UNOLS Ocean Class Meeting
January 25, 2005
10:30 am ~ Ocean.US Office, 2300 Clarendon Blvd., Suite 1350
Arlington, VA 22201-3667

Meeting call to order – An Ocean Class Meeting was held on January 25, 2005 at the Ocean.US Office in Arlington, VA. Frank Herr, ONR, and Peter Wiebe, UNOLS Chair welcomed the participants. Introductions were made, including those joining by phone/web conferencing. The agenda for the meeting is attached as ***Appendix I*** and the list of participants is included as ***Appendix II***.

Presentation by Dan Rolland, JJ McMullen Associates – Dan Rolland provided a presentation on the characteristics of the three hull forms under consideration, the X-Craft variant, the SWATH, and the monohull vessel. His slides are available at <http://www.unols.org/_projects/fic_ocean/xcraft/JJMAslides_012505.pdf>.

Dan reviewed the work that had been completed since the last meeting:

- Design of new monohull variant - 10 feet longer and optimized beam
- Design of Narrow beam catamaran
- Seakeeping Analyses
    - New monohull variant
    - Corrected X craft
    - On station
- Wide beam monohull powering
- Variable draft SWATH
- Construction cost update

The dimensions of each new variants under consideration are:

Monohull:	LOA=237 ft, LWL=220 ft, Beam=48 ft, Draft=17 ft
SWATH:	LOA=200 ft, LWL=186.5, 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=72 ft, Draft=17 ft

The profile and arrangements of the new monohull variant were presented. The new design is 10 ft longer and 2 ft wider than the previous design. There is more room around the vans than with the previous configurations. Eight vans can be accommodated on the main deck and below. The vans would be cargo loaded. To load, hatches on both levels would be opened, the first deck is loaded, hatches are closed, and then the hanger level is loaded.

JJMA examined whether the X Craft lateral accelerations could be improved. The accelerations result from the excessively high transverse stability. There are no motion control devices available; the only solution is to reduce stability. There are two options:

- Raise VCG (not practical in required amount)
- Reduce waterplane inertia

- Move volume from waterline area to lower hulls (make more SWATH-like)
- Move hulls closer together (while retaining superstructure width)

Dan's slide 8 provides sketches of the X-Craft variant with reduced waterplace area. The new characteristics include:

- Draft increased from 15.5 ft to 17 ft to remove volume from waterplane
- Waterplane inertia reduced to approximately that of wide beam monohull
- Powering doesn't appear to be impacted - Speed is slow enough that hull interference not a problem
- Seakeeping analysis not performed
- Roll performance expected to be similar to wide beam monohull
- Lateral accelerations could be improved slightly but roll excesses remain

Dan hasn't seen this type of X-Craft built, but doesn't see any major obstacles. Twin hulls in general will be expensive. The multibeam performance would likely have less risk than with an X-Craft having hulls of wider separation.

Next Dan reviewed the variable draft SWATH options. Four options were studied (shown in slide 10):

- Baseline Navy SMR SWATH
- High Cp SWATH
- Aluminum SWATH
- Wide beam SWATH

To achieve the variable draft SWATH, 400 tons are needed for ballasting. A combination of these options can be applied. A combination might even offer a shallower draft. The aluminum option alone will provide the 400 tons variable ballast needed. Slide 11 provides a breakdown of tonnage for the three SWATH variants.

Slide 12 provides a chart showing the powering requirements for the variable SWATH variants. They are fairly consistent up to 12 knots with no big difference in powering requirements. Powering requirements ramp up significantly at speeds greater than 12 knots. The high Cp option requires roughly double the horsepower than the UNOLS SMR SWATH at 14 knots.

Slide 13 shows the effect of beam on monohull powering. The power curves for the Phase II monohull and the optimal monohull are very similar. The widebeam option requires more power. The optimal monohull at 12 knots, requires roughly 1800 SHP, while the widebeam requires ~2100 SHP. Monohulls are better than SWATHs in terms of powering. This is due to the SWATH's increased hull surface (more frictional resistance). The catamaran requires more power than the monohull.

Next Dan discussed seakeeping characteristics. He reviewed the correction to the X-Craft speed polar plots. At sea state 5 (SS5) there is significant roll excess with the X-Craft. The narrow beam X-Craft would likely have even more excess rolls. Only the X-

Craft exceeds the motion criteria in SS5. The longer (10 ft) monohull doesn't change the seakeeping much compared to the previous monohull variant.

Slide 17 shows the maximum roll angles for the monohull, SWATH, and X-Craft. The X-Craft roll angles are significantly higher than the other two variants. There was some discussion on how the roll could be improved for the X-Craft. Dan indicated that roll tanks would not help since the motions are too quick. At higher speeds, stability fins could be added, but this would not be appropriate for the slow speed variant. The only solution is to change heading. Bilge keels can be installed on monohulls and they help a lot to reduce roll amplitude. The JJMA models include monohull bilge keels.

Slide 18 shows the on-station speed polar plots (these are enlargements of the circle centers). Speeds are 0 to 2 knots. At SS6, the SWATH has low resistance to pitch in stern seas. Installing an active fin system could probably reduce this.

