UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

Prioritization of Regional Class Science Mission Requirements

Report to the National Science Foundation, Division of Ocean Sciences, Integrated Facilities Section

By

The University-National Oceanographic Laboratory System (UNOLS)

Prepared by the Regional Class Advisory Committee (RCAC) and approved by the Fleet Improvement Committee and UNOLS Council.

Dated: July 1, 2004

Introduction

This report provides recommendations by UNOLS to the National Science Foundation (NSF) concerning relative priorities for certain elements of the Regional Class Science Mission Requirements. These recommendations were prepared by the Regional Class Advisory Committee and reviewed by the UNOLS Fleet Improvement Committee and UNOLS Council.

Charge

At the request of the National Science Foundation, UNOLS was tasked with providing relative priorities for some of the Science Mission Requirements (SMR) for new Regional Class research vessels. A report with UNOLS recommendations was requested by mid to late June 2004. A Regional Class Advisory Committee was formed to review the relevant SMR elements, seek community input and to draft a set of recommendations that would be provided to NSF by UNOLS after further community review and input. In order to accomplish this task in the short time frame provided, the use of phone and web conferencing, email and web based questionnaires was employed.

High-impact SMRs

To kick off the effort, NSF with support by the Naval Sea Systems Command (NAVSEA) and the naval architect firm, John J. McMullen Associates (JJMA), provided an assessment of the various SMR elements and ranked them as high, medium and low impact. This was based on the impact these particular elements would have on the overall size, construction cost, and operation of any Regional Class vessel design. NSF asked that UNOLS prioritize or rank order the high impact SMR elements and to indicate any areas where these requirements could be reduced below the published values. The high impact SMR elements include: science berthing, deck space, lab space, endurance, range, speed and sea-keeping.

Membership on the Regional Class Advisory Committee (RCAC)

The Chair of FIC in conjunction with the Chair and members of the previously formed Regional Class Science Mission Requirements (SMRs) Steering committee created a Regional Class Advisory Committee (RCAC) to address this issue. The goals for the makeup of this committee were to have disciplinary and regional balance as well as institutional and gender diversity. The committee should also include operational representatives. Requests for interest in participating in this effort were sent to all those scientists and operators that had contributed to the development of the Regional Class SMRs either by submitting comments and/or by attending the SMR workshop. Over thirty people expressed an interest in serving on the RCAC. The final choices of committee members were made with the above goals in mind.

Regional Class Advisory Committee (RCAC)

- Wilford Gardner, Chair, TAMU, Gulf, geo-chem
- Vernon Asper, USM, Gulf, bio-geo
- Cynthia Moore, RSMAS, East/Gulf, chem-optics
- Joan Bernhard, WHOI, East, bio
- David Townsend, U. Maine, East, bio
- John Morrison, North Carolina State Univ., East, phys oc
- Bruce Corliss, Duke, East, geo
- Curt Collins, NPS, West, phys oc
- Charles Paul, MBARI, West, geo
- Frank Sansone, U. Hawaii, West, geo-chem
- Stewart Lamerdin, MLML, West, ops-technician
- Louis Zimm, SIO, West, ops-captain
- Steve Lanoux, UT, Gulf, ops-management
- Steve Rabalais, LUMCON, Gulf, ops-management
- Also participating: Dave Hebert, FIC Chair, URI, phys oc

Process

JJMA prepared a presentation, which showed several variants of mono-hull and swath vessel designs that could meet the published Regional Class SMRs to various degrees. In addition, they showed how various SMR elements impacted the design. This report was made available to members of the RCAC and to anyone providing input to the committee. This report is attached as an appendix.

A questionnaire was prepared by the Regional Class Steering committee and posted online for input by the UNOLS community. Requests were sent to all UNOLS representatives, Council and committee members as well as all those that had participated in the creation of the Regional Class SMRs. The questionnaire was also linked from the UNOLS homepage. A total of 86 people completed the questionnaire. These responses were summarized and posted to the website and reviewed by the RCAC. A summary of these results is attached as an appendix.

