Future Research Vessels

Larry P. Atkinson
Old Dominion University, latkinso@odu.ed

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PAPER

Larry P. Atkinson
Old Dominion University
Norfolk, VA

ABSTRACT

The academic research vessel fleet in the United States is embarking on a great experiment. By 2004 we will know if SWATH vessels such as the Kilo Moana *and the possible built Woods Hole Oceanographic Institution coastal SWATH have such great advantages that all future vessels will be of SWATH design. Or, we will find that the two hull forms have distinct niches and the fleet will evolve with a strategic mix. Regardless of the future hull form research vessels will grow in size to accommodate advanced technology and the people to run and maintain it. The research vessel will become an office and laboratory at sea with seamless communication to the shore for the oceanographer.*

INTRODUCTION

Future research vessels will no doubt be shaped by two principles: thousands of years of tradition and exciting new ways for us to explore the ocean. Our traditions are driven by the fundamental physics of objects on or below the sea surface: objects that include the humans trying to do research. Thus we must conform to time proven designs while trying to extend them to improve research at sea. Research at sea is changing because of our new insights and our new tools. Both are placing new demands on research vessels. This paper focuses on the process we employ to design future ships, the new demands on research vessels and the possible characteristics of future vessels.

MERGING SHIP DESIGN, THE FUTURE AND SCIENCE REQUIREMENTS

The U.S. academic research fleet has evolved by merging the far ranging needs of research scientists with the practicality of running a safe and efficient ship. The process that makes this happen starts with development of the Science Mission Requirement (SMR). I mention this process not that it may interest you specifically but to show how it is a way that we can rationally face the future.

The SMR process starts with a meeting of a key group of ocean going research scientists. They must be at the leading edge of their field and have considerable sea experience. They must determine what types of shipboard tools should be available to perform future research. For example there is a growing trend to do very deep (> 50m) piston coring for climate change research. Requiring a ship to do that has implications for deck layout and winch capacity among other things. Another example is increased use of autonomous vehicles. The ship may be required to launch and retrieve them under heavy sea state conditions. The SMR group delves into issues as broad as those just mentioned and as detailed as the volume of freezers and quality of power supplies. They specify cruising range and deck space, storage space and tie down spacing. Finally the process considers the region where the whip will be operating because features like ice-strengthening, maximum draft, and endurance depend on that. The process is very comprehensive.

While this process proceeds there are critical 'reality checks'. As you can image a group of scientists can develop some requirements that are just not practical. Thus there is a person with ship design experience in the group who inserts a bit of reality when needed but does not stifle the discussion. It seems to work well.

Ad hoc workshops are also held to assess the future in a broader way. One such workshop was held at Oregon State University in 2000 (Cowles, 2000). Here a diverse group tried to look twenty years out in their assessment of mission requirements.

The reason I am saying this is because part of what I say in this article is based on the visions of scientists arising from the SMR and workshop process. There is one other process I will mention before I proceed.

The recent workshops have found several common themes. One is the traditional desire to work on a more stable platform and to work in heavier seas on that more stable platform such as studies during winter storms. A second is the vision that ships will be required to repeatedly and over long period's work at observatories in remote locations. A third vision is that vessels will carry more technical staff to manage observatories, sophisticated biochemical instrumentation, and vehicles of various sorts. A fourth common theme was Internet connectivity to land.

Research in Heavy Weather

The desire to work through the storm, plan a winter cruise or work in a part of the ocean in a season that has not been accessible to now is a common thread in all discussion about the future. Possibly the most significant development in the coming decades will be the arrival of ships that allow us to work in higher sea states than ever before. Right now an experiment has started with the construction of the *R/V Kilo Moana* (AGOR-26) for the University of Hawaii. It is noted that the SWATH design *R/V Western Flyer* is already capably performing its submersible specific mission

The construction by the U.S. Navy of the *Kilo Moana,* and the possible construction of a coastal SWATH by Woods Hole Oceanographic Institution points to the arrival of the SWATH as a general oceanographic vessel. It is here. Now how will they operate? That is the question.

