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Summary of UNOLS Ocean Class Science Mission Requirements

This table provides criteria for key design elements of Ocean Class research vessels. The criteria included in the table are items that are quantifiable and could have a range of acceptable levels or scope. In order to make the Science Mission Requirements (SMRs) a more effective resource in ship design development, target objectives, minimum requirements, and relative priorities have been established to help guide design decisions. Minimum Threshold Values reflect the minimum acceptable value for this Class of vessel. Target Objectives for this Class represent greater capabilities that are desired if they can be achieved within the budget and without compromising the threshold values.

The priority levels provide the relative importance of each criteria. Three priority levels have been selected; "Critical," "Very Important," and "Important." "Critical" means that achieving the minimum threshold value is a critical element of meeting the requirements of this Class and are areas where achieving the target objective should be given a higher priority. Very Important means that achieving the minimum threshold has a high priority and attempts to meet the target objective should be given a second order of priority. Important means that these capabilities should be achieved only if they can be accomplished without compromising other objectives and without exceeding the available budget. The Fleet Improvement Committee established the priority levels for each criteria.

[Most table values come from ranges in the UNOLS Ocean Class SMR Version 1.1. Other sources are: PEO-Ships – Nov. 2007 report on performance parameters and the Fleet Improvement Committee]

Requirement	***Target Objective for Class***	***Minimum Threshold Value***	***Priority***
Accommodations			
# Of berths – non crew	25 [orig. SMR] 30 [FIC suggestion]	20 [orig. SMR] 22 [FIC suggestion]	Critical
# Of staterooms – non crew	15 (at least 3 single staterooms for Marine Technicians and scientists)	10	Very Important
# Of crew per stateroom	1 - all crew	1 – officers, 2 – all others	Very Important
# Of persons per toilet & shower facilities	2 for 25 % of accommodations, 4 for remainder.	No more than 4	Important
Habitability			
HVAC –Temperatures	Maintain between 70° - 75°F (20° - 24° C) in all anticipated external environmental conditions	Maintain between 70° - 75°F (20° - 24° C). *M*eet the requirements for 80% of the anticipated environmental conditions.	Very Important
HVAC – Relative Humidity	50%	50%	Very Important
HVAC - # of air changes in each space per hour	11	9	Very Important

Requirement	*Target Objective for Class*	*Minimum Threshold Value*	*Priority*
Noise Levels		*Pick numbers from standards listed (NVIC 12-82, IMO A.468 (XII), OSHA 29cfr1910.95*	Critical
Vibration		*ABS or SNAME Standards? [Add reference or text from standard]*	Very Important
Light Levels	Community Input Requested.	*Minimum OSHA Standard? [Add reference or text from standard]*	Very Important
ADA Design Features	ADA Guidelines for UNOLS Vessels_Final_Feb08.pdf, Section 4	Implement ADA Guidelines that do not impact size of vessel.	Very Important
Enhanced Habitability to improve productivity and well being of personnel	Employ the services of an ethnographer with experience in vessel design.	The productivity of all personnel sailing in these vessels can be enhanced by providing comfortable, aesthetically pleasing spaces, and by including, to the extent possible, areas for off-hour activities other than staterooms and workspaces such as a library, lounge, or conference room with tables, good lighting, video capability, and etc. Equipment and appropriate space for exercise should be provided. Staterooms should include connections to the ship's network and entertainment systems, but they need also to be separated from the noise associated with off-hour activities.	Critical
Operational Characteristics			
Endurance	30+ days continuously underway at survey speed of 4 knots up to cruising	40 days (20 cruising – 20 Station)	Critical
Range	10,800 nm (20,000 km) at optimal cruising speed.	8,000 nm (14,800 km) at optimal cruise speed	Critical