A phone and web conference was held on Friday, June 4th from 1 to 4 pm EDT during which the JJMA report and questionnaire results were reviewed. The RCAC then discussed the various high impact SMR elements and identified those areas where they felt there was general consensus regarding relative priorities and acceptable values. Some areas were not quite as clear, but a sense of what might be acceptable was formed and this was articulated in the draft report and circulated for community input. Minutes of the phone conference were circulated to the RCAC and NSF and are attached as an appendix.

A draft report with recommendations by the RCAC was created and circulated to NSF and the community for comment. Input received was incorporated into a final report, which was forwarded to NSF by FIC and the UNOLS Council and published to the community on the UNOLS website.

Overall objectives of Regional Class SMR prioritization (relative to previous and current steps in the process)

FOFC Academic Fleet Renewal Plan

Vessels to replace current Cape Class and some of the intermediates

Regional Class vessels should be more capable than the vessels they replace.

Some parameters were set in the FOFC plan and needed to be refined or reduced to keep vessel size and cost within limits.

Regional differences are not addressed in the FOFC plan or in the current plans for implementation of that plan for Regional Class vessels.

Published UNOLS SMRs

Published SMRs provided a set of scientific requirements based on initial constraints set by the FOFC plan.

Some provided ranges from minimal to desired.

Relative priorities between requirements such as lab and deck space were not provided based on the assumption that all requirements could be met with the right vessel design.

NSF Phase III design prioritization effort

Although the design feasibility studies conducted for NSF by NAVSEA and JJMA showed that a design could be created that met all of the Regional Class SMR requirements, this design would be at the upper end of the size range and potentially exceed the budget for construction cost. In addition, the yearly cost to operate this vessel is projected to be greater than amounts acceptable to NSF and many other potential users of these vessels.

With constraints on overall size, construction cost and operating costs along with guidance on which SMR elements have the most impact on these parameters it is possible to set relative priorities with regards to space utilization, hull form and propulsion size.

Summary of recommendations

For the most part, the RCAC and many members of the community that provided input believe that the published SMRs remain a valid description of the scientific requirements for Regional Class vessels. Given the desire to keep the overall size, construction cost and operating cost lower, the RCAC and UNOLS recommend that the Regional Class vessel can be designed with some reductions in the published Science Mission Requirements and by giving priority to some elements over others when and if choices are necessary.

The range can be reduced to somewhere between 12,000 and 10,000 km. Endurance should be maintained at a minimum of 21 days, however extending endurance to 30 days should be given less importance. The vessel should be

designed to a maximum speed of 12 knots and a fuel-efficient cruising speed between 10 and 11 knots. Cruising speeds greater than 11 knots and maximum speeds greater than 12 knots are not a high priority. Sea-keeping remains a high priority for these vessels, but not to the extent that a SWATH vessel hull form would be preferred. A mono-hull design, optimized for sea-keeping, is preferred for flexibility in operations, payload, draft and lower cost.

For choices in the allocation of space in the Regional Class design, the RCAC and UNOLS recommend that every attempt be made to stay within the ranges provided in the published requirements by using a balanced and flexible design. While maintaining the minimal number of science berths at 16, the design should give highest priority to free and clear deck space with a well-designed capability to handle two vans. Lab space is the second priority, with the ability to use vans for added lab space providing the required flexibility. The ability to provide additional or surge berthing was the lowest priority relative to deck and lab space. The use of smaller staterooms and the careful design of toilet/shower spaces and common use spaces should be incorporated to meet space utilization goals. Although not listed as a high impact SMR, the committee felt that habitability requirements remain a high priority and that designers should make every effort to incorporate recreational and meeting space in the designs, especially if stateroom sizes are kept to a minimum.

