

Evolution of Science Mission Requirements (SMR) for Antarctic Research Vessel (ARV).

References:

1. [Report of the Ad Hoc Subcommittee on the U.S. Antarctic Program’s Research Vessel Procurement, National Science Foundation Office of Polar Programs Advisory Committee, 14 Aug 2019.](#)

The Science Mission Requirements (SMR) for the Antarctic Research Vessel (ARV) were updated and defined most recently with science community input as reported in reference 1. The SMRs are the basis for the ARV Performance Specifications that in turn are the basis for the ARV design.

During the ARV Project Requirements Development Stage and the Concept Design Phase NSF provided guidance to the ARV Project Vessel Integrator (VI), Leidos, that result in enhanced capabilities overall, but also eliminated two requirements in order to increase the flexibility and cost effectiveness of the design. NSF designated three SMR elements as Key Performance Parameters (KPPs) and set them at the objective level recommended in Reference 1. NSF also prioritized other SMR elements as shown in the tables below.

The resulting KPP requirements are summarized in Table 1 below:

Parameter	Requirement	Value
<i>Icebreaking</i>	The capability to independently break ice	≥ 4.5 ft at ≥ 3 kts Polar Code (PC3)
<i>Endurance</i>	Maximum endurance without replenishment	≥ 90 days underway
<i>Science & Technical Personnel</i>	Provisions for messing, berthing, sanitation, and scientific workspaces	Crew and ≥ 55 science and technical personnel

Table 1: ARV Key Performance Parameter Requirements

Other requirements for the new ARV that are critical to the success of the new vessel, but are not considered KPPs, are indicated in Table 2, below:

Requirement	Supports	
	<i>Science</i>	<i>Safety/SAR</i>
<i>Maximum vessel draft to allow for docking at Palmer Pier</i>	X	X
<i>Capacity to transfer 60kgal mission fuel to Palmer Station</i>	X	X
<i>International Maritime Organization (IMO) Polar Code Compliant – PC3</i>	X	X
<i>Accommodate > 15 standard 20’ containers</i>	X	
<i>Full science operational capability in 4-8’ seas (SS4)</i>	X	X
<i>Routine underway operations 8-13’ seas (SS5)</i>	X	X
<i>Underwater Radiated Noise meets modified ICES 2009 criteria</i>	X	

Table 2. Vessel requirements and their necessity to support science and/or safety/Search and Rescue (SAR).

Table 3 details the communications between NSF and the Vessel Integrator, Leidos, that modified the original SMRs contained in reference 1.

Date	Requirement Change
August 2019	Provided Reference 1 report with SMRs for VI and design agent, Glosten, evaluation and use by the ARV project.
March 2020	<p>NSF ARV Capability provided to Leidos that identified the KPPs and the prioritized SMR elements. It also removed the SMR requirements for a moonpool and helicopter deck with its supporting infrastructure as a trade-off to allow for more flexibility for other key design elements and to mitigate the potential for increased cost of construction and operation. Two trade-off studies were completed to help inform these decisions:</p> <ul style="list-style-type: none"> • Glosten Project Memo dated 1 April 2020 re: IBRV Moonpool Requirement. • Glosten Project Memo dated 6 April 2020 re: IBRV Helideck Requirement.
June 2021	Major Facilities Proposal approved by NSF Director June 2021 containing new higher threshold requirements for the three KPPs.

Table 3. NSF SMR decisions through the end of the Concept Design Phase