Scientific Mission Requirements for Intermediate Ice-Capable, General-purpose Oceanographic Research Ship

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General:	The ship will serve as a general-purpose arctic research vessel. It will be ice-strengthened to increase the capability of the UNOLS fleet to work in ice-covered seas. An intermediate-size ship is necessary to conduct multidisciplinary cruises of long duration since access to fuel and other services will be severely limited. The primary concerns are hull strength and endurance with seakeeping and speed being secondary.
Size:	The size ultimately is determined by the requirements. However, it is intended that this be an intermediate size (Class III, UNOLS; 150-199 ft LOA), which has limited ice capability and endurance.
Endurance:	Ninety days; providing the ability to transit 30 days at cruising speed, 30 days station work, and 30 days hotel service. 15,000 mile total range.
Ice Capability:	This ship should have the ability to operate in 9/10 first-year ice and of maintaining a speed of 3 kts in 2.5 ft continuous ice cover and capable of transiting 7-ft ridges. This corresponds approximately to the Canadian ice classification #2 and the ABS classification 1AA. Ship must be able to be withstand being beset by ice. Because it is expected to work in the Canadian arctic, it should meet Canadian specifications for ice- worthiness and pollution control.
Accommodations:	20-24 scientific personnel in two-person staterooms. Science Library-Lounge with conference room capability. Science office.
Speed:	12 knots cruising; 10 knots sustainable through Sea State 4. Speed control (0.2 knot in 0-7 knot range, +/- 0.1 in the 0-2 knot range.
Seakeeping:	Maintain science operations in following speeds and sea states: 10 knots cruising through Sea State 4 8 knots cruising through Sea State 5 6 knots cruising through Sea State 6
Station-keeping:	Maintain station and work in Sea State up through 5. Ship must be capable of maneuvering in ice leads. Considerations should be made to minimize ice buildup on superstructure and hull during severe icing conditions.
Deck Working Area:	Spacious stern working area of 1,500 sq ft minimum with up to half enclosed (minimum of 10 ft clearance overhead) for weather protection. Contiguous work area along one side (8 x 80 ft minimum) to allow piston coring. Provide for deck loading up to 1,200 lbs/sq ft and an aggregate total of 90 tons.

Heavy-duty hold-downs on 2-ft centers. Highly flexible to accommodate large and heavy equipment. Removable bulwarks. Dry main working deck not greater than 6-8 ft above waterline.

Usable clear foredeck area to accommodate specialized towers and booms extending beyond bow wave. Foredeck area to accommodate helicopter landing or alternatively a laboratory van.

All working decks accessible to power, water, air, and data and voice communication ports.

Cranes: A suite of modern cranes to handle heavier and larger equipment than at present: 1) to reach working deck areas and offload vans and heavy equipment up to 20,000 lbs; 2) articulated to work close to deck and water/ice surface; 3) to handle overside loads up to 5,000 lbs, 30 ft from side and up to 10,00 lbs closer to side; 4) overside cranes to have servo and motion compensations; 5) usable as overside cable fairleads for towing at sea; 6) cranes adaptable for manned egress onto ice surface.

Winches: New generation of oceanographic winch systems providing fine control (0.5 m/min); constant tensioning and constant parameter. Wire monitoring systems with inputs to laboratory panels and shipboard recording systems. Local and remote controls.

Permanently installed general-purpose winches include:

- Two hydrographic-type winches capable of handling 30,000 ft of wire rope or electromechanical cable having diameters from 1/4" to 3/8".
- A heavy winch complex capable of handling 40,000 ft of 9/16" wire/synthetic fiber rope; or 30,000 ft of 0.68" electromechanical cable (up to 10 KVA power transmission) or fiberoptics cable. This is envisioned as one winch with multiple storage drums which could be interchanged.

Additional special-purpose winches may be installed temporarily at various locations along working decks. Winch sizes may range up to 30 tons (140 sq ft) and have power demands up to 300 hp.

Sheltered winch control station(s) located for optimum operator visibility with reliable communications to laboratories and ship control stations.

Overside Handling: Various frames and other handling gear to accommodate wire, cable and free launched arrays. Maximum hoist capacity 30,000 lbs. Matched to work with winch and crane locations but able to be relocated as necessary.

Stern A-frame to have 15-ft minimum horizontal, 25-ft vertical clearance; 12-ft inboard and outboard reaches.

Heated staging and sampling area with overhead rail and 15-ft clearance at an optimum overside working area.

Capability to operate overside handling rigs along working decks from bow to stern.

Sheltered control station(s) to give operator protection and operations monitoring and be located to provide maximum visibility of overside work.

Towing: Capable of towing large scientific packages up to 10,000 lbs horizontal tension at 6 kts and 25,000 lbs at 2.5 kts. Capable of towing in ice-covered seas and protecting those packages while towing.

Laboratories: Approximately 2,000 sq ft of laboratory space, including: Main lab area (1,000 sq ft) flexible for frequent subdivision providing smaller specialized labs; Analytical lab (300 sq ft) with no exterior bulkheads and stable temperature control and Wet lab (300 sq ft), both located contiguous to sampling areas; Electronics/Computer lab and associated user space (300 sq ft); two climate controlled chambers (100 sq ft) capable of maintaining -2oC (one suitable for primary productivity measurements); and feeezer (100 sq ft).

Labs should be located so that none serve as general passageways. Access between labs should be convenient.

Labs to be fabricated using contaminated and "clean" materials and constructed to be maintained as such. Furnishings, HVAC, doors, hatches, cable runs, and fittings to be planned for maximum lab cleanliness.