SMRs affecting use of space

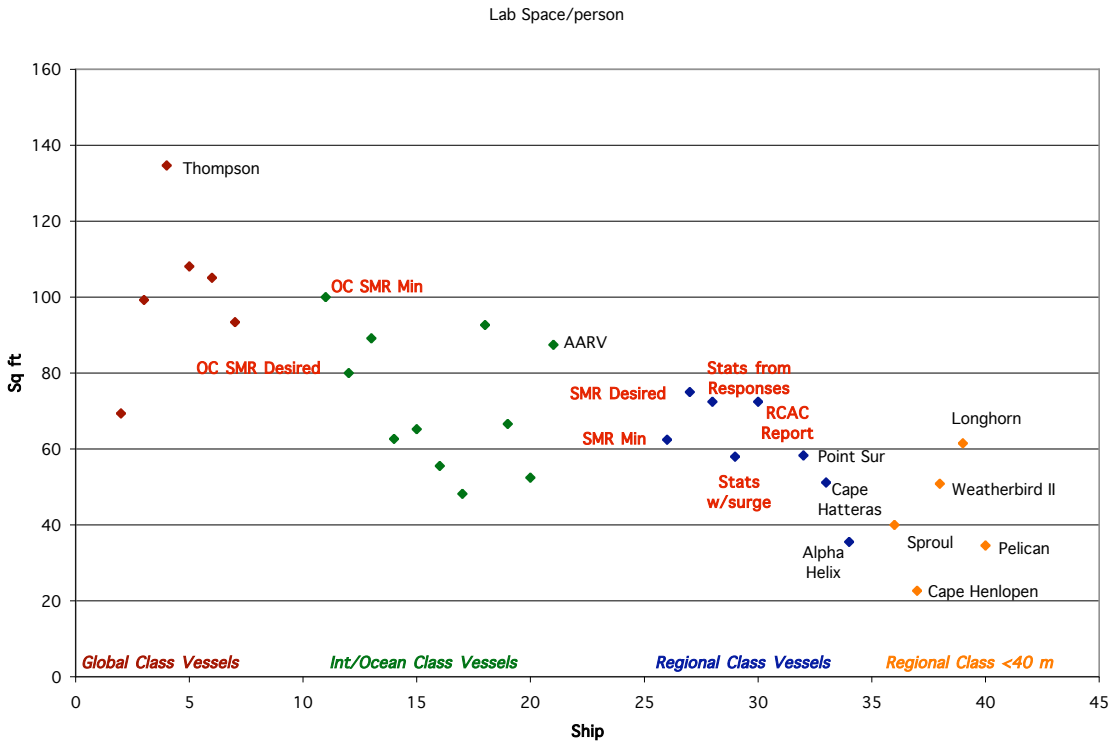
Relative priorities

Preferences expressed in the survey for deck space, lab space or berthing were a somewhat mixed bag. Deck space was chosen as the first priority by most, with lab space second priority and berthing space the third priority.

Balance and ratio between spaces

When making choices between deck, lab and berthing space, is important to maintain a logical ratio and balance. A design should not sacrifice lab space to creating berthing to the extent that there is no room for the extra scientists to work. The converse is true, creating a huge lab space for a minimal science complement would not make sense either. Lab spaces should be reduced in number as well as size, being careful not to create spaces that are largely unusable due to their small size (i.e., CAPE Class wet lab).

The following three charts show the amount of lab, deck and combined lab/deck space per science berth for the current UNOLS vessels and those contemplated by the SMRs and this report.


