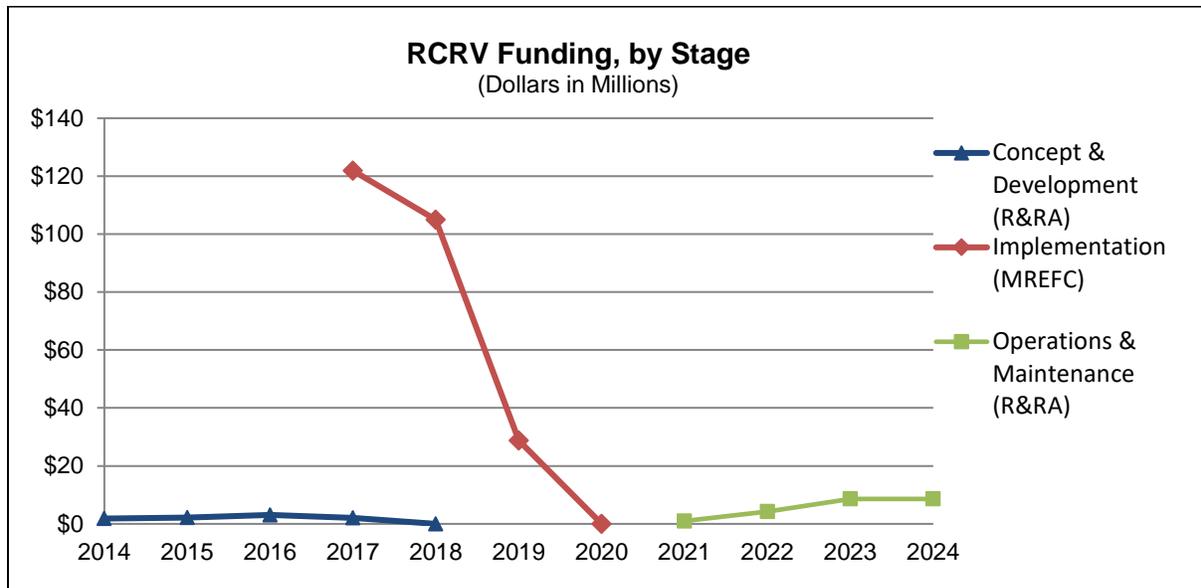
⁶ National Ocean Council. *Federal Oceanographic Fleet Status Report*, 2013. https://obamawhitehouse.archives.gov/sites/default/files/federal_oceanographic_fleet_status_report.pdf

Major Research Equipment and Facilities Construction

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 awarded a contract for construction to Gulf Island Shipyards, Houma, LA. NSF plans to fund the operations of the RCRVs without increasing overall fleet costs, which is a result of fleet right-sizing and modernization.

Total Funding Requirements for RCRV
(Dollars in Millions)

	Prior Years	FY 2017 Actual	FY 2018 Estimate	FY 2019 Request	ESTIMATES				
					FY 2020	FY 2021	FY 2022	FY 2023	FY 2024
<i>R&RA:</i>									
Concept & Development	\$9.82	\$2.11	-	-	-	-	-	-	-
Operations & Maintenance	-	-	-	-	-	1.00	4.30	8.60	8.60
Subtotal, R&RA	\$9.82	\$2.11	-	-	-	\$1.00	\$4.30	\$8.60	\$8.60
<i>MREFC:</i>									
Implementation	-	121.88	105.00	28.70	-	-	-	-	-
Subtotal, MREFC	-	\$121.88	\$105.00	\$28.70	-	-	-	-	-
TOTAL REQUIREMENTS	\$9.82	\$123.99	\$105.00	\$28.70	-	\$1.00	\$4.30	\$8.60	\$8.60



Management and Oversight

- NSF 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 Office of Budget, Finance, and Award Management (BFA), BFA Large Facilities Office, BFA Division of Acquisition and Cooperative Support, BFA 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 Structure:** The RCRV project is funded through a series of cooperative 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 NSF and manages the RCRV administrative staff. The project scientist is a co-Principal Investigator on the award. The PM manages the core RCRV team including the risk manager, earned value management and schedule specialist, 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 stakeholder federal agencies (e.g., NSF, Office of Naval Research, and the 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.