Fume hoods to be installed permanently in Main lab. Wet lab shall have provision for temporary installation of fume hoods.

Cabinetry shall be high-grade laboratory quality, including flexibility through the use of unistruts and deck boltdowns.

Heating, ventilations, and air conditioning (HVAC) as appropriate to laboratories, vans, and other science spaces being served. Laboratories has maintain temperature of 60 - 75o F, 50% relative humidity, and 9-11 air changes per hour. Filtered air provided to Analytical lab. Each lab area to have a separate electrical circuit on a clean bus with continuous delivery capability of at least 40-volt amperes per square foot of lab deck area. Labs to be furnished with 100 v and 220 v AC. Total estimated laboratory power demand is 75 KVA. Uncontaminated seawater supply to most laboratories, vans, and several key deck areas. Compressed air supply to be clean and oil-free.

Vans:	To carry two (2) standardized 8 ft by 20 ft portable deck vans which may be laboratory, berthing, storage, or other specialized use. Hookup provision for power, HVAC, freshwater, uncontaminated seawater, compressed air, drains, communications, data and shipboard monitoring systems. Vans must have heated water and sewage lines. Vans should have direct access to ship interior but located in wave sheltered spaces. Vans should be capable of withstanding arctic climate. Capability to carry additional portable non-standard vans (200 sq ft total) on super-structure and working decks. Supporting connections at several locations around ship, including the foredeck.
Workboats:	At least one (1) 21-ft inflatable (or semi-rigid) boat located for ease of launching and recovery. Capability to carry and deploy scientific work boat 25-30 ft LOA, specially fitted out for supplemental operations at sea, including data/sample collecting, instrumentations, and wide angle seismic measurements, to be accommodated as one of the two-van options above.
Helicopter:	Occasional landing of helicopter forward is envisioned with no provision for a permanently assigned craft necessary.
Science Storage:	Total of 15,000 cu ft of scientific storage accessible to labs by interior and weatherdeck hatch(es) and elevators. Half to include suitable shelving, racks, and tie downs; remainder open hold. The open hold should be equipped with heavy duty hold-downs on 2-ft centers. Hazardous materials storage should be provided with easy access to the labs.
Acoustical Systems:	Ship to be as acoustically quiet as practicable in the choice of all shipboard systems and their location and installation. Design target is underway, conventional echo sounding in Sea State 4 and acoustical dynamic positioning through Sea State 5. Ship to have conventional 12 kHz and 3.5 kHz echo sounding systems and provision for additional systems, including: • Acoustic Doppler Current Profiling (ADCP) system with both 150 and 300 kHz transducers hull-mounted. • Forward-looking submarine search-type sonar for mid-water trawl net guidance and ice navigation. • Hull-mounted transducers appropriate for dynamic positioning using seafloor transponders. • Transducer wells, one located forward and one aft. Pressurized sea chest to be located at optimum acoustic location for at-sea installation and servicing of transducers and ransponders.
Navigation/ Communications:	Global Positioning System (GPS) with appropriate interfaces to data systems and ship control processors for automatic computer steering and speed control.

	Dynamic positioning both relative and absolute in 35-knot wind, Sea State 5 and 1.5-knot current in depths to 6,000 m using GPS and bottom transponders; maximum excursion +/- 150 ft.
Internal Communications:	Internal communication system providing high- quality voice communications throughout all science spaces and working areas.
	Data transmissions, monitoring, and recording system available throughout science spaces, including vans and key working areas.
	Closed-circuit television monitoring and recording of working areas.
	Monitors for all ship control, environmental parameters, science and overside equipment performance to be available in all, or most, science spaces.
External Communications:	Reliable voice channel for continuous communications to shore stations (including home laboratories), other ships, boats, and aircraft. This included satellite, VHF and UHF. Facsimile communications to transmit high-speed graphics and hard-copy text on regular schedules.
	High-speed data communications (via satellite) links to shore labs and other ships on a continuous basis.
Satellite Monitoring:	Carry transponding and receiving equipment including antenna to interrogate and receive satellite readouts of environmental remote sensing data.
Discharges:	All discharges will be on the port side with their holding tanks capable of holding for a minimum of 24 hours.
Ship Control:	Chief requirement is maximum visibility of deck work areas during science operations and especially during deployment and retrieval of equipment. This would envision a bridge-pilot house very nearly amidship with television monitors as well as direct, unobstructed stern visibility. Portable hand-held control units could also be used at various after deck locations during overside equipment handling.
	The functions, communications, and layout of the ship control stations should be carefully designed to enhance the interaction of ship and science operations. For example, ship course, speed, attitude, and positioning will often be integrated with scientific operations requiring control to be exercised by computer from a laboratory or working deck area. Also, a collision avoidance system should be provided to help insure safe, remote computer- controlled operations in traffic congested waters.

Sea State		*Height*	
	Description	*Feet*	*Meters*
0	Calm-glassy	0	0
1	Calm-rippled	0 to 0.5	0 to 0.1
2	Smooth-wavelets	0.5 to 1.5	0.1 to 0.5
3	Slight	1.5 to 4	0.5 to 1.25
4	Moderate	4 to 8	1.25 to 2.5
5	Rough	8 to 13	2.5 to 4
6	Very rough	13 to 20	4 to 6
7	High	20 to 30	6 to 9
8	Very high	30 to 45	9 to 14
9	Phenomenal	Over 45	Over 14