

SECTION III-C

Operational Performance Requirements

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OPERATIONAL PERFORMANCE REQUIREMENTS

1. Icebreaking Capability

The ship must be able to operate independently, year-round, through thin first-year ice conditions. See table below for details.

Table 1: Icebreaking capability requirements for vessel.

Level Ice thickness of 1 foot (0.3 meter) with continuous forward progress:	
Ice Strength	
Flexural:	100 psi (0.7MPa)
Compressive:	575 psi (4.0 MPa)

The ship must also be able to operate in thick close pack ice of 3 feet (0.9 meters) thickness.

2. Trimming

The ship should have sufficient ballast tankage in the ends of the ship to change the trim by 3 feet (0.9 meters) at both the bow and stern.

3. Open Water Powering

The ship is required to make a calm water speed of 12 knots at 60 percent of maximum continuous service rating of the diesel engines. Model tests or recent full-scale measurements should be submitted to verify this performance.

4. Seakeeping

The ship should be able to maintain ship motions that do not exceed the values given below in sea state 5 (10-foot significant wave height) and short-crested seas (cosine squared spreading function) on any heading at speeds up to 8 knots. Wind is co-linear with the seas as described in Section III-B 3 and a steady current of 2 knots is at 45 degrees.

Table 2: Seakeeping Requirements, Sea State 5.

Significant Pitch	5 Degrees
Significant Roll	8 Degrees
Accelerations	
On the bridge wings	0.2 g's Athwartship
	0.4 g's Vertical
On main deck on centerline at after perpendicular	0.2 g's Athwartship
	0.4 g's Vertical
Slamming	10 occurrences per hour
Deck Wetness	
At after perpendicular	5 occurrences per hour
At 5 % aft of forward perpendicular	5 occurrences per hour

5. Stationkeeping

The ship must be able to maneuver and keep station within a 300-foot, or 5 percent of the water depth, diameter watch circle in seas up to 10-foot significant wave height, with mean winds of 30 knots and 2 knots of steady current. The wind and waves directions are co-linear and the current direction is at 45 degrees to them. Ship heading can be selected to give best stationkeeping ability.

6. Trackkeeping

The ship shall be capable of remaining within plus or minus 500 feet or 5 percent of the water depth, whichever is greater, of any specified straight trackline and shall be capable of maintaining its mean heading for all forward speeds between 15 degrees of its mean heading for all forward speeds between 1 and 6 knots, in sea state 5 (long-crested seas of 10-foot significant wave height, 25 knots mean wind speed and 2 knots steady current), where the wind and waves are co-linear and have an arbitrary heading relative to the trackline and the current direction is at 45 degrees from the wind/wave direction.

7. Night Operation

Ship operations are based on year-round science. Science and logistics operations can be expected to take place 24 hours a day and anytime the vessel is underway or alongside. The vessel shall be crewed accordingly. Long periods of darkness can be anticipated during the winter months because of the extreme latitudes of operation. The ship must provide adequate lighting on all working decks as well as lighting of the ice or water surface adjacent to and astern of the ship.

8. Stability, Compartmentation, and Limiting Drafts

The ship must meet the US Coast Guard requirements of Subchapter U for Oceanographic Research Vessels (CFR Title 46, Parts 188 to 196). Additionally, the ship must meet the intact stability requirements of Subchapter U with the icing load described in Section III-B 9 **Topside Icing**.

9. Endurance and Range

The ship must be capable of an endurance of 75 days. The minimum range of the vessel must be 12,000 nautical miles calm water transit at 12 knots. The corresponding fuel tankage should be equal to the fuel consumed by the propulsion diesel(s) to achieve a 12-knot calm water speed and the associated fuel consumed by the auxiliary machinery in service during that time. There should be a 10-percent margin of usable fuel left onboard upon returning to port. The total computed volume of fuel should be 95 percent of the required tank volume. The ship must be able to fill the required tank volume with fuel, load a full complement of scientists, stores, fully loaded scientific containers and scientific cargo and still meet her loadline requirements.

10. Service Life

A minimum service life of 20 years from charter commencement is required.

11. Vibration and Airborne Noise

The ship and its equipment should be free of excessive vibration and airborne noise during open water and icebreaking operations. Vibration and airborne noise should not exceed the levels given in the latest revision of the ABS rules HAB+ notation for spaces occupied by the crew or scientific personnel. (Reference section III-E 1 **Classification**) All Science working spaces should be considered equivalent to Ship's Offices for the purpose of the ABS HAB+ notation.

12. Underwater Noise

The ARSV is a multi-mission ship but a major emphasis of its science work now and into the future is the acoustic measurement of marine life. This requires the ship to be as acoustically quiet as possible at a range of cruising speeds up to 8 to 12 knots (the higher the better). The International Council for the Exploration of the Seas Cooperative Research Report No. 209 (ICES 209) gives an acoustic standard for ships doing this type of work and several ships have been designed to this standard (reference NOAA FRVs

and NSF ARRV). The criterion is not easily met and typically involves acoustic assessment of all aspects on the ship: hull form, propellers, propulsion and auxiliary machinery, ducting, etc. A ship that meets this criterion is considered to fully meet the requirements for the science. However, it is recognized that meeting the criterion is onerous and bidders may therefore propose alternative approaches to mitigate underwater noise and achieve an acoustically quiet ship.

In addition, noise generated by the ship shall not interfere with the operation of the installed sonars. Further details on sonar systems can be found in Section III-D 8 of the **Science Requirements**.