Requirement	*Target Objective for Class*	*Minimum Threshold Value*	*Priority*
Speed	12 knots sustainable through sea state four. 15 knots in calm seas at sea trial. Cruising speed 12 kts at 80% MCR; Max speed based on installed power.	10 knots sustainable through sea state four Cruising speed 12 kts at 80% MCR; Max speed based on installed power.	Very Important
Draft – Navigational	17 ft	19 ft or less	Very Important
Sea-keeping – this section needs some definite feedback from JJMA/Peo-Ships			
Fully Operational	Sea State Five	Sea State Four	Critical
Meets the motion criteria 80% of the time on all headings for on station operations with CTDs and similar types of deployments	At Sea State Six	At Sea State Five	Very Important
Meets the motion criteria 75% of the time on all headings with mooring deployments and other similar equipment deployments	At Sea State Six	At Sea State Five	Very Important
Meets the motion criteria 50% of the time on all headings with ROV, coring and other sensitive or complicated deployments	At Sea State Six	At Sea State Five	Very Important
Meets the motion criteria 50% of the time on all headings and able to maintain 7 knots	See Above	At Sea State Six	Very Important
Safely Hove to	Sea State Seven plus	Sea State Seven plus	Critical
Maximum Vertical Accelerations	0.15 g (rms) SS6	0.15 g (rms) SS5	Very Important
Maximum Lateral Accelerations	0.05 g (rms) SS6	0.05 g (rms) SS5	Very Important
Maximum roll	< 3° (rms) SS6	< 3° (rms) SS5	Very Important
Maximum pitch	< 2° (rms) SS6	< 2° (rms) SS5	Very Important
Station Keeping			

Requirement	*Target Objective for Class*	*Minimum Threshold Value*	*Priority*
Maintain position at best heading in SS4	± 2 meters from a fixed location OR ± 5 meters at higher wind, current and sea state	± 5 meters from fixed location	Very Important
Maintain position at best heading in SS5, 35 knot wind, 2 knot current	*± 5 meters from a fixed location*	± 20 meters from fixed location	Critical
Track Line Following			
Follow a defined straight track segment in SS5, 30 knots of wind and 2 knots beam current at speeds of 2 knots or greater	Alternate would be to specify the off track distance and have a range of environmental conditions	± 5 meters from intended track with less than 45° heading deviation.	Very Important
Ship Control			
	Design for maximum visibility of deck working areas during deployment and retrieval of equipment. Functions, communications, and layout of ship control must allow the close interaction of ship and science operations. Cameras can be used where necessary for maximizing visibility of operations.		*Critical*
Ice Strengthening			

Requirement	*Target Objective for Class*	*Minimum Threshold Value*	*Priority*
	Two vessels with the capability to operate in the presence of ice covered waters (one in Atlantic & one in Pacific). Designed to IACS Polar Class PC5: Year-round operation in medium first-year ice, which may include old ice inclusions. IACS Polar Classes PC6 or PC7 are alternatives for second vessel if some ice capability is needed, but budgets do not allow the higher classifications. Ship designs must be compliant with hull requirements for the geographic areas in which they will operate.	One vessel in this class (Alaska Region) have the capability to operate in the presence of 6/10 coverage of first year ice and designed to meet the criteria for IACS Polar Class PC5: Year-round operation in medium first-year ice, which may include old ice inclusions.	Important
Over-the-side Handling			
Stern Frame	Community Input Requested	Structural Design IAW 46 CFR 189.35-9 for use with cables having a breaking strength = 120,000 lbs. Able to move 30,000 lbs through full range of motion. Minimum horizontal clearance = 20 ft. Minimum vertical clearance between deck and attachment point = 27 ft. Minimum inboard and outboard reach = 12 ft. Refer to UNOLS Load Handling System Functional Requirements for further detail.	Critical

