Antarctic Research Vessel Science Advisory Sub-Committee (ARV SASC) of the Office of Polar Programs (OPP) Advisory Committee

Progress of Antarctic Research Vessel Design
February 2, 2023

Members:

Bruce Appelgate, UCSD Scripps Institution of Oceanography
Alice Doyle, UNOLS
Amy Leventer, Colgate University (Chair)
Carlos Moffat, University of Delaware
Kristin O'Brien, University of Alaska Fairbanks, member and OPP/AC liaison
Patricia Quinn, NOAA/PMEL
Clare Reimers, Oregon State University
Deborah Steinberg, Virginia Institute of Marine Science

Tim McGovern, National Science Foundation - OPP liaison
Jonathan Michael Prince, National Science Foundation – OPP liaison

The primary objective of the ARV SASC is to provide advice to the NSF, and through the NSF, back to the contracted Design Team, on the design of the proposed new Antarctic Research Vessel. Our goal is to work toward maximizing the capabilities of the proposed ship which we anticipate will work in icier and more remote regions of the Southern Ocean and coastal Antarctica, and meet greater demands for both multi- and inter- disciplinary science than the RVIB *Nathaniel B. Palmer* that was built in 1992. We worked to help develop a ship design that has built-in flexibility for shared use with a vision that includes anticipating future demands, advances in technology, and green technologies. While our early focus was to "identify the practical flow of moving samples and instrumentation from the deck to the labs in order to confirm an efficient arrangement of laboratory spaces on the vessel", our scope expanded to include all aspects of ship design, including, but not limited to, over-the-side handling and scientific package deployment, habitability, berthing, and shared common spaces.

In achieving the objective described above, and as noted by the Conceptual Design Review Panel, the ARV SASC mission is to serve as a formal conduit between our community and this project. While the ARV SASC is a well-balanced team in terms of expertise and skills, composed of sea-going scientists with diverse scientific backgrounds and Antarctic research experience, sea-going technicians, and those with experience operating research vessels, we sought additional input on elements of design that our subcommittee is less familiar with and with regard to anticipated science needs beyond our expertise. Members of the SASC reached out to community members (see list at end) with specific questions about design details and incorporated their comments and suggestions into the design reviews completed to date. We contacted colleagues, researchers and sea-going technical staff who are more experienced with specific systems than most members of our subcommittee, and whose interests will guide science aboard the new vessel. We also contacted user groups (MARSSAM: The OSU Marine Sediment Sampling Group (https://marssam.ceoas.oregonstate.edu/),the OSU Marine and Geology Repository (https://osu-mgr.org/), the Multibeam Advisory Committee (https://mac.unols.org/), and SCOAR, (https://www.unols.org/committee/scientific-committee-oceanographic-aircraft-research-scoar). In every case their valuable and quite specific advice is incorporated into our review documents.

To reach out on a broader scale, questions and concerns from the community were solicited via the NSF website (https://future.usap.gov/arv/; We Want Your Input: Submit your comments, questions, or feedback to the NSF/GEO ARV Team using the link below, or view the Community Input section for more information on how to contribute.). The community input page at this site includes email contact information for all SASC members. In addition, our presentations to the Polar Advisory Committee were open to the public; questions from the Advisory Committee and from community members were answered in real time.

The subcommittee has met regularly (weekly to every several weeks) since mid-April 2022, via one-hour zoom calls, with our schedule dependent on workload and the timing of the four Design Reviews. Our meeting minutes are posted on an NSF SharePoint site; our subcommittee work progressed via a shared Google doc. Following each of the Design Reviews, which consisted of 1-2 day full-day presentations from the Design Team, our subcommittee provided a written evaluation of design elements and presented this evaluation to the Advisory Committee for Polar Programs.

Over the past 10 months, we've observed significant changes to ship design, many of which reflect consideration of advice from our subcommittee. Others were guided by the advice from the many technical experts who provided input on design, ranging from modeling hull design, bubble sweepdown, seakeeping, tank testing icebreaking capabilities, and identification of the use of batteries to conserve power consumption and as a reserve. Some changes are still under consideration for after Preliminary Design Review. A few highlights of changes incorporated into ship design in response to SASC input include:

- identification of a Science Operations Center and Bio/Chem/Analytical Lab
- reorganization of lab spaces on the main deck level to cluster wetter lab spaces aft
- improved connectivity of spaces to foster ease and efficiency of sample and instrument movement
- changes to the details of design of individual labs, especially focused on elements like sinks and hoods, that are "hardwired" into the ship design
- relocation and reorientation of the Science Lab Van Bay on the back deck
- increased size of the UAV deck and hangar, and relocation to a center position
- combining the Meteorology Lab and the Marine Mammal Observation Space
- greater number of single berth staterooms, and several with dayrooms intended for private conversation
- expansion of common spaces, including a conference room and lounge on the 01-deck, making this space large and inviting, with natural lighting.

