Scientific Mission Requirements for Intermediate General-purpose Oceanographic Research Ship, Small Waterplane Area Twin Hull (SWATH)

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General: The ship is to serve as an intermediate-size, general-purpose research ship. The overriding required characteristic is that the ship provide the most stable environment possible in order to allow both overside and laboratory work to proceed in greater capacity and in higher sea states than is now possible. 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: It is intended that this SWATH ship have a general capability equivalent to an existing monohull research vessel of between 180-200 ft LOA. Available information indicates that such a SWATH vessel would be approximately 150 ft LOA and about 800 tons displacement.

The ship should have, or be capable of deballasting to, a harbor draft of not more than 16 ft.

Endurance: Thirty days; providing the ability to transit 15 days at cruising speed and 15 days station work (see stationkeeping and towing); 6,000 mile total range.

Accommo-dations: Twenty scientific personnel in two-person staterooms. Expandable to 24 through the use of van(s). Science Library-Lounge with conference room capability. 10-12 crew persons.

Speed: 12 knots cruising sustainable through sea state 4. Maximum speed 14 knots. Speed control $\pm$ 0.1 knot in 0-6 knot range; and $\pm$ 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

To provide exceptionally stable seakeeping capabilities. Design targets for at rest condition in the following sea states are:

	Sea State (Sig. Wave Height)	
	SS-4 (6.9 ft)	SS-5 (12 ft)
Pitch (ampl)	3.0 degrees	4.0 degrees
Roll (ampl)	3.5 degrees	4.5 degrees
Heave (ampl)	2.2 ft	4.0 ft
Vert. Accel.	0.06 g	0.09 g
Horiz. Accel.	0.06 g	0.11 g

Stationkeeping:	Maintain station and work in sea state up through 5. Dynamic positioning both relative and absolute in 35-knot wind, sea state 5, and 2-knot current in depths to 6,000 m using GPS and bottom transponders; maximum excursion ± 150 ft.
Ice Strengthening:	None: not intended for work in ice.
Deck Working Area:	Spacious stem working area: 2,500 sq ft minimum with contiguous waist work area along one side 18 x 80 ft minimum. Provide for itinerant (disposable) deck loading up to 1,200 lbs/sq ft and an aggregate total of 50 tons. One-inch bolt-down fittings on 2-ft centers grid pattern to provide accommodation for portable equipment. All working decks accessible for power, water, air, and data and voice communication ports.
Centerwell:	Approximately 15 ft x 30 ft centerwell accessible from working deck and interior deck.
Cranes:	A suite of modem cranes to handle heavier and larger equipment than at present; (1) to reach working deck areas and offload vans and heavy equipment to 20,000 lbs; (2) articulated to work close to deck and water surface; (3) to handle overside loads up to 5,000 lbs, 20 ft from side and up to 10,000 lbs closer to side; (4) usable as overside cable fairleads for towing at sea. Ship capable of carrying portable cranes for specialized purposes.
Winches:	Oceanographic winch systems providing fine control (0.5 m/min); constant tensioning. 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 3/8" to 1/4". -A winch complex capable of handling 30,000 ft of 1/2" wire/synthetic fiber rope; or 30,000 ft of 0.68" electromechanical cable (up to 10 KVA power transmission) of 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 20 tons (120 sq ft) and have power demands to 150 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 25-ft vertical clearance, 12- ft inboard and outboard reaches. Capability to carry additional overside handling rigs along working decks from bow to stern. 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 knots, and 25,000 lbs at 2.5 knots.
Laboratories:	Approximately 2000 sq ft of laboratory space including: Main lab area (1000 sq ft) flexible for frequent subdivision providing smaller specia1ized 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 (400 sq ft); refrigerator (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 hood to be installed permanently in Wet Lab and have provision for temporary installation of fume hoods in Main lab. 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- 75° F, 50% relative humidity, and 9-11air changes per hour. Labs to be furnished with 110V and 220V AC. 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 standardized 8 ft by 20 ft portable deck vans which may be laboratory, berthing, storage, or other specialized use. Hookup provision for power, fresh water, uncontaminated sea water, compressed air, drains communications, data and shipboard monitoring systems. Vans should have direct access to ship interior but located m wave sheltered spaces.
Workboats:	One 17-ft inflatable (or semi-rigid) boat located for ease of launching and recovery.

	Capability to carry and deploy scientific workboat 25-30 ft LOA, specially fitted out for supplemental operations at sea including data/sample collecting, instrumentation, and wide angle seismic measurements. To be accommodated as one of the two-van option above.
Science Storage:	Total of 5,000 cu ft minimum of scientific storage accessible to labs by interior and weatherdeck hatch(es). Half to include suitable shelving, racks, and tie downs; remainder open hold. Otemical reagent storage in suitable location.
Acoustical Systems:	Ship to be acoustically quiet as practical in the choice of all shipboard systems and their location and installation. Design target is underway, conventional and SEABEAM Swath echo sounding in sea state 4 and acoustical dynamic positioning through sea state 5.
	Ship to have conventional 12 kHz, 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; -Acoustic Doppler current profiler; 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. Pressurized sea chests to be located at optimum acoustic locations for at-sea installation and servicing of transducers and transponders.
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 Systems with both absolute and relative positioning parameters using both GPS and seafloor acoustic navigation transponders.
Internal communications:	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 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 includes 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.

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 amidships 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