Requirement	*Target Objective for Class*	*Minimum Threshold Value*	*Priority*
Side Weight Handling Appliances	Community Input Requested	Structural Design IAW 46 CFR 189.35-9 for use with cables having a breaking strength = 45,000 lbs. Able to move 20,000 lbs through full range of motion. Minimum horizontal clearance = 10 ft Minimum vertical clearance between deck and attachment point = 18 ft Minimum inboard and outboard reach = 10 ft Refer to UNOLS Load Handling System Functional Requirements for further detail.	Very Important
Winches & Wire			
Hydrographic Winches	Two winches with 10,000 meter capacity for wire rope, E-M cable and F-O cables from ¼" to ½" diameter. Two or more mounting locations.	One winch with 10,000 meter capacity for wire rope, E-M cable and F-O cables from ¼" to ½" diameter. Mounting location for second similar winch. Refer to UNOLS Load Handling System Functional Requirements for further detail.	Very Important
Heavy Duty Winch Complex	Traction winch system with two drums with the capacity to hold 12,000 meters of 9/16" wire rope AND 10,000 meters of either 0.680" E-M cable or 0.681" F-O cable.	One winch system with interchangeable drums or capability to change wire/cable having a capacity for 12,000 meters of 9/16" wire rope or synthetic rope OR 10,000 meters of 0.680" E-M cable OR 10,000 meters of 0.681" F-O cable.	Very Important

Requirement	*Target Objective for Class*	*Minimum Threshold Value*	*Priority*
Cranes	A crane that can reach all working deck areas and that is capable of offloading vans and equipment weighing up to 20,000 lbs to a pier or vehicle in port. Two smaller cranes, articulated for work with weights up to 4,000 lbs at deck level and at the sea surface, with installation locations forward, amidships, and aft should be provided.	At least one crane should be able to deploy buoys and other heavy equipment weighing up to 10,000 lbs up to 12 feet over the starboard side at sea in sea state 4. One smaller crane, articulated for work with weights up to 4,000 lbs at deck level and at the sea surface, with installation locations forward, amidships, and aft should be provided.	Very Important
Towing	Community Input Requested	The ship should be capable of towing large scientific packages up to 10,000 lbs tension at 6 knots, and 25,000 lbs at 4 knots. Winches should be capable of sustaining towing operations continuously for days at a time.	Very Important
Science working spaces			
Working deck - Total	2,300 sq ft total	Total amount of clear working area available on the main deck aft should be at least 2,000 sq ft.	Very Important
Aft Deck Area	1,800 sq ft aft of deck houses	1,500 sq ft minimum aft of deck houses as open as possible.	Very Important
Side Deck Area	80 ft x 10 ft in addition to aft deck	Contiguous waist work area along one side that provides a minimum of 80 ft clear deck area.	Very Important
Vans	Space to carry two standardized 8 ft by 20 ft portable deck vans and the capability to carry up to two additional portable, possibly non-standard size, vans (500 sq ft total)	Space for Two Standard Vans that is in addition to the working deck requirements.	Critical

Requirement	*Target Objective for Class*	*Minimum Threshold Value*	*Priority*
Laboratories	Total lab space should be approximately 2,000 sq ft including: Main (dry) lab area (1,000 sq ft) designed to be flexible for frequent subdivision; Separate wet lab/hydro lab (400 sq ft) located contiguous to sampling areas; An electronics/computer lab (300 sq ft); A separate electronics repair shop/work space for resident technicians; High bay/hanger space for multiple purposes adjacent to the aft main deck; Climate controlled work space or chamber (approx.100 sq ft) A dedicated, physically secure shipboard server compartment that is climate controlled.	1,800 sq ft total	Critical
Storage	Approximately 5,000 cubic feet of storage space that could also be used as shop or workspace when needed would be important.	4,000 cubic feet	Very Important
Science load	250 LT	Variable science load should be 200 LT. 150 LT	Critical
Workboats	Capability to carry and deploy a 25 – 30 ft scientific workboat in addition to the inflatable boat.	At least one 16-ft or larger inflatable boat located for ease of launching and recovery	Very Important
Masts	Second light weight mast and capacity for up to 250 lbs of mounted scientific equipment	Capacity for five scientific packages with a total weight of 200 lbs.	Very Important
On-Deck Incubations	Additional XX sq ft of deck space? Community Input Requested	200 sq ft of clear deck space with access to 50 gals/min of water at a temperature within 1° C of ambient seawater temperature.	Very Important