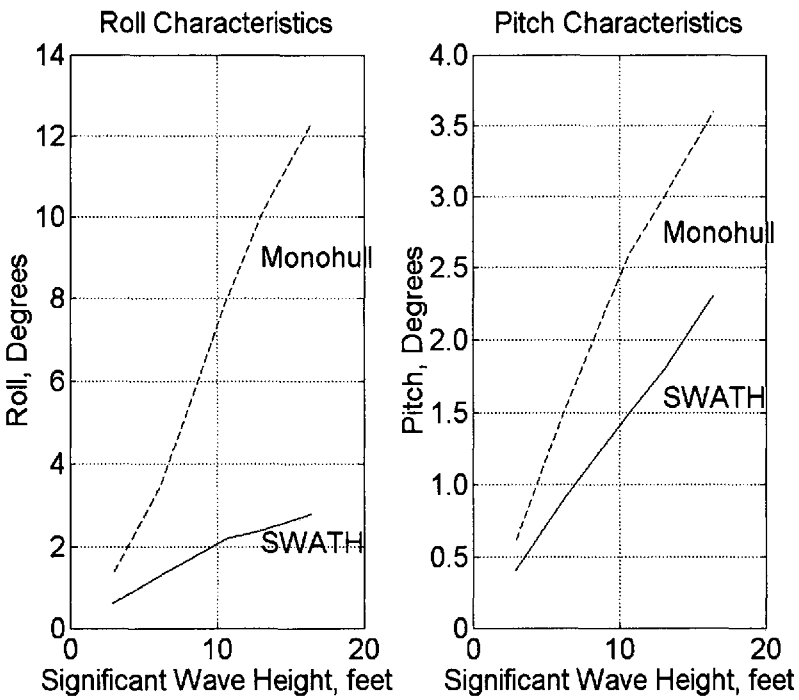
SWATH designs perform much better in heavy seas than regular monohulls (Figure 1). If SWATH designs prove to be as capable in heavier seas as suggested they would permit vastly different research at sea. As noted by Dinsmore (1994) they have the following advantages and disadvantages:

Advantages:
- Steadiness in disturbed seaway
- More useable enclosed volume and deck space
- Ability to maintain speed in high sea states

Disadvantages:
- Excessive draft
- Higher propulsion power
- Weight sensitivity

In about two years (2003) we will know how capable research SWATHS are. Their performance will portend the future of all research ships.

Figure 1. Comparison of pitch and roll on monohull and a SWATH. Note the more seakindly performance of the SWATH. Data from Mr. Joe Coburn at WHOI. The data are from the WHOI research vessel R/V Oceanus (177 feet long) and the planned coastal SWATH (105 feet long).



Research at Observatories

The coming of ocean observatory science will place new demands on ships. These demands constrain ship scheduling as scientists return repeatedly to remote locations. Both the research and maintenance at the observatories will lead to greater berthing requirements. Specialized maintenance may lead to the need for specialized ships handling robotic devices as is done in the oil industry.

Large Technical Groups

The recent trends in vessel use have seen some cruises, especially interdisciplinary ones, filling all berths and sometimes berthing vans are added. Since there is a national emphasis on interdisciplinary research the need for significantly more berths on some cruises seems obvious. More berths may also be required as research begins to focus on observatory locations. Of course more berths implies more lab space.

Autonomous Vehicles

The advent of many kinds of remote vehicles, autonomous or controlled, is extending the sensory 'feel' of a ship at sea. Devices can range for many tens of miles with sensor systems. Clearly such capability will require specialized launching and retrieving, shipboard maintenance areas, technical staff, etc. Dynamic positioning may be necessary. These requirements will constrain the deck layout, freeboard and propulsion systems.

Ship to Shore Connectivity—Who will be on the ship?

One topic at the Oregon State workshop was Internet connections. The coming generation of oceanographers sees the research ship as an extension of their office and laboratory. They expect seamless, reasonably priced, and fast Internet connections twenty-four hours a day. Imagine the ability to create DNA probes on board to quickly respond to new species found at vent sites. Doing this requires DNA sequencing machines that would be onboard, technicians to run them and large bandwidth to shore laboratories were DNA specialists would design the probes that would then be built on the ship. The hardware and technical expertise will be required and expected on next generation ships.

CONCLUSION

It seems clear that in the next few years we will see a great change in our research vessels depending on how the *Kilo Moana* and other SWATHS perform. If scientists find they can do work at sea states two higher than normal and the disadvantages are not insurmountable we may find all SWATH ships in the future. Or, we may find that the SWATH and monohull have distinct niches and we will see a mix of them in the fleet. Regardless of the hull form the exciting new developments in observing devices; the trend to interdisciplinary and observatory science, and the need for more technical skills onboard will drive us towards larger vessels.

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REFERENCES

Cowles, T. 2000. Reporting on the future science needs workshop. Corvallis, Oregon, August 9–10, 2000. Sponsored by the National Science Foundation, Ocean Center and Facilities Programs, Division of Ocean Sciences.

Dinsmore, R.P. 1995. Swath Ships: Their numbers grow, *MTS Journal*. 28(4): 39–46.