



## **PROJECT MEMORANDUM #6**

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### **Alaskan High Latitude Research Vessel**

Concept Design/ Seakeeping

From: Dirk Kristensen  
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File No.: 00100  
To: Management Committee

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Reference: 1. Roll Report, The Glosten Associates, 11 April 2001

### **Seakeeping Analysis**

At the 12 March design review meeting two variant hull forms were discussed: a high beam to draft ratio hull, ARR<sub>V\_1</sub>, which was predicted to have superior seakeeping properties and ARR<sub>V\_2</sub>, a more conventionally proportioned hull having better resistance/powering characteristics. The high B/T hull form was initially chosen to take advantage of lessons learned from past designs, specifically the Medium Endurance Research Vessel developed for Scripps in the 1980's.

However, our early investigations of seakeeping characteristics showed the more conventionally proportioned ARR<sub>V\_2</sub> to have superior seakeeping characteristics to the high B/T hull form with the exception of vertical accelerations in a relatively narrow head seas heading sector. As these results were not anticipated we undertook to study the relative seakeeping characteristics in more detail. Our fear was that we may have reached some "forbidden middle" ground where B/T could not be made reasonably large enough to take advantage of the high damping such a hull form would have.

Bruce Hutchison and Justin Morgan analyzed the relative roll motions of the two hull forms and compared them with known characteristics of the following vessels:

- R/V Alpha Helix
- R/V Knorr
- R/V Wecoma
- Glosten/Scripps MERV
- USCG GLIB (Great Lakes Ice Breaker – Concept Design)

This analysis confirmed that ARR<sub>V\_2</sub>, the more conventionally proportioned model did indeed have superior roll motions to that of our original high B/T hull form! Additionally, it was shown that the benefits of a U-tube type anti-roll tank could be more effective on ARR<sub>V\_2</sub> than on the original hull form.

A copy of Bruce's report is attached for reference.

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## Design Direction

Based on the results of the seakeeping study it seems logical to proceed with a more conventionally proportioned hull form that incorporates some form of anti-roll tank, either U-tube or free surface type. Good seakeeping, lower open water resistance and presumably lower ice resistance should result from a modified hull form.

We are currently proceeding with a concept design that more closely resembles the proportions of ARR<sub>V</sub>\_2. The principal dimensions are within the guides established at the 12 March. The principal characteristics of our current hull along with ARR<sub>V</sub>\_1 and ARR<sub>V</sub>\_2 are summarized below:

Characteristic	Current Concept	ARR <sub>V</sub> _2	ARR <sub>V</sub> _1
Length, Overall	220'-0"	210'-0"	210'-0"
Length, waterline	192'-0"	190'-0"	186'-0"
Beam, Maximum	48'-0"	43'-0"	55'-0"
Depth, Main Deck	29'-0"	25'-6"	22'-0"
Draft, Design Waterline	18'-0"	18'-6"	15'-0"
Displacement (approx)	2,700 LT	2,500 LT	2,700 LT

We have asked Arno Keinonen to comment on the ice performance of this new hull form in addition to commenting on:

- If a hull form were to be developed that did not have reamers or ice-clearing wedge, what modifications to the hull geometry would be recommended and what would the impact on ice-going performance be?
- What is the feasibility of developing a parent hull form that could optionally have reamers and wedge?

## Implications to General Arrangements

The high B/T hull form allowed some unique arrangement benefits that must now be re-thought:

- The main deck proportions allowed all labs to be placed on the main deck. This provided excellent access between all labs and between the labs and the main deck and Baltic deck.
- The main deck and focsle deck proportions allowed for ample area, in excess of requirements.
- The relatively high displacement-length ratio provided a great deal of fuel tank capacity for the length of the vessel.

Some thoughts in regards to the arrangements of the vessel with current proportions:

- Labs will need to be arranged on multiple decks. A 'tween deck could be placed between the waterline and the main deck, similar to the NOAA FRV-40, the new *R/V Sars*, the *R/V Scotia* and the new Icelandic fisheries R/V.
- This 'tween deck, or #1 platform deck, could be best utilized as a winch deck and perhaps some labs/shops not requiring direct access to the main deck could be placed on this deck.
- There is also the possibility of making the aft portion of this deck open (as was done on the MERV) thereby satisfying those who require low freeboard access overboard.