Requirement	*Target Objective for Class*	*Minimum Threshold Value*	*Priority*
Marine Mammal & Bird Observations	Semi-protected location as high as possible for two to three marine mammal observers with 180° unobstructed view forward of the beam with mounting locations for big eyes and access to navigation data.	Location in pilothouse or flying bridge for marine mammal observations.	Important
Science and Shipboard Systems			
Navigation	Best available commercial systems, including: - Differential GPS - Automatic radio detection finder - Ship's depth finder - GPS assisted inertial reference system with gyro backup - Doppler speed log - 10- and 3- cm radars	Same	Critical
Data Network and Onboard Computing	A modern and expandable data network should be integrated into the design for all spaces on the research vessel including labs, deck areas, instrument mounting spaces, bridge, machinery spaces, common areas, and staterooms. Wireless networks should be available in laboratories. Connecting cables/wiring should be installed to all areas and include provisions for growth.	Same.	Very Important
Real-Time Data Acquisition	A well designed "system" for real time collection of data from permanently installed sensors and equipment as well as provision for temporarily installed sensors and equipment that allows for archiving, display, distribution, and application of this data for a variety of scientific and ship board purposes should be designed and specified by a group of knowledgeable science users and operators.	Same.	Critical

Requirement	*Target Objective for Class*	*Minimum Threshold Value*	*Priority*
Communications – Internal	Telephone system, public address system, and sound powered telephone system	Same.	Very Important
Communications – External	Commercially available voice and data channels for continuous communications to shore stations, other ships, boats and aircraft including satellite, VHF, FAX, aircraft transceivers, cellular phone, INMARSAT B, and high speed data communications links.	Same.	Very Important
Underway Data Sampling and Collection	The infrastructure and space for continuous underway sampling and data collection for as many ocean and atmospheric parameters as possible should be included in all design phases and construction details.	Same.	Very Important
Scientific Electrical Power		Use current IEEE 45 or equivalent standards for shipboard power and wiring and current IEEE standard for UPS and clean power specifications. Electrical service for the labs should include: - 110 VAC, single phase 75-100 amps service for each lab; - 208/230 VAC, 3-phase, 50 amps, “readily available” (i.e., in the panel, or 1-2 outlets); and - 480VAC, 3-phase available “on demand” (for example, run into the lab from auxiliary outlets on deck). Provide for multiple simultaneous connections for 480V 3-phase, 208 – 230V 3-phase and single phase, and 110V single phase with up to 50 amps service for vans, laboratories, and on deck.	Critical

Requirement	*Target Objective for Class*	*Minimum Threshold Value*	*Priority*
Lab – Water		Uncontaminated seawater should be supplied to most laboratories, vans, and several key deck areas. This water must be collected as close as possible to the bow and piping must be made from materials acceptable to the majority of science users. It is desired that uncontaminated seawater intakes be available at multiple depths from the surface including access to surface water at about 1m depth. As a minimum, one uncontaminated seawater intake is required.	Critical
Lab – Air		The ship's service compressed air supply (@100 psi) should be available in the labs and have the ability to add filters as needed. Clean dry air needs are to be handled by bottled air or user supplied filter systems. Air quality should meet or exceed ISO 8573.1:2001 Class 1.2.1	Very Important
Multibeam – deep water	1° x 1° deep water multibeam	1° x 2° deep water multibeam	Critical
Multibeam – shallow water	Multibeam system capable of obtaining useful data in water as shallow as 50 meters		Important
Acoustic Doppler Current Profiler (ADCP)	Acoustic Doppler Current Profiling system with transducer wells for more than one frequency (i.e. 38, 75 or 150 kHz); hull mounted with a combined capability of 1000-meter depth and fine scale shallow water performance.	Acoustic Doppler Current Profiling system with transducer well either 38 or 75 kHz frequency; hull mounted with a capability of 1000 meter depth.	Critical
Deep Water Echo Sounder	Multi-frequency Deep Water Echo Sounder	12 kHz Echo Sounder	Critical