Lab Space/person
Sq ft
Ship
Thompson
OC SMR Min
AARV
OC SMR Desired
Stats from Responses
SMR Desired
RCAC Report
SMR Min
Longhorn
Point Sur
Stats w/surge
Cape Hatteras
Weatherbird II
Sproul
Pelican
Alpha Helix
Cape Henlopen
Global Class Vessels
Int/Ocean Class Vessels
Regional Class Vessels
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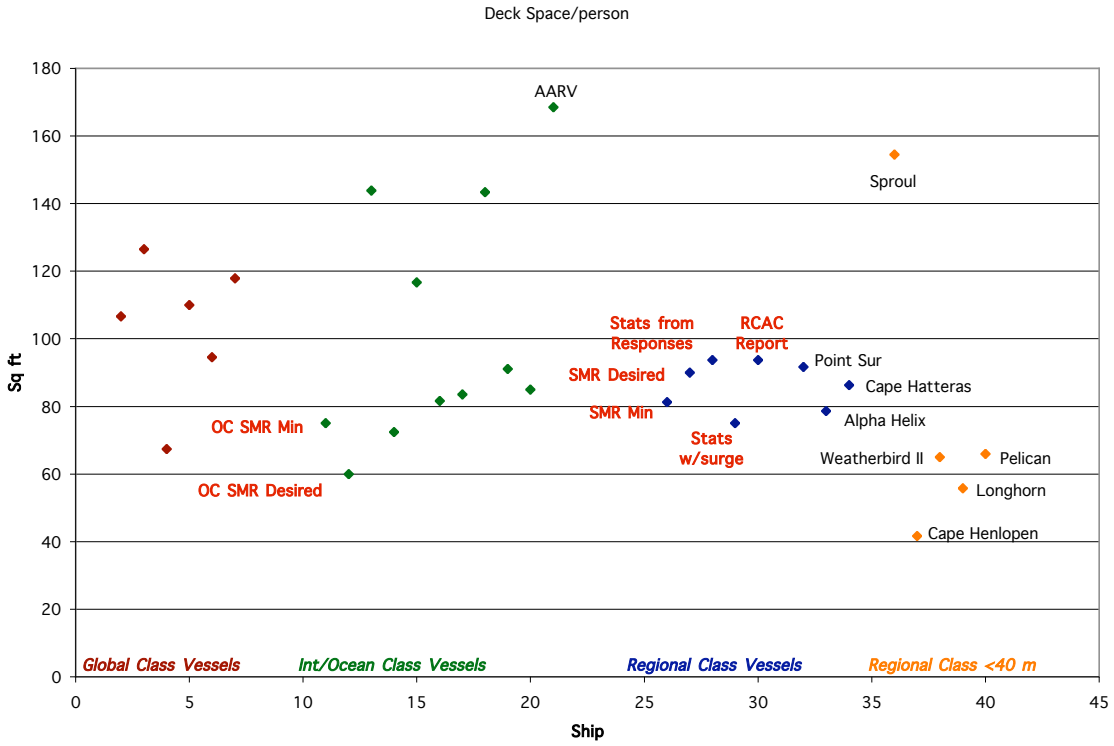
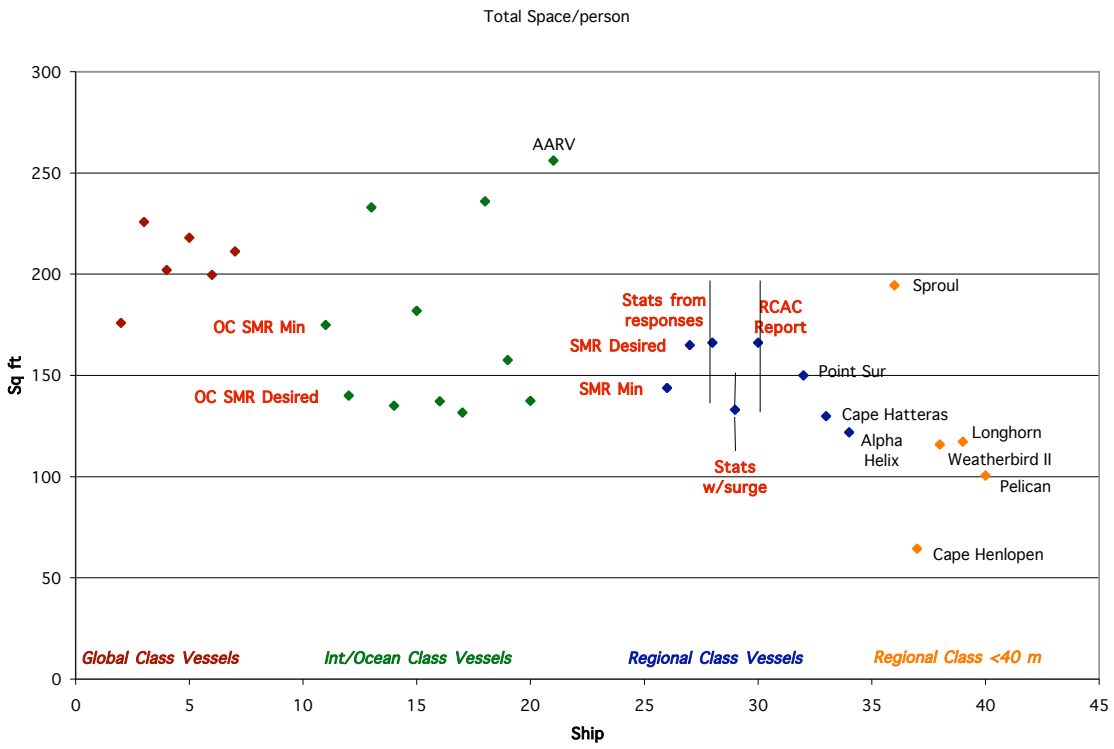