Slide 19 provides estimated construction costs for each of the variants:

- Monohull = 1843 LS tons = $53,377,268
- SWATH = 2014 LS tons = $64,605,274
- Aluminum Catamaran = $95,070,308

Pete Kilroy commented that the catamarans used to derive the X-Craft construction cost estimates are not research vessels. He feels more confident with the cost estimates of the other hulls, which were for research vessels. The cost of a steel catamaran would probably be similar to the SWATH cost. The ARRV estimated construction cost (not project) is approximately $70M, but it will require a lot more steel.

Slide 20 provides an estimate of the NAVSEA program and construction cost. The monohull has the lowest estimated construction cost.

Dan received feedback from KILO MOANA's master. His comments include:

- Mooring Recovery
  - Doesn't like stern-to recoveries
    - Can't see well from aft control station
    - Little margin for error - propellers more exposed
  - Side Recoveries
    - Set up bridge wing control station
    - Approach mooring downwind
    - Bring mooring along port side
    - Secure main screws and use bow thruster to pivot stern in or out
    - Throw grapnel from upper deck on port side and walk aft
    - If grapnel misses, last chance at main deck aft
- Seakeeping of KILO MOANA
  - Ship rides well in rough weather
  - Max wave height observed ~ 25 feet
  - Some slamming occurs but doesn't seem to be a problem

- Occasionally has become too rough for over-the-side work
  - ➢ CTD handling difficult because of relative motion of ship/sea surface
- His experience on catamarans (VICTORIA CLIPPER) is that ride quality is not that good

• Draft - deep draft has occasionally been a concern in some ports

Lastly Dan showed a UUV launch/recovery concept from the X-Craft.

Lunch Break

UNOLS Weights to SMRs - Dave Hebert reported on the weight system that was applied to the Ocean Class SMRs. Committee members were asked to weight each SMR element in the table based upon their relative importance. SMR elements were rated as being of high importance (weight of 10), medium importance (weight of 5) or lower importance (weight of 1). UNOLS attendees will further discuss the weight scale and possible modifications to it following this meeting. The relative importance of the SMR elements 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 SMRs elements included in the table were:

Science Mission Requirements	
Cost	
	Competitive Day Rate
	Construction Cost
	ABS Class and USCG Certified
Space, Size, and Arrangement	
	# Science Accommodations
	Working Deck Area and Arrangement
	Laboratory Area and Arrangement
	Side exterior passageways
	Science Storage
	Overboard Handling Operations
	Long Coring Capability
	Mast location, Met sensors
	On deck incubations, location/water
	Marine Mammal and Bird observations
	Overboard discharges/stack emissions
	Draft (<20-ft)
	Single SRs for Crew
Performance	
	Dynamic Positioning
	Range
	Seakeeping
	Maneuverability at low speeds

Load Capacity	
	Variable Science Payload
	Permanent Science Load
Acoustic Systems and Performance	
	Radiated Noise
	Sonar Self Noise
	Bubble Sweepdown
	One Deg Multibeam installation
Navy SMRs	
	Helicopter Capability
	AUV Handling
	Interior Staging Area for AUVs
	UAV Handling
	Speed (greater than 12kts cruising)
	Larger numbers of vans (>4)
	Interior Location for Vans
Total	

Frank remarked that the weights are important and would likely be used as a scorecard for the designers of the ship. The items that are weighted high will be the ones that they would work hard to meet.

Charlie Flagg pointed out that there are important things that are not on the list such as computer networking that should be considered as new ships are designed and constructed. Generally only those SMR elements that would be impacted by the choice of hull form were considered in the SMR Table. There are other items that are important, but are not hull dependent.

The FIC and Ocean Class Committee also individually scored the ability of the hullforms to meet the SMRs based on the information learned during the past JJMA presentations. The group briefly discussed the scoring scale and it was generally decided that negative values for poor scores are preferred.

Next the SMR elements that are listed in the table were reviewed and discussed. Additional topics were also addressed:

ABS Class and USCG Certified – There was discussion of whether this item should be scored. Dan Rolland explained that each hull would be designed to meet ABS and certifications. It is essential. The group agreed that it should be removed from the table.

Service Life - Mike Reeve asked if an X-Craft would have the same service life as a monohull. Dan Rolland explained that the ships could be designed to have the same service lifespan.

Maintenance Monitoring - Frank Herr asked if UNOLS would be interested in a ship that could better monitor its maintenance requirements. Response - UNOLS would be

interested if it would save money. Additional construction costs would be acceptable if lifecycle costs could be reduced.

Single Staterooms for Crew – Frank Herr raised the issue of single staterooms for crew. Response – Single staterooms are needed for crew retention. It is the way of the future and existing ships are being retrofit. There is some loss of space. The heads are still shared. Frank asked if there is a significant increase in plumbing. Dan Rolland explained that plumbing wasn't a huge issue; additional passageways are more of a challenge.