We note continued attention from the Design Team to the specifics of the location and accessibility of science containers (particularly those in the hold), and the ease and efficiency of deploying workboats. We continue to recommend addressing the details of the storage of hazardous materials, and details of the Aquarium room, the science seawater systems, and the siting of incubators.

Specific examples of the flow of information between our subcommittee and the Design Team:

- DR #3 and #4 included a back-and-forth conversation that was facilitated by the direct response of the Design Team to 'customer comments'. Their spreadsheet included a description of every suggestion / question / concern noted in our reports, along with their response. It was abundantly clear that our input is carefully considered as changes are made to ship design.
- During Design Reviews, we were asked to comment very specifically on certain design elements, such as constraints on the location of specific containers, ship's networking, and details of telepresence/outreach space. These requests led to discussion points for our subcommittee, and suggestions in our reports.
- We note a combined effort to reach out for community input regarding specific elements of ship design. For example, Ross Hein (LEIDOS ARV Science Mission Coordinator), initiated a meeting of experts to discuss the deep water Multibeam system for the proposed ARV, attended by a combination of members of the Multibeam Advisory Committee, technical experts, members of our subcommittee, Tim McGovern, and Mike Prince.

Several significant details of ship design have evolved over time, based on analytical work completed by the contractor; these changes were needed to meet icebreaking capacity, range and endurance requirements, and to comply with seakeeping requirements. The ship design is now at 365 ft LOA and 80 ft beam and meets all of the Key Performance Parameters.

The Design Summary Report and Science Systems Report, two of the deliverables from the Design Team for Design Review #4, are excellent reviews of progress to date, and include clear evaluations of the open issues and descriptions of how the design team plans to move forward on addressing these open issues, post Preliminary Design Review, as well as providing a road map for future SASC discussions and recommendations.

The Design Team describes their engagement philosophy as follows: “The design of the ARV has been guided by a singular goal: Support the Science. Not a decision is made on this design without contemplating how that decision impacts the science capabilities of the ship.” This subcommittee is in agreement with this statement, based on the continuing progress of ship design, with a view toward built-in flexibility and “future-proofing” in anticipation of technological advancements.

List of contacts for comments

Stian Alesandrini, Schmidt Ocean Institute
Chuck Amsler, University of Alabama at Birmingham
Phil Bart, Louisiana State University
Allan Beaudry, Noise Control Engineering LLC
Kim Bernard, Oregon State University
Stefanie Brachfeld, Montclair State University
Megan Cimino, NOAA and University of California Santa Cruz
Dwight Coleman, University of Rhode Island
Jessie Creamean, University of Colorado Boulder
Thomas Desvignes, University of Oregon
Bill Detrich, Northeastern University
Ellen Druffel, University of California Irvine
Lee Ellett, Scripps Institution of Oceanography
Helen Fricker, Scripps Institution Oceanography
Allison Fundis, Nautilus Live, Ocean Exploration Trust
Tim Gates, Gates Acoustics
Ali Graham, University of South Florida
Jamin Greenbaum, Scripps Institution Oceanography
Sean Gulick, University of Texas Institute for Geophysics (UTIG)
Jim Happell, UMiami Tritium Lab, Operation SWAB
Jamee Johnson, Science Implementation - Peninsula, USAP
Vicki Ferrini, Lamont-Doherty Earth Observatory
Ari Friedlaender, University of California Santa Cruz
Kevin Jarrum, Paul Johnson, Larry Mayer, (Center for Coastal & Ocean Mapping/Joint Hydrographic Center), Multibeam Advisory Committee (https://mac.unols.org/)
Ted Maksym, Woods Hole Oceanographic Institution
Paty Matrai, Bigelow Laboratory for Ocean Sciences
Frank Nitsche, Lamont-Doherty Earth Observatory
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Ethan Roth, University of Alaska Fairbanks
Ted Scambos, CIRES, University of Colorado Boulder
Britney Schmidt, Cornell University
Amelia Shevenell, University of South Florida
Emily Shimada, Oregon State University
Christine Siddoway, Colorado College
Sharon Stammerjohn, University of Colorado Boulder
Liz Sykes, Rutgers University
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Maureen Walczak, Paul Walczak, MARSSAM: The OSU Marine Sediment Sampling Group
Julia Wellner, University of Houston
Chris Zappa, Lamont-Doherty Earth Observatory, chair of UNOLS Science Committee on Oceanographic Aircraft Research (SCOAR)