Scientific Mission Requirements for Small General-purpose Oceanographic Research Ship

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General:	This monohull ship will service as a general-purpose research vessel with limited endurance and maximum flexibility of operations. It is fully capable of continuous 24-hour operations. The primary design requirement is to combine multi-disciplinary capability with small size and cost effectiveness. Vessels of this size often serve educational programs in addition to their research work. For this vessel, endurance and cruising speed are secondary to broad operational capabilities and seakeeping qualities.
Size:	LOA = less than 150 ft; BEAM = not less than 30 ft; DISPLACEMENT = 500 to 50 tons; GROSS TONNAGE = <300 tons; DRAFT = 7 to 10 ft.
Endurance:	21 days. Endurance formula should include 50% cruising and 50% on-station. RANGE = 5,000 nautical miles.
Accommo -Dations:	12 to 16 scientific personnel in two-person cabins,under research cruise conditions. Expandable to 24 with a van. Up to 40 personnel on day trip basis. Crew size <10.
Speed:	12-13 knots cruising; sustain 10 knots through sea state 4. Maximum speed = 14 knots. Speed control +/- 0.1 knot in speed range from 0 to 6 knots. Design trade-offs should favor sea-keeping over speed.
Seakeeping:	Maintain science operations at these speeds and sea states: 9 knots in sea state 4 7 knots in sea state 5 4 knots in sea state 6
Station-Keeping:	Maintain station and over-the-side vertical operations in sea state 4, without dynamic positioning. Bow thruster.
Ice Strengthening	ABS Class C (ability to transit loose pack ice) may be desirable for one or more vessels of this class, but distinct from a dedicated, ice-strengthened, high-latitude research vessel.
Deck Working Area:	Approximately 1500 sq ft with contiguous work area along starboard waist = 8 ft x 20 ft minimum for CTD and rosette sampler handling. Deck loading at 1500 lbs/sq ft. Heavy duty holddowns on 2-ft centers. Able to accommodate at least one (preferably two) 8 ft by 20 ft van yet retaining clear access to stern and waist work areas. Removable bulwarks with hinged freeing ports to provide dry deck conditions in beam or quartering seas. All working decks with multiple access for power, fresh and salt water, air and cableways for data and voice communication lines. Low freeboard at fantail (3 to 5 ft). No stern ramp.

Cranes:	(2) (One articulated crane to handle large and heavy (up to 8,000 lbs) gear over both sides, on station and underway, with lateral motion damping, and an outboard reach of 14 ft on one side. This crane also capable of reaching all working deck areas for loading and off-loading of equipment (including empty van). Man-rated for launch and recovery of small submersibles. A second, smaller crane with re-location sites foreward, midships and aft; articulated for work at deck level and at the sea surface, with weights up to 4,000 lbs, also usable as over-the-side, cable fairlead for vertical work and light towing.
Winches:	Two modern winches with state-of-the-art controls providing fine control (0.5m/min); constant tensioning or with tension accumulator. Wire monitoring systems on both winches, with readouts on laboratory panels and shipboard recording systems, as well as on the bridge. Local and remote control boards. Winches to be re-locatable (in port) to allow reconfiguration of deck layout. Capable of transferring winch drums at sea. Hydrowinch with interchangeable drums capable of handling up to 30,000 ft of wire rope, Kevlar synthetic line or electromechanical cables having diameters from 1/4" to 3/8" or 11 mm standard (e.g., Markey DESS-5 or equivalent). Slip rings with 6 conductors. Trawling winch capable of handling 20,000 ft of 1/2" trawling or coring wire or 20,000 ft of 0.68" electromechanical cable (up to 10 KVA power transmission) or fiber optics cable. Can be operated with interchangeable drums. Slip rings with 6 conductors. A traction winch is a possible alternative. All-weather winch control station(s) located for optimum operator visibility of work area and overside gear, with fail-safe communications to deck level, laboratories, and bridge. A-frame controls included.
Overside Handling:	Various frames, davits and other handling gear to accommodate wire, cable and free-launched arrays. Matched to work with winch and crane locations, and with moveable capstans, but able to be relocated as necessary. Stern A-frame to have 15-ft throat (horizontal width at deck level and up to 15 ft off deck) and 20-ft vertical clearance, 12-ft inboard and outboard reaches. Man-rated for launch and recovery of small submersibles. Safe working load of 20,00 lbs. Controls to be located at A-frame and at winch control station.
Towing:	Capable of towing midwater benthic gear at speeds up to 4 knots with line tensions of 20,000 lbs.
Laboratories:	Minimum of 1,000 sq ft of laboratory space allocated: 75% main lab (including separate electronics lab capability), and reconfiguration into smaller specialized labs. Wet lab to be located contiguous to sampling areas; main lab with temperature and humidity precisely controlled. Labs to be located so that none serve as general passageways. Access between labs to be convenient. Dry lab and electronics lab areas with door sills to keep water out. Main lab access to be large enough to accommodate transfer of large equipment items.