Requirement	*Target Objective for Class*	*Minimum Threshold Value*	*Priority*
Sub-Bottom Profiler	2 – 8 kHz Sub-Bottom Profiler	Capability to install 2 – 8 kHz Sub-Bottom Profiler	Very Important
Acoustic Navigation and Tracking System	Transducers and equipment installed	Mounting location for transducers and equipment	Important
Underwater Communications system	Transducers and equipment installed	Mounting location for transducers and equipment	Important
Additional Transducer Mounts		Locations in hull and for over-the-side mounting with capability of changing in-hull transducers while afloat.	Very Important
Acoustic performance and radiated noise		As acoustically quiet, as is feasible considering the choice of all shipboard systems, their location, and installation. Special consideration should be given to machinery noise isolation, including heating and ventilation. Propeller(s) are to be designed for minimal cavitation, and hull form should attempt to minimize bubble sweep down.	Very Important

Requirement	*Target Objective for Class*	*Minimum Threshold Value*	*Priority*
Discharges		All liquid discharges from sinks, deck drains, sewage treatment systems, cooling systems, ballast pumps, fire fighting pumps, and other shipboard or science systems should be on the port side, with tanks capable of holding normal discharges for a minimum of 24 hours. Design should allow for zero discharges on the starboard side, including deck drains, when required during normal operations.	Very Important

Requirement	*Target Objective for Class*	*Minimum Threshold Value*	*Priority*
Waste Management		A well thought out waste management plan should be developed during the design phases so that these vessels can prevent, control, or minimize all discharge of garbage and other wastes at sea. The use of all appropriate and best available systems and methods such as compactors, incinerators, vacuum toilets, low flow showers, oily water separators, efficient marine sanitary devices, recycling, adequate holding tanks, and others should be used to prevent, reduce, and control waste discharges. The location of garbage storage areas should be well defined. The vessel should be designed and equipped so that it can effectively adhere to all local, state, federal, and international (MARPOL) pollution regulations, to prevent contamination of science experiments, protect the environment, and to ensure the health and safety of embarked personnel.	Very Important
Hazardous Waste		An on-deck hazardous storage capability for chemicals plus a holding capability for class C waste should be provided. Provisions for low-level radioactive waste storage will be incorporated in the radiation vans.	Very Important

Requirement	*Target Objective for Class*	*Minimum Threshold Value*	*Priority*
Exhaust Discharges		Discharges of engine exhaust, tank and sewage system vents, exhaust from fume hoods, and ventilation systems should be designed so they do not re-enter the ship's interior or ventilation systems, and so they can all be directed away from the ship at the same time with proper placement of the relative wind (i.e. all on the port side aft). Exhaust and air system discharges should be separated from sensor locations as much as possible. Engine choices should emphasize minimized exhaust discharges and should as a minimum adhere to Federal regulations and State regulations for normal operating area.	Very Important
Green Technology	Every effort should be made to incorporate recycled materials, non-polluting equipment and instrumentation and fuel efficient or alternative fuel technologies to make these vessels as environmentally friendly and cost effective as possible.		Important
Maintainability		The ability to maintain, repair, and overhaul these vessels, and the installed machinery and systems efficiently and effectively with a small crew should be a high priority. The choice of machinery and ship's system should consider the cost and level of effort necessary to maintain and operate these systems.	Very Important

Requirement	*Target Objective for Class*	*Minimum Threshold Value*	*Priority*
Operability		Design should ensure that the vessel could be effectively and safely operated in support of science by a well trained, but relatively small crew complement. The regional conditions, available ports, and shore side services should be considered during the design process. The impact of draft, sail area, layout, and other features of the design on the ability to operate the vessel during normal science operations should be evaluated by experienced operators, technicians, scientists, and crewmembers.	Very Important
Economy of Operation		Economy of operation has been a big benefit of the smaller classes of research vessels, and this aspect should be retained as much as possible in the new Ocean Class designs.	Very Important