Reviews

- **Proposal Review:** In 2012, NSF issued Solicitation 12-558, Construction of Regional Class Research Vessels, to select a lead institution for construction and ship operations. An NSF external review panel was convened to evaluate three proposals, and OSU was selected.
- **Interim Design Review (IDR):** Although an Interim Design Review was not required by NSF, OSU hosted its own IDR on July 23-25, 2013, in Corvallis, OR. NSF program staff assessed the OSU project team performance and concluded the IDR followed closely the NSF requirements, and used the R/V Sikuliaq example, as appropriate, to craft the RCRV Project Execution Plan (PEP). Both the design and the PEP were well-developed at this pre-Conceptual Design Review phase; particularly the organizational structure, work breakdown structure (WBS), risk management, and configuration and contingency management.
- **Conceptual Design Review (CDR):** CDR was conducted December 3-5, 2013, at NSF Headquarters in Arlington, VA. The NSF program staff concurred with the panel's conclusion that the Project Execution Plan and Technical Design Package met, and in some cases exceeded, the requirements of the Conceptual Design Phase.
- **Preliminary Design Review (PDR):** PDR was conducted August 5-7, 2014, at NSF Headquarters. The panel found that the Project Execution Plan and the technical design package were both well-developed to support a future budget request and recommended that the project proceed to the Final Design Phase.
- **Post-PDR Reconciliation:** Following PDR, in response to the panel recommendations and NSF program staff direction, OSU incorporated modifications to the design and revised their estimated project costs and schedule accordingly. The NSB was presented with the post-PDR Project baseline as the basis for their authorization to request funding for RCRV in future budget requests.
- **Acquisition Strategy Review:** A review of all aspects of the shipyard selection process was held in February 2016, at NSF. NSF directed OSU to make minor revisions to the Request for Proposals (RFP) based on the review.
- **Interim Design Review:** A second IDR was held by OSU in May 2016. Although not required, the value of the previous IDR for improvement to the technical package and the Project Execution Plan was sufficient that another IDR to prepare for FDR was warranted. The review was hosted by the RCRV Project Team in Corvallis, OR, and attended by NSF program staff as well as the RCRV SOC. The SOC provided minor technical improvements to the RCRV, which were incorporated into the RFP.
- **Final Design Review (FDR):** The FDR was held in December 2016 to ensure that anticipated project costs remained realistic and that no unforeseen events had arisen prior to the start of construction during FY 2017. Several members of the PDR panel also participated in the FDR. Like CDR and PDR, FDR was conducted in compliance with NSF's Large Facilities Manual. The FDR Panel recommended to NSF that the project was ready to advance to the Construction Stage.

Project Status

As stated above, NSF selected OSU as the lead institution. A cooperative agreement was awarded to encompass 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 (Years one to three)

Phase II: Shipyard Selection (Year four)

Phase III: Construction (Years five through eight)

Phase IV: Transition to Operations (Years eight and nine)

The project completed Phase II in CY 2017, during which bids for construction of RCRV were solicited and evaluated from U.S. shipyards. The Phase III construction award with OSU has been made. Total funding to OSU for RCRV through FY 2017 is \$11.39 million in R&RA funds and \$121.88 million in MREFC funds. The remaining required funding for the construction of two ships is \$105.0 million in FY 2018 and \$28.70 in FY 2019 for a total of \$255.58 million in MREFC funding.

Cost and Schedule

The length of the project is projected to be eight fiscal years, including nine-months of schedule contingency. Funding for the construction of RCRV over FY 2017, FY 2018, and FY 2019 supports the shipyard contract structure.

One significant enhancement to NSF oversight is holding a portion of budget contingency (up to 100 percent) and only allocating to the program, for obligation to the project, based on demonstrated need. This oversight mechanism will generally result in some MREFC carry over each year, however, future obligation is anticipated to manage project risks.

Risks

Technical: The following technical risks are among the principal risks that were identified and listed on OSU's project risk register. Planned mitigation strategies are included here with each identified risk. (1) Various situations may occur that could delay or 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. (2) Sonar sensors, science load handling systems, and other vessel sub-systems may also 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 be otherwise limited contractually with the shipyard. (3) Growth in weight and vertical center of gravity may require design changes in order to ensure vessel seaworthiness. This is a typical risk for ship construction (and research vessels in particular) that will require active management by OSU and the shipyard, as well as oversight by NSF, such that the ship can operate safely and effectively. A science prioritized, time-phased de-scoping plan is in place (per NSF Large Facilities Manual, NSF17-066) to minimize impacts to science capabilities in case contingency funds are insufficient to cover realized risks.

Future Operations Costs

Annual ship operations costs are well understood after several decades of experience with vessels of all types in the U.S. Academic Research Fleet. OSU understands how to estimate future costs given their experience operating vessels similar to RCRV, such as R/V Wecoma and R/V Oceanus. OSU included an estimate for the first year of operations beginning in 2021 using reasonable assumptions for escalations through 2020. They also assumed a robust but reasonable operating schedule of 200 days per year. OSU estimates RCRV will cost \$6.10 million to operate in its first year, resulting in a rate of \$30,441 per day, including technician support. This is comparable to the operation of current similar vessels after applying the appropriate cost escalation factors for size and complexity. NSF supports approximately 70 percent of

the use of the U.S. Academic Research Fleet, which suggests RCRV is likely to cost NSF approximately \$4.30 million in FY 2022, which is the first year the lead ship transitions into full operations in the ARF. A solicitation for operations of additional vessels beyond the first RCRV operated by OSU was released in January 2018.



Artist's rendition of the RCRV as constructed. *Credit: The Glosten Associates Inc.*