Deck Space/person
Sq ft
Ship
AARV
Sproul
Stats from Responses
RCAC Report
Point Sur
SMR Desired
Cape Hatteras
SMR Min
Alpha Helix
OC SMR Min
Stats w/surge
Weatherbird II
Pelican
OC SMR Desired
Longhorn
Cape Henlopen
Global Class Vessels
Int/Ocean Class Vessels
Regional Class Vessels
Regional Class <40 m



Flexibility

Maintaining flexibility in the design is a very high priority. This is probably the greatest reason for giving deck space precedence over lab and berthing space. With greater deck space, it is simpler to temporarily (or even permanently) provide additional lab space through the use of vans. A well-placed and properly designed van could also be used for berthing, although this option is not recommended by many people. The published SMR gives appropriate cautions.

Berthing

Number of berths

The published requirement, calling for 16 berths at a minimum and a surge capacity of 4 additional berths, continues to be the choice of most. Some respondents continue to believe that a greater number of science berths should be provided and a few felt that less than sixteen were required on permanent basis, but that a surge capacity to at least sixteen was desired.

Total berths required will be affected by number of crew and technicians as well as total science berths. For this class vessel, the use of smaller staterooms can be used, especially in the case of private single person staterooms. It is still desirable to maintain science berthing at two-person staterooms for the normal minimal complement and single staterooms for the crew is desirable.

Surge berthing

Generally speaking, the committee is concerned that attempts to create surge berthing may result in designs that contain too many compromises or create berthing options that are not useable. If at least 16 and perhaps more science berths are provided, then the creation of surge berthing becomes a lower priority.

Use of Vans

Options for creating surge berthing could include the use of a well-designed berthing van in conjunction with a location on the O-1 deck that is mated directly to the superstructure. Any location should be capable of very secure attachment, protection from weather/seas and protected access to and from the interior of the vessel. A head/shower should be located nearby.

Multi-person staterooms and other approaches

Other options could include some staterooms that are large enough and designed to carry 3 or 4 scientists in a surge capacity or third drop down berths in several staterooms. The ability to convert other spaces, such as lounge areas do not hold much promise as these areas would be in more demand when a larger science complement was embarked.

Heads

In the JJMA report on regional class vessel hull forms, the smaller size variant was designed with community heads (toilet/shower) that were designed to accommodate more than one person at a time. These so-called “group heads” are not considered a viable option and should be avoided if at all possible. There was a preference for semi-private heads (a head shared between two cabins), however, some preferred single person units that opened into passageways and would be more of a community space. There are pluses and minuses to both approaches. It was agreed that the ratio of people per head should remain at four, except for cases where surge berthing is employed. In that case, ratios as high as six per head could be used. A creative approach to provide community and semi-private toilet shower space should be examined. In any event, at least one community toilet should be provided on the main deck.

Common spaces

The habitability SMR was not included among those presented by JJMA as having a high, medium or low impact on vessels size and cost. The RCAC, however believes that habitability issues are a high priority and some of these items may have an impact on overall size of these vessels. In particular, common use spaces such as lounges, science meeting space, mess deck and recreational spaces will compete with other space uses. The committee felt that it was important to provide for these areas on this class of vessel, especially if staterooms are kept at a minimal size. Again creative use of space and designing spaces for multiple use will help to allow for these common areas without expanding the overall size of the vessel.

Deck Space

Amount required

The published range of a desired deck space remains valid. At least 1,000 sq ft of clear deck space aft of the main house is required and when you include the contiguous waist area on the starboard side, the minimum should be 1,300 sq. ft. First priority should be given to increasing the clear deck space aft of the house to at least 1,200 sq ft and a total working area of 1,500 sq ft on the main deck.

Clear space on rail

Maintaining 50 ft of clear space along the starboard rail is considered a high priority.

Van spaces

These vessels should be capable of carrying two standard size vans. There is a preference for both van locations to be on the main deck, but the requirement is that at least one van space be located on the main deck. In all cases safe and secure access to vans by personnel should be provided for in the design.

