UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM
Moss Landing Marine Laboratories 8272 Moss Landing Road, Moss Landing, CA 95039
(831)-771-4410 Fax (831) 632-4413 www.unols.org office@unols.org

March 7, 2005

RADM Jay M. Cohen, Chief of Naval Research
Office of Naval Research
800 Quincy Street
Arlington, VA 22217-5000

Dear RADM Cohen:

This letter is in response to your charge to UNOLS at the Annual meeting last October to carefully evaluate three potential Ocean Class hull types, the monohull, the SWATH, and the X-craft, in collaboration with the Naval architectural firm John J. McMullen Associates, Inc. (JJMA) and to make a recommendation as to the hull type that should be the basis for the construction of new Ocean Class vessels to replace our aging Intermediate vessels. The UNOLS Fleet Improvement Committee (FIC) and the Ocean Class Advisory Committee (OCAC) worked with JJMA on an accelerated evaluation of the different hull types. **Based on the information developed (See Appendix), UNOLS has reached the conclusion that the next ocean class ships should be monohulls.**

This decision was arrived at through a series of meetings and community inputs, which are documented in sections of the attached Appendix. Key to reaching the decision was the development of the Science Mission Requirements (SMRs) for Ocean Class vessels that began in earnest in February 2002. Starting with the broad parameters for the Class given in the FOFC Plan, an Ocean Class Steering/Advisory Committee conducted a large community SMR definition workshop and solicited broad user community comment on the draft SMRs. This process culminated in publication of the SMRs in March 2003. At a meeting and X-Craft shipyard visit on November 16-17, 2004, ONR introduced several additional *desiderata* from the standpoint of future Navy uses of the ships. These objectives had not been explicitly noted in the existing SMRs. These additional “Navy SMRs” were then included in subsequent hull form assessments. The combined SMRs constitute a substantial body of interdisciplinary and broadly-based thought about the anticipated scientific needs and uses for these new vessels.

As a result of this series of meetings, each hull form was developed in two or three variants, details of which are given in documents for the Dec. 20, 2004 web conference:

1. Monohull: baseline ship, a lengthened ship with additional hangar space, and a wide-beam variant
2. SWATH: versions with large and small hangars, reflecting tradeoffs between open deck space and enclosed space
3. X-Craft: Three different hangar sizes, reflecting tradeoffs similar to the SWATH situation.

Upon consideration of these variants the UNOLS group recommended at the Jan. 5, 2005 meeting that further consideration be restricted to one variant of each type: a slightly lengthened “baseline” monohull, a “small-hangar” SWATH and a “small-hangar” X-Craft. These down-selections reflected many factors. Importantly, the “baseline” monohull was deemed sufficiently responsive to SMRs (including provision for eight internal vans) that a significantly enlarged length or beam was not necessary or cost-effective, and the “small-hangar” choices for the other two forms reflected a concern for retaining a useful amount and arrangement of open deck area for a number of near-surface scientific purposes (coring, instrument recovery alongside, etc.). Subsequent design refinements and eventual scoring were carried out using these three hull forms, one of each type.

Monohull:	LOA= 237 ft, LWL=220 ft, Beam= 48 ft, Draft=17 ft
SWATH:	LOA=200 ft, LWL=186.5 ft, Beam (WL) = 88 ft, Draft = 25 ft normal operating; 19 to 20 ft light draft (variable ballast option)
X-Craft:	LOA=240 ft, LWL=230 ft, Beam (WL) = 72 ft, Draft = 17 ft

The evaluation of the relative suitability of the three basic hull forms was based on the UNOLS and Navy SMRs. Generally only those SMR elements that would be impacted by the choice of hull form were considered in this evaluation. As an example, computer networking was not scored because it was felt that excellent computer networking could be accomplished in any hull form.

The SMR elements that were evaluated were given weights depending upon their relative importance as determined by the evaluation committee. SMR elements were rated as being of high importance (weight of 9), medium importance (weight of 5) or lower importance (weight of 1). The weights assigned by the different members of the group were averaged to arrive at their relative importance. This is in effect a rank ordering of the various SMR elements. The relative importance of the SMR elements or areas of emphasis is independent of any hull form or design considerations, but is an evaluation of how important this element is to the successful completion of future science missions.

