

## Development of the RCRV Design: Top Level Requirements

The Top Level Requirements (TLR) for the Regional Class Research Vessel (RCRV) are the principal design requirements for major vessel characteristics and capabilities that have guided the RCRV Design Refresh and which will continue to inform the Project through construction and transitioning to operations. The only quantitative values are the “iron triangle”: Payload; Speed; and Endurance/Range.

The TLRs come from NSF’s Solicitation 12-558, the “NSF Determinations on the FIC Response to RCRV Design”, the NSF Determinations Review (NDR) recommendations made by the Science Oversight Committee (SOC) after a meeting with NSF and project team members in February 2013, and an NSF Action memo that followed the project’s Conceptual Design Review (CDR) in December 2013. These and other earlier sources are referenced in the “Basis of Requirements” paragraph near the end of this document. Figure 1 illustrates how design requirements are leading to the baseline design and bid specifications.

### Basic Design

The RCRV shall be a modern monohull research vessel, with integrated diesel-electric propulsion, capable of general-purpose interdisciplinary oceanographic research in areas from shallow coastal bays and estuaries to and beyond the continental shelf and slope. The ship shall be capable of operating on any ocean worldwide, in a regional research capacity. Vessel particulars shall be determined by:

- Payload: Science payload of 50 long tons at departure condition, with up to 29 total personnel (16 science + martech, 13 crew). Additionally, the RCRV is expected to have the capability to carry and dock a 4-person UNOLS berthing van.
- Speed: Calm water cruising speed of 11.5 to 12.0 knots
- Endurance: 21 days and range of 5,400 nm

### Science Mission Characteristics

The ship will operate in coastal regions worldwide, will make open ocean transits, and may operate in or around light first-year ice and call into ports which occasionally experience some ice. This is met by requiring ABS Ice Class classification C0. The ship shall be capable of high-performance station keeping and will be designed to meet ABS Dynamic Positioning classification DPS1 with some DPS2 capability for reliability and redundancy. The vessel's Underwater Radiated Noise (URN) will be minimized through treatments and vibration dampening to meet a URN amplitude-frequency curve similar to that established for the *R/V Sikuliaq* making it acoustically quiet under most general oceanographic operating scenarios. The vessel shall be fuel-efficient and have minimal impacts on the natural environment (i.e., shall be "Green"), as economically and technically practicable while meeting the regulatory requirements and operational goals for the vessel.

The ship shall be capable of performing the following tasks:

- Sampling and data collection of surface, mid-water, and sea floor parameters using modern scientific laboratories and instrumentation, including portable laboratory vans
- Acoustic multibeam bottom mapping and sub-bottom profiling
- Launch and recovery of scientific packages, both tethered and autonomous using state-of-the-art handling systems
- Handling, monitoring, and servicing of remotely operated vehicles (ROVs) (appropriate for vessel size) and autonomous underwater vehicles (AUVs)
- Deployment and recovery of unmanned aerial systems (UASs) and weather balloons
- Deployment and recovery of moorings and coring equipment (appropriate for vessel size)
- Deployment and recovery of small craft (appropriate for vessel size), including autonomous surface vehicles (ASVs)
- Deployment and recovery of free-floating instruments

- Full-time, high speed satellite connectivity for communications, internet access and data transfer including telepresence between researchers afloat and researchers, students and the general public ashore
- Precise navigation, station-keeping and track-line maneuvering to support deep sea and coastal operations
- Long periods of operation on-station, or underway at low speeds for towing and bathymetric surveys
- Providing access to the sea for scientific personnel with visual, hearing or mobility limitations within the limitations of regulatory and other requirements.

### **Regulatory and Classification Regimes**

The Design Refresh shall comply with appropriate regulations and classification society requirements: United States Coast Guard (USCG); International Convention for the Safety of Life at Sea (SOLAS); International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW); International Convention for the Prevention of Pollution From Ships (MARPOL); United States Environmental Protection Agency (EPA); and, the American Bureau of Shipping (ABS).

The Design Refresh shall incorporate regulations and requirements that are in effect through Phase I Preliminary Design Review or projected to be in effect through Phase II Shipyard Selection, and Phase III commencement of construction of RCRV Hull #3. Regulatory and classification status shall be reported at periodic Project Reviews and incorporated into the RCRV Risk Management Plan.

The Design Refresh shall not incorporate the requirements of the Maritime Labor Convention (MLC) in the General Arrangements.