Lab Space

Amount required

Lab space was the second priority and should be kept as close to the published SMR requirements as possible. If choices must be made, lab space should be reduced before deck space and can be kept closer to the minimum requirements if necessary (1,000 sq ft).

Location

Wet labs and main labs should be kept on the main deck, contiguous with the working decks. It may be possible to locate other labs on other decks if necessary.

SMRs affecting power and hull form/size

Relative priorities

Endurance was the first priority for most with range a second priority and speed a third priority when competing against each other. This is harder to interpret, but probably means that maintaining the ability to meet the minimum endurance and the shortened minimal range are more important than achieving greater speed.

Sea-keeping was clearly a higher priority than increased speed.

Range

There was clear consensus that the published range of 15,000 km was greater than what was required and that this value could be reduced to 12,000 km and perhaps as low as 10,000 km.

Endurance

Endurance was an important consideration and was generally given a higher priority relative to range and speed for the Regional Class vessel design. Maintaining a minimum endurance of 21 days was given a high priority, however surge endurance to 30 days was given less importance. It is still desired, but not at the risk of significant increase in cost or reduction in other requirements.

Speed

Speed at the upper end of the published SMR requirement is not a high priority. Speeds greater than 12 knots are not required and should not come at the expense of sea keeping or a large increase in daily rate. A maximum speed of 12 knots is still desired, and an optimum cruising speed in the 10 to 11 knot range is acceptable.

Sea-keeping

Sea-keeping remains a high priority and takes precedence over speed in making hull form choices. Sea-keeping does not over-ride the negative aspects of choosing a SWATH vessel hull form (e.g., draft, payload, cost). The committee believes that a mono-hull design, optimized for sea-keeping makes the most sense for a Regional Class vessel.

Conclusion

Need for creativity and multiple ideas in early design

It is clear that in order to provide maximum capability while at the same time keeping the overall size and cost of the Regional Class vessels under control it will be absolutely necessary to use creativity and to explore multiple ideas early in the design process.

Need for continued community input

At the same time community input is required at all stages to ensure that these ideas will meet their scientific requirements, especially when weighing one requirement against another.

Potential need for more than one design or variations of design for regional differences.

Regional preferences for either a slightly larger or for a less expensive smaller design remain and it may be necessary to consider options or variations of a

design that might be adapted to these varying requirements. Perhaps a scalable design could provide for regional differences with minimal additional cost if a single design cannot meet the needs of every region.

Designs under 300GRT (un-inspected vessel?)

Many people felt that designing a capable research vessel that would meet the needs of many people while maintaining an operating cost close to that of existing Regional Class vessels should be a high priority, although this question was not asked explicitly in the questionnaire. Since the size of the crew has one of the biggest impacts on the cost of operations, designing for a crew size of no more than eleven, for example, would help to keep these costs lower. It is the opinion of several members of the committee that designing the vessel so that it would be less than 300 GRT and operated as an un-inspected research vessel would be an important goal to consider in keeping the cost down. Alternatively, crew size considerations could be explored with the Coast Guard in an attempt to develop a design for an inspected vessel that had a smaller crew complement.

Summary Table of Recommendations

Parameter	Published SMR Capability or Characteristic	*RCAC*	
		Recommendations	**Comment**
Habitability			
Accommodations	16 to 20 non-crew personnel	16 minimum with Surge of 4 berths	Can use smaller staterooms
Heads	Ratio = 4 people/head	- Keep SMR ratio (4:1) - Avoid "group heads" - Semi-private preferred - 6 per head acceptable when surge berthing in use.	At least one head on Main deck
Common Spaces		High priority	
Operational characteristics			
Endurance	21 days; surge capacity 30 days (15 transit and 15 station)	- Keep 21 day minimum - Surge to 30 days less important	Highest operational priority
Range	15,000 km	12,000 km to 10,000 km	Second operational priority
Speed	12 - 14 knots; 10 knots sustainable through sea state 4; 7 knots in SS 5	Optimal cruising speed = 10 to 11 knots Max speed = 12 knots	Third operational priority
Sea keeping	Ability to work in sea states 4 (1.25 - 2.5 m wave heights); >50% operational in SS 5 (2.5 - 4 m wave heights).	High priority and takes precedence over speed	Monohull preferred over SWATH