The relative strengths of the different hull forms in meeting the SMRs were rated on a scoring scale of 7: Excellent, 5: Very Good, 3: Good, 1:Fair and -1: Poor. Based on the information in the several reports provided by JJMA each hull form was examined to determine how well it met the SMRs (Appendix Section 7).

The construction costs of the vessels depended basically on the amount of steel or aluminum used. In steel, the monohull is the least expensive to construct. The SWATH and X-craft are roughly 20 percent more expensive to construct. An aluminum version of either twin hull-form is much more expensive. The estimated day rates are $21,250 for the monohull, $23,000 for the SWATH, and $23,500 for the X-Craft; the two twin-hull versions have higher maintenance and fuel costs. In general, it was found that the monohull excelled in certain operations such as long coring capability and recovery of free floating instruments requiring unobstructed side exterior passageways and lower freeboard for over-the-side handling. Structural constraints for the SWATH and X-craft versions put limitations on the working deck arrangement as well. The larger interior space within the X-Craft and SWATH vessels allows for easier arrangement of the required number of science accommodations. This additional space makes helicopter operations, preparation of AUVs for deployment, UAV operations, and interior location and handling of vans somewhat easier for the X-Craft and SWATH.

Some of the hull forms have serious limitations. For example, a variable-ballast SWATH version is necessary to have a draft less than 20 feet, which is needed to access many normal ports of call. It is also difficult to install a 1-degree multibeam on either the SWATH or X-Craft vessel. The SWATH and X-Craft have greater difficulty meeting the variable science payload requirement. With the larger superstructure (windage), maneuverability at low speeds, station keeping, and dynamic positioning are harder to achieve than with a monohull.

The seakeeping of the SWATH is better than the monohull and X-Craft. Bubble sweepdown on the SWATH is less due to its deeper draft and better seakeeping. Sweepdown remedies have been engineered for monohulls; remedies for X-Craft are more speculative. Sonar self noise and radiated noise are thought to be a greater concern for the twin-hull versions compared to the monohull.

A summary of the SMR scoring for each of the three hull variants is provided in two tables of Appendix section 7. The first table is the result of averaging the weights and scores as determined by eleven members of the UNOLS working group. The second table is the same as the first table with the Navy SMRs arbitrarily given the highest possible weights to gauge the impact of the Navy SMRs on the final results. At the bottom of each table, the total weighted scores have been normalized by the monohull weighted score for ease of comparison. In both evaluations, the Monohull scored substantially higher than either the SWATH or the X-craft.

A description of the hull evaluation process and the two tables with the weights and scores were sent to the academic oceanographic community along with web links to background documents with a request that individuals review the information and provide feedback including an opinion about which hull form would best serve the oceanographic community in the future. Eighty one individuals or groups of individuals responded representing all oceanographic disciplines and twenty-eight institutions (see Appendix Section 8). Most considered the process of evaluation to be thorough and objective, and most felt the SMR prioritization was appropriate. The overwhelming response was to favor the monohull for the next Ocean Class Vessel.

By-and-large, the community believes the monohull to be the most economical solution over the lifetime of the vessel and in many ways the most flexible and adaptable to new instrumentation packages. In addition, most consider it to be the most reliable and flexible platform for supporting evolving and innovative research programs. Taking a well designed monohull with the innovations that the Navy SMRs embody and outfitting it with the latest instrumentation, communications, propulsion, and auxiliary equipment is, in our view, the most cost effective way to successfully renew the academic research fleet.

UNOLS greatly appreciates the opportunity to formulate this hull-form advice to ONR. We have approached this task with the seriousness it deserves, knowing that the Ocean Class ships will be a major component of US oceanographic capability for decades to come. We are deeply grateful for your efforts individually and those of ONR generally to support the future of US oceanography in this manner, and we are mindful that this is just the latest chapter in a long, illustrious and fruitful collaboration between academic ocean scientists and the US Navy to explore and comprehend the world ocean that is the work arena for all of us.

Peter H. Wiebe
UNOLS Chair

Dave Hebert
UNOLS FIC Chair

Enclosures (8)

cc: Dr. Frank Herr, ONR
Dr. Mike Reeve, NSF