Radiated Noise – Radiated noise is from internal ship equipment such as motors and engines that radiates into the water. There have been reports from KILO MOANA that when the bow thrusters are powered up, radiated noise levels become high. The bow thrusters are needed to stay on station, such as during AUV operations. The high noise levels result in the inability to track AUVs. Frank asked if there a huge cost impact in quieting the bow thruster. Scripps has done this, they redesigned the their ship impeller. This could be explored further. Dolly asked if there is an external IMO standard yet.

Helicopter capability - Dan Rolland explained that they only considered a light commercial helicopter capability in the concept designs. It was pointed out that commercial helicopters have a 200 mile range limitation. This would not be very useful for use with the Ocean Class vessels. For emergency purposes, only a clear space is needed for loading/unloading, which can be accommodated on our ships now. The Navy, however, wants the helicopter capability as an operational feature. Frank recognizes that staging helicopter operations from the Ocean Class vessels is nearly impossible.

One degree multibeam – The problem of how to install a one degree multibeam on a twin hull has not been solved. It will even be a challenge on a monohull. This is of high interest to the community and it may be a cost driver. UNOLS will need to consider this issue further.

Review project timeline, process for community input, other issues.

Peter reviewed a draft outline for a letter to RADM Cohen. The major components include:

1) Introduction: The Cohen Challenge for new Ocean Class ship construction and the initial list of stipulations.

2) The process ONR/UNOLS setup for conducting evaluation leading to a hull decision.

3) Description of the meetings and summary of results including the down-selection to one variant for each hull form.

4) Summary of the JJMA/UNOLS evaluations of the three hull forms in relation to the SMRs.

a) Criteria for decision
- SMRs of high importance to the community
- SMRs impacted the most by hull form
- Evaluation of the impact of Navy emphasis SMRs
- Evaluation of other SMR related elements
- Relative strengths of each hull form and how they support the SMRs

5) The recommendation for the next Ocean Class Hull form.

Letter appendices could include:

I. UNOLS Ocean Class SMR Summary Table
II. New Navy Ocean Class SMRs
III. Ocean Class Meetings - Meeting reports & JJMA reports
IV. SMR weighting spreadsheets
V. Community feedback

The letter should be short and precise, approximately 2 pages.

All agreed that it would be good to have community feedback prior to sending the letter to Admiral Cohen.

Frank suggested that a small group of UNOLS representatives brief Admiral Cohen before coming to a conclusion. Simultaneously UNOLS could survey the community regarding the hull evaluation. After meeting with the Admiral and obtaining community input, a recommendation can be drafted. Frank indicated that the elements of the letter outline look ok. He stressed the importance of weighting the SMRs.

ONR requested that a hull recommendation from UNOLS be sent to RADM Cohen by the end of February/early March. This would allow them to stay on track for the remainder of the project.

Dolly Dieter asked John Freitag whether ONR's ship use would change once the new Ocean Class vessels enter service. ONR use of the large ships has not been very good, will ship use with these new ships increase? John indicated that this is an unknown and budgets are currently down.

Peter Wiebe asked Dolly and Mike Reeve if the process that is being used by UNOLS in the hull evaluation is acceptable. Mike Reeve indicated that it seems reasonable.

The meeting adjourned at approximately 2:30 pm. Some FIC and Ocean Class Committee members remained to further review the SMR weights and scoring.

APPENDIX I

Agenda for 25 January UNOLS Ocean Class meeting
10:30 am ~ Ocean.US Office, 2300 Clarendon Blvd., Suite 1350
Arlington, VA 22201-3667

10:30	Meeting call to order, Introductory Remarks by Dr. Herr ONR 32 and Dr. Peter Wiebe, UNOLS Chair
10:45	Participant introductions, connection to call in participants.
10:50	Presentation by Dan Rolland, JJ McMullen Associates, Detailed studies of the 3 hull forms under consideration. X-Craft variant SWATH Hull vessel Monohull vessel
12:30	Lunch
13:30	Reconvene meeting: Dan Rolland finish presentation and question period.
14:00	Discussion Period - Interactive discussion of variants.
14:45	Review project timeline, process for community input, other issues.
15:00	Adjournment

15:15	UNOLS Session - UNOLS Representatives reconvene for discussion on UNOLS recommendations and letter to RADM Cohen.

APPENDIX II

Meeting Participants:

1. Tim Askew, HBOI
2. Lorena Castro
3. Jim Cochran, LDEO
4. Annette DeSilva, UNOLS
5. Dolly Dieter, NSF
6. Charlie Flagg, SUNY
7. John Freitag, ONR
8. Dave Hebert, FIC Chair, URI
9. Bob Herman, PEO Ships, NAVSEA
10. Frank Herr, ONR
11. Bob Houtman, Navy
12. Pete Kilroy, NAVSEA
13. Bob Knox, SIO
14. Mike Prince, UNOLS
15. Mike Reeve, NSF
16. Dan Rolland, JJMA
17. Jason Thomas, JJMA
18. Peter Wiebe, UNOLS Chair, WHOI
19. Craig Willett, CSC
20. Bob Winokur, Oceanographer of the Navy/FOFC Chair

Joining by Phone/Web Conference:

21. Rich Findley, U.Miami
22. Al Suchy, WHOI