### **Design Margin Policy**

The RCRV Class Design Refresh shall incorporate a rational margin policy, based on best marine industry practices, that recognizes the impact and lessons learned of both design maturity and life-cycle maturity. The design margins shall be developed in more detail in Design Requirements and shall include:

- Displacement (Weight and Vertical Center of Gravity) Margins
- Speed (Power) Margins
- Electric Load Growth Margins

### **Basis of Requirements**

The RCRV Class Design Refresh is based on the following governing documents:

- NSF Solicitation for Design and Construction of Regional Class Research Vessels (NSF 12-558)

- OSU RCRV Proposal (OSU document NSF 12-558, dated 09/07/12)
- NSF Award and Notice to Proceed dated December 13, 2012
- NSF Cooperative Agreement (NSF Award OCE-1333564)
- NSF Cooperative Support Agreement for Phase I (NSF Award OCE-1262188)
- NSF Design Determination Review (NDR) and Science Oversight Committee recommendations approval March 20, 2013
- NSF RCRV Conceptual Design Review Actions memo, January 6, 2014 which included direction to include an active U-tube anti-roll stabilization system in the design baseline thus increasing the vessel length by 6 ft (to accommodate the U-tube) with added length put in the aft deck
- Applicable regulatory and classification society documents

The RCRV Class Design Refresh leverages prior development efforts:

- UNOLS Prioritized RCRV Scientific Mission Requirements (SMRs)
- DI-001 Regional Class Research Vessel Contractor's Ship Specifications Rev C, Dec 2008

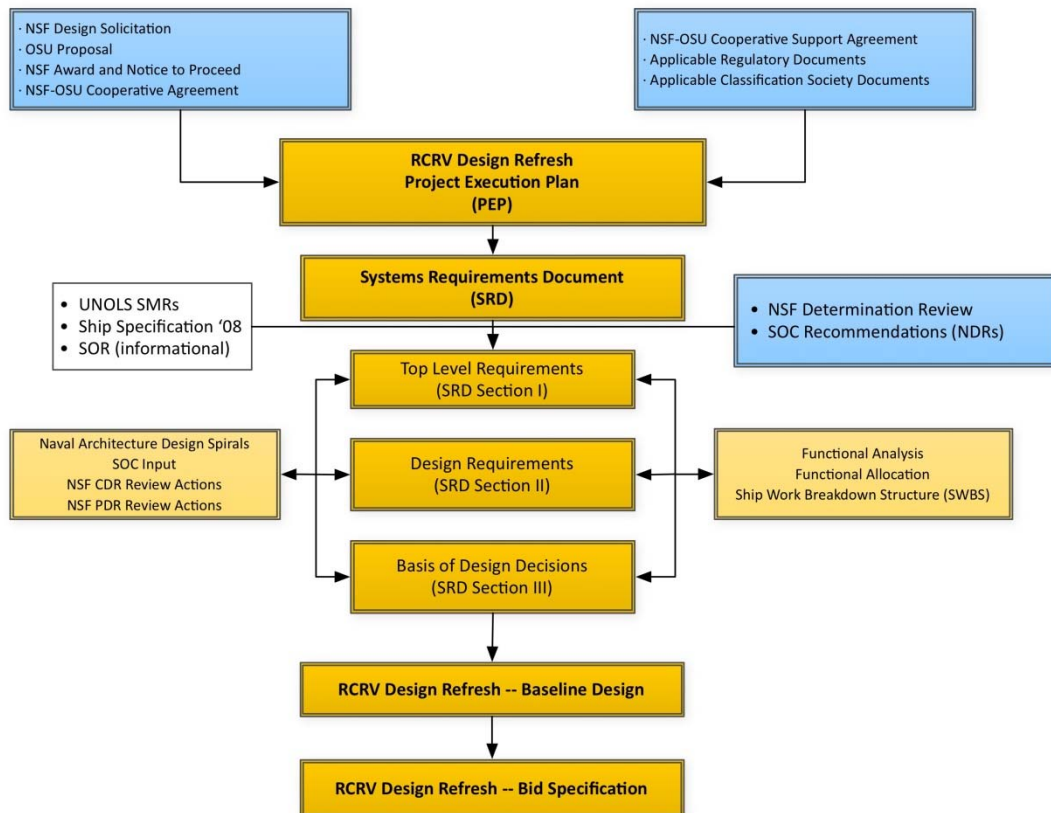


Figure 1 Development of RCRV System Requirements, Project Baseline, and Bid Specifications