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PROJECT MEMORANDUM

IBRV Moonpool Requirement		*1 April 2020*
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FROM:	Tim Leach	
JOB/FILE NO.	19136.01	

References

1. *Report of the Ad Hoc Subcommittee on the U.S. Antarctic Program's Research Vessel Procurement*, National Science Foundation - Office of Polar Programs Advisory, 14 August 2019
2. NSF ARV Capability Matrix and Scoring_13Mar2020_final.xlsx

Introduction

The original requirements for the IBRV (reference 1) required a moonpool. The intent was to allow easier launch and recovery of some equipment, such as CTDs, while in ice. Additionally, there was some consideration to topside drilling through this moonpool.

Reference 2 eliminated the requirement for the moonpool. This memorandum discusses the pros and cons of including a moonpool in the design.

Moonpool Description

The moonpool envisioned is similar to what is onboard the R/V *Kronprins Haakon* and R/V *Attenborough*. The moonpool would be approximately 14'x14' and located within the Baltic room. Doors at the main deck would serve as deck space when closed. Non-tight doors at the bottom hull would also be required to help prevent ice and slush from entering the moonpool. Steam systems would be required to melt ice and slush that did accumulate. An illustration of the approximate layout can be seen in Figure 1.

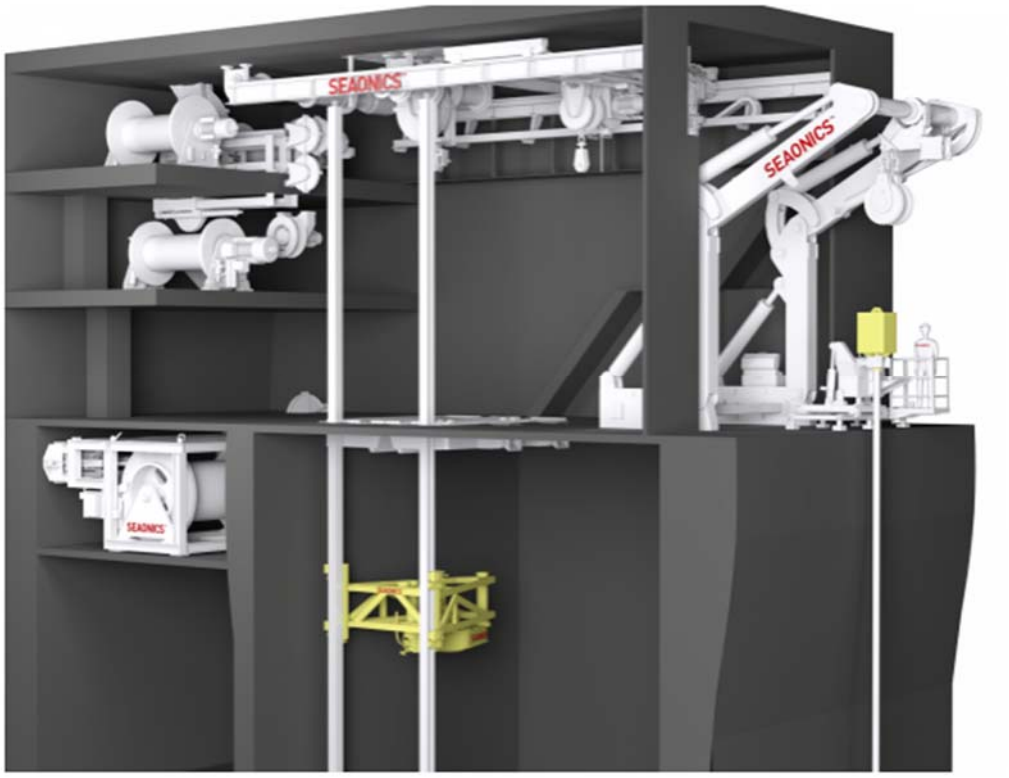

Figure 1 R/