Scientific Mission Requirements for an Intermediate General-purpose Oceanographic Research Ship

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General:	The ship is to serve as a general-purpose research ship. The primary requirement is a maximum capability commensurate with ship size to support science and engineering operations in all oceans in terms of improved over-side equipment handling, station keeping, towing, and to provide a stable laboratory environment for precision measurements. Other general requirements are for large scientific parties and greater flexibility in use of laboratory/deck spaces than is now available aboard intermediate-size ships.
Size:	The size ultimately is determined by the requirements. However, it is intended that this is to be a class ship to replace the current university research ships having such capabilities as the OCEANUS class (177 ft LOA; 33 ft BEAM; 1015 tons DISP).
Endurance:	Thirty days; providing the ability to transit 15 days at cruising speed and 15 days station work (see station keeping and towing); 8,000 mile total range.
Accommo-dations:	15-20 scientific personnel in two-person staterooms. Expandable to 25 through the use of vans. Science Library-Lounge with conference room capability. Science office.
Speed:	14 knots cruising; 12 knots sustainable through sea state 4. Maximum speed 15 knots. Speed control (0.1 knot in 0-6 knot range; and (0.2 knot in range 6-14 knots.
Seakeeping:	Maintain science operations in following speeds and sea states: 12 knots cruising through sea state 4 10 knots cruising through sea state 5 6 knots cruising through sea state 6
Station Keeping:	Maintain station and work in sea states up through 5. Dynamic positioning both relative and absolute in 35-knot wind, sea state 5, and 3-knot current in depths to 6,000 m using GPS and bottom transponders. Maximum excursion +/- 150 ft.
Ice Strength-ening:	Ability to transit loose pack (3/10 cover Class 1c). Not intended for icebreaking or close pack work.
Deck Working Area:	Spacious stern working - 1,500 sq ft minimum with contiguous waist 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 60 tons. Heavy-duty holddowns on 2-ft centers. Highly flexible to accommodate large and heavy equipment. Removable bulwarks. Dry working deck but not greater than 6-8 ft above waterline.

Usable clear foredeck area to accommodate specialized towers and booms extending beyond bow wave.

All working decks accessible for 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 all working deck areas and offload vans and heavy equipment up to 20,000 lbs; (2) articulated to work close to deck and water surface; (3) to handle overside loads up to 5,000 lbs, 30 ft from side and up to 10,000 lbs closer to side; (4) overside cranes to have servo controls and motion compensation; (5) usable as overside cable fairleads for towing at sea.

Ship capable of carrying portable cranes for specialized purposes.

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 cables having diameters from 1/4" to 3/8".

- A heavy winch complex capable of handling 40,000 ft of 9/16" wire/synthetic wire rope; or 30,000 ft of 0.68" electromechanical cable (up to 10 KVA power transmission) or fiber optics 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 to 300 hp.

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 and 25-ft vertical clearance; 12-ft inboard and outboard reaches.

Capability for articulated stern ramp, providing variable configuration ranging from a flush deck to a waterline platform.

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

Control stations(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 tension at 6 knots, and 25,000 lbs at 2.5 knots.

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; Hydro lab (200 sq ft) and Wet lab (200 sq ft) both located contiguous to sampling areas: Electronics/Computer lab and associated users space (300 sq ft); climate controlled chamber (100 sq ft), and freezer (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 uncontaminated 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 Wet lab and Analytical lab. Main 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, ventilation, and air conditioning (HVAC) appropriate to laboratories, vans, and other science spaces being served. Laboratories shall maintain temperature of 70-75o 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 110v and 20v AC. Total estimated laboratory power demand is 75 KVA. Uncontaminated sea water 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 20ft portable deck vans 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. Van should have direct access to ship interior but located in wave sheltered spaces.

Capability to carry up to two (2) additional portable non-standard vans (500 sq ft total) on superstructure and working decks. Supporting connections at several locations around ship including foredeck.

Ship should be capable and offloading vans using own cranes.

Workboats: At least one (1) 16-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, instrumentation, and wide angle seismic measurement. Boat to have 12-hour endurance including both manned and automated operation. "Clean" construction. To be accommodated as a one of two-vans option above.
Science storage:	Total of 10,000 cubic 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.
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 and Sea Beam SWATH echo sounding in Sea State 4 and acoustical dynamic positioning through sea state 5. Ship to have conventional 1kHz, 3.5 kHz echo sounding systems and provision for additional systems, including: - Phased array, multibeam SWATH sonar system (equivalent to "Sea Beam") for guiding seafloor sampling/photography for and deep tow geophysical profiling studies; and for limited bathymetric charting. - Forward-looking submarine search-type sonar for mid-water trawl net guidance. - Hull mounted transducers appropriate for dynamic positioning using seafloor transponders. - Transducer wells; one located forward and one aft. Large pressurized sea chest (3 ft x 6 ft) to be located at optimum acoustic location for at-sea installations and servicing of transducers and transponders.
Navigation/ Communi-Cations:	Global Positioning System (GPS) with appropriate interfaces to data systems and ship control processors for automatic computer steering and speed control. Selected vessels should be equipped with "dynamic positioning" capability to maintain the ship on station or on a trackline to the stationkeeping specifications under automatic control and appropriate navigational reference.
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 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 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 communication (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.
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 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 by computer from a laboratory or working deck area. Also a collision avoidance system should be provided to help ensure 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