Labs to be fabricated using uncontaminated and "clean" materials and constructed so they can be easily maintained in an uncontaminated condition. Furnishings, HVAC, doors, hatches, cable runs, plumbing, and fittings to be planned for maximum lab cleanliness.

Fume hood to be installed permanently in wet lab. Main lab to have provision for temporary installation of fume hood. Hood flues able to withstand acid fumes and situated so no fumes can be drawn back to occupied areas inside or on deck.

Cabinetry shall be of high grade laboratory quality including flexibility through the use of unistruts and deck boltdowns on 1-ft centers.

Heating, ventilation and air conditioning (HVAC) capabilities as follows: labs shall maintain temperature of 70-75o F in all weather conditions, 25% relative humidity; and 9-11 air changes per hour. 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 110 v and 220 v AC. Maximum estimated laboratory power demand is 50 KVA. Uncontaminated sea water supply to wet and dry labs, and deck areas (including anywhere on the fantail). Compressed air supply to all labs and deck area; supply to be clean and oil free, with 100 lbs service pressure at outlets.

Special Science Facilities: Science shop with workbench, vise, and basic hand and power tools.

Science freezer space = 36 cubic ft @ -20 degrees C, and 50 cubic ft @ -5 degrees C.

SCUBA support facilities- compressor, water entry platform and ladder, tank storage racks.

Space capability for setting up and operating station for a small ROV; with deck space for cable payout and coiling, launch and recovery. ROV control center with video monitor, recording gear and communications in the main lab or on the bridge. Undisturbed air flow at bow for air-sea interaction studies.

Van: Capable of handling and carrying at least one standard 8 ft by 20 ft portable deck van, which may be laboratory, berthing, storage or other specialized use. Hookup provision for power, HVAC, fresh water, uncontaminated sea water, compressed air, drains, communications, data and shipboard monitoring systems. Vans should have close, if not direct access to ship's interior. Ship should be capable of loading and offloading empty van using its own crane at dockside.

Workboats: One 16-ft rigid hull boat with inboard or outboard power, and at least one 12- to 16-ft inflatable boat with outboard power.

Science Storage: Readily accessible 1250 cubic ft minimum for operator's science support gear and resident technician's stores. Accessible safe storage for chemical reagents and hazardous (non-radioactive) materials.

Acoustical Systems:	Ship to be as acoustically quiet as possible in the choice of all shipboard systems and their location and installation. Ship to have conventional 12 kHz, and 3.5 kHz echo sounding systems and provision for additional systems as needed. Transducers to be mounted so as to provide clean transmission and reception from both lateral (tracking) and vertical signals. Three transducer wells with at sea access for servicing and installation.
Navigation/ Positioning:	Global Positioning System (GPS) and Loran C with appropriate interfaces to data systems in lab and ship control processors. Short baseline acoustic navigation system.
Internal Communi-cations:	Internal communication system providing high-quality voice communications throughout all science spaces and working areas.
	Data transmission, monitoring, and recording system available throughout science space including van and key working areas.
	Closed-circuit television monitoring of all outside working areas including subsurface performance of equipment and its handling.
	Monitors for all ship control, environmental parameters, science and overside equipment performance to be available in all, or most, science spaces.
External Communi-Cations:	Reliable voice channels for continuous communications to shore stations (including home laboratories), other ships, boats and aircraft. This includes satellite, VHF and UHF.
	Facsimile communications to transmit high-speed graphics and hard-copy text on regular schedules.
	High-speed data communications links to shore labs and other ships on a continuous basis.
	Capability to receive real-time or near real-time satellite imagery.
Ship Control:	Chief requirement is maximum visibility of deck work areas and adjacent sea surface, during science operations and especially during deployment and retrieval of equipment.
	The functions, communications, and layout of the ship control station 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 from a laboratory or deck working area.