Parameter	Published SMR Capability or Characteristic	*RCAC*	
		Recommendations	**Comment**
Science working spaces		- Balanced ratio between spaces needed - Maintain space flexibility	
Working deck area	1,000 sq ft minimum clear area **aft** of deck houses; desirable 1,500 sq ft. Additional contiguous minimum 50' x 10' area along one side for coring, etc. Total amount of clear working area available on the aft main deck should be at least 1,300 sq ft.	Keep SMR requirements. - 1st priority should be increasing clear deck space aft of the main house to 1,200 sq ft or greater. - 50 ft along STBD rail is high priority. - Space for 2 standard vans.	Highest Space priority One van can be on upper deck if necessary or for berthing.
Laboratories	Total lab space should be a minimum of 1,000 sq ft (1,500 sq ft is desirable) including: Main (dry) lab area (800 sq ft) Separate wet lab/hydro lab (400 sq ft) Electronics/computer lab; separate or part of main lab. A separate electronics repair shop/work space for resident (and visiting) technicians is desirable. High bay/hanger space Climate controlled workspace or chamber (~100 sq ft)	- Keep close to SMRs. - Labs should be reduced before deck space - Can be kept closer to the minimum SMRs if needed - Wet labs and main labs should be on main deck, but some other labs may be located on other decks if necessary.	Second space priority - Additional lab space thru use of vans

References

Federal Oceanographic Facilities Committee (FOFC), 2001, Charting the Future for the National Academic Research Fleet, A Long-Range Plan for Renewal, 32 pp

University-National Oceanographic Laboratory System (UNOLS), 2003, Regional Class Science Mission Requirements, 38 pp

Appendices

I. JJMA report on high, medium and low impact SMRs

II. Questionnaire seeking community input

III. Summary of responses to questionnaire

IV. Notes from RCAC phone/web conference

Appendix I

Report by John J. McMullen Associates (JJMA)

May 15, 2004

Regional Class Research Vessel

Impact of SMRs on Size and Cost

http://www.unols.org/committees/fic/regional/JJMA_rc_phase3_041504.pdf

Appendix II

UNOLS Questionnaire for community input
Prioritization of High Impact Regional Class SMRs

The complete questionnaire is online at the UNOLS website:

http://www.unols.org/committees/fic/regional/regional_smr_priorities.asp

Questions asked are listed below:

Berthing

- What should the minimum number of permanent berths be?
- How many surge capacity berths are needed?
- Can surge berthing be multi-occupant (more than two person)?
- Should vans be used for berthing?
- Should Toilet/Shower be semi-private (4 per unit) or community? semi-private/community
- Should smaller staterooms (minimum allowed by regulations) be used to gain more berths if needed?

Deck Space

- What is the minimum required clear deck space on the main deck?
- Is 50 ft of deck space along the rail required? (answer no if you think it can be reduced)
- What should be the minimum number of van spaces?
- Do both van spaces have to be on main deck?

Lab Space

- What is the minimum required lab space?
- Do all labs have to be on the Main Deck?

Endurance

- What should the minimum endurance be?
- Is the ability to have a surge endurance of 30 days a high priority?

Range

- Can the range be reduced below 15,000 km (8,100 nm)?
- How much range is adequate for work from a regional vessel?

Speed

- Do you require more than 12 knots maximum speed?
- What should the optimum cruising speed be?

Sea-keeping

- Is improved sea-keeping capability over the Cape Class a high priority?

Rank Ordering of High Impact SMRs

- Assumes that choices will have to be made to meet cost and size constraints.
- Within each group below, rank order the choices with 1 being the highest priority
- Berthing vs Lab Space vs Deck Space
- Range vs Endurance vs Speed
- Speed vs Sea-keeping

Comments

- Comments could be provided for each section and in general.

Appendix III

Summary of Community Input to UNOLS Questionnaire

Prioritization of Regional Class Vessel High Impact SMRs

http://www.unols.org/committees/fic/regional/regional_priorities_result.html

Appendix IV

Regional Class Advisory Committee

Phone/Web conference meeting

June 4, 2004 – Meeting Notes

http://www.unols.org/committees/fic/regional/RC_webconf_041504_notes.html