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MEETING MINUTES

High Latitude Research Vessel (HLRV)

Concept Review Meeting, 12 March 2001

From: DHK
Date: 13 March 2000
File No.: 00100
To: All Project Team Members

Attendees:

From the University of Alaska Fairbanks (UAF)
- Vera Alexander
- Robert Elsner
- Tom Smith
- Tom Weingartner
- Terry Whitledge (via conference call)

From Woods Hole Oceanographic Institution (WHOI)
- Dick Pittenger
- Robertson Dinsmore
- Joe Coburn
- Peter Wiebe

From NSF
- Mike Reeve
- Dolly Dieter

From The University of Washington
- Knut Aagaard

From Western Washington University
- Suzanne Strom

From Bigelow Laboratory
- John Christensen

From NOAA NMFS
- Jim Meehan
- John Hotaling

From UNOLS
- Mike Prince

From The Glosten Associates
- Mr. Duane Laible
- Mr. Justin Morgan
- Mr. Dirk Kristensen

Presiding:

Dr. Robert Elsner

- Discussions relating to suitable draft restriction
  - Science work will require the vessel to be capable of operating in 10m (33') water depths, e.g., estuaries.
  - NOAA suggested a minimum of 4.6m (15') underkeel clearance.
  - A maximum draft of 18 feet was decided for the concept design.

- Discussions relating to the ICES noise criteria and bubble sweep-down
  - Revise the speed at which the ICES criterion is to be met from 11 knots to 8 knots.
  - Continue to investigate the suitability of Azipod type thrusters and their ability to meet noise criteria (AC hum).
  - NOAA has investigated twin screw 11 ft. diameter props versus single larger prop in the current NOAA design. The twin 11 ft. propellers were on a shallower draft version of the design.
  - Need single mission examples – Oversight Committee will develop and supply to Glosten to enable endurance estimates.
  - Need to consider bubble sweep-down for shallow water multi-beam installation. The multi-beam is a necessity for coring work. According to Peter Weibe, a multi-beam that will be able to map the entire water column (fish) is being developed – do we need to consider any additional design constraints for this apparatus? There is some possibility that these may be small enough to mount on a lowering centerboard – needs investigation.
  - Damaged propellers (from ice) will no longer be quiet.
  - Need definition of SS, speed, type of multi-beam – from Oversight Committee.
  - Centerboard is a solution that could be considered for bubble sweep-down avoidance.
  - Multi-beam frequency needs to be defined (300 kHz?).

- Cost discussion
  - The budget estimate is missing cost increases due to special science and ICES.
  - Need independent review at some point in the process – only get to make one budget request.
  - As size (cubic number) increases, costs will increase.

- Freeboard discussion
  - Deck wetness is undesirable.
  - New techniques will allow over-side items to be launched close to water surface via articulated cranes. International fleet currently uses this technology.
  - Work in winter Gulf of Alaska and Bering Sea will require healthy freeboard.
  - General consensus was to allow increase in freeboard to 9 to 10 feet.

- Differences related to Atlantic variant
  - Bow variants.
  - Higher speed?
  - No draft restriction.

- NSF comments (Mike Reeve/Dolly Dieter)
  - NSF perceives a strong demand for operations further north.
  - Must compliment *Healy* capabilities, i.e., be able to do those things the *Healy* cannot, e.g., shallow draft operations
  - Encouraged to think about science needs 15-20 years out.
  - The ship is to be used by the entire Arctic science community.
  - Three main missions in shelf areas work in ice, work in higher sea states, and operate with low noise.
  - Work in the marginal ice zone to compliment *Healy*.
  - Endurance on *Gould* and *Palmer* is 44 days (normal for Antarctic vessels).
- Service life discussion
  - Plan for mid-life refit.
  - Proposals for mid-life lengthening are not funded.
  - One way to expand service life is to build a larger hull, but limit the science and accommodation outfit to that of a smaller vessel.
  - Current trends in vessel science indicate a cyclic pattern from large to small projects.
  - Number of berths should be proportional to lab space.
  - Science parties will need to share "wire time."
  - Scheduling trend towards longer cruises.
  - On longer cruises berth space is limiting.
- Seakeeping discussion
  - Improved seakeeping is a priority in the science community.
  - Lateral acceleration varies with vertical distance from roll center. Wider ships tend to have lower acceleration at working deck, but acceleration increases more rapidly with height above deck.
  - WHOI provided seakeeping criteria used in their recent SWATH model tests.
  - Seakeeping performance must increase operational season to year-round (~300 days per year) in order for the vessel to pay for itself.
- Azipod advantages
  - Improves maneuvering in both open water and ice.
  - Can use the wash to clear a track in ice.
  - Moving motors outside of hull results in more usable space.
  - Increase in propulsive efficiency due to tractor propeller.
  - Potential for reduced cavitation noise due to tractor propeller.
  - Successful implementation on *Botnica*.
- Azipod disadvantages
  - Increased noise relative to conventional strut/shaft arrangement, primarily due to motor hum in pods, but noise attenuation measures are more likely to succeed with motor than with propeller.
  - Relatively new technology raises reliability questions. Mean time between failure, life cycle costs.
  - Potentially more difficult to repair than other options.

- Helicopter pad discussion
  - Sole purpose of heli-pad is for personnel transport.
  - Helicopter will not be used for science or ice navigation.
  - USCG operates large helicopters (Dolphin and Jayhawk) but would most likely hover for an evacuation.
  - Size of Evergreen helicopters and landing pad requirements to be investigated.
  - No hangar or refueling required.

Design trade-offs discussion

- Hull dimensions
  - Consensus to accept extension of length parameter by 10-15 feet.
  - Consensus to relax 15 foot draft restriction to about 18 feet.
  - Consensus to examine a hull dimensions about 220' length x 47' beam x 18' draft for next cycle.
  - The effect of reamers on the new hull is to be explored.
  - The draft increase improves ice capability and seakeeping. The length increase helps reduce resistance, and helps seakeeping. The beam is a compromise between a wide hull for seakeeping and a narrow hull for reduced ice and open water resistance.

- Operating Profile
  - Consensus to maintain the 45 day endurance requirement.
  - Example missions discussed. 5 day transit + 20 days station surveys (4-6 knots between stations) + 10 days ice + 5 day transit ➔ 42-44 days total. Often full steam between stations.
  - The NOAA FRV COR contains a worked example of some mission profiles.
  - Percentage of ice operations varies by location and mission from 5 days at the ice margin up to 75% in first-year ice.
  - Consensus that on average 20-25% full power in ice is realistic.
  - An Atlantic version of the Alaska region accessibility chart that is keyed to ice capability, ice climatology and sea conditions needs to be developed.

- ICES
  - Consensus that ICES noise requirements at 8 knots a goal.
  - The 11 knot standard represents a basis for the exchange of research information.
  - NOAA indicated that ICES at 8 knots would provide sufficient capability for training purposes.

- Helicopter
  - No refuel, touch-and-go pad.
  - Check with Evergreen for size requirements.
  - Helipad should not obscure visibility for ship operations.

- Science Deadweight
  - 50 LT is way low for a vessel of this size.
  - Cape class - 35 LT. *Oceanus* - 50 LT. *Knorr* - 125 LT.
  - A heavy deadweight should be selected to minimize changing gear, which is more difficult in northern regions.
  - Consensus to use 100 LT for the new vessel. Note, this is to be the "variable" science load – exclusive of major science equipment such as winches, wires, boats and cranes.

- Speed
  - WHOI expressed a desire for an operating speed of 14 knots.
  - Installed horsepower driven by resistance in ice.
  - Consensus to use an operating speed of 12 knots for calculating endurance.
  - Consensus that vessel should have a 14 knot trial speed.

- Azipods
  - Noise a question to be resolved.
  - Z-drives produce more noise.
  - Reliability an issue to be investigated. Contact operators of *Botnica*.
  - How is a propeller changed? Is drydocking required?

- Ice capability
  - Primarily first-year ice.
  - Vessel will tow in ice, fish in ice, perform multiple wire operations in ice, and use a single warp net.
  - Dynamic positioning in ice needed, but performance is subject to ice flows.
  - Revise SMR to reflect a speed requirement of 2 knots in level ice.
  - East Coast variant to use the ABS A1 ice class (same as Alaska vessel).
  - Hull strength to exceed ice class per SMR to resist crushing if beset.
  - CASSPR compliance is required in spite of *Healy*'s apparent exception. Contacting captain of *Healy* recommended for CASSPR insights.
  - ABS does not have much experience with ice class. Recommend designing vessel to Canadian or DNV rules to benefit from their experience in ice.
  - Heated working decks are to be provided, similar to those on *R/V Nathaniel Palmer*.

- Science Outfit
  - Dual purpose trawl winch is not feasible due to incompatible wire requirements for fishing and oceanographic work.
  - Fishing winches should be removable, since stock assessment is not a primary mission.
  - Alvin will not be used, but small ROV and AUV will be launched and recovered.
  - Mast/keel recommended for transducers. Mast should only be used in open water.
  - Ramp on *Knorr* is useful, but plate over required.

- Defining transducer frequency requirements critical to identifying a successful arrangement.
- Transducers flush for ice operations. *Healy* has problem with thickness of window for ADCP
- Dual purpose, i.e., fishing and science, not feasible.
- Fish trawling is not expected on each cruise so capability should be portable
- The science winch should be below decks and should be a dual purpose traction winch capable of handling 9/16" and .680 EM/EO cable.
- Trawl ramp should have a high strength cover.
- All fishing gear should be removable.

- Schedule
  - Preliminary design start – July 2001.
  - Model test start – October 2001.
  - Contract design start – January 2002.
  - Contracting process start – January 2003.
  - Three levels of involvement in design process: management committee, advisory committee, and science community.
  - Preliminary design meetings at 30, 60, 80, and 95 percent complete. Contract design meetings at 30, 60, and 90 percent complete.
  - Release design information to the science community during the preliminary design phase at 30, 80 and 95 percent and during the contract design phase at 90 percent.
  - Present information at AICC meeting in December 2001
  - Present information at Ocean Science meeting February 2002.
  - NOAA design started in 1996 and began contracting in 2000. Overall engineering cost $3 million. Model testing program cost $750,000.
  - Vendor support critical for congressional funding approval on NOAA FRV project. Model testing in the D.C. area also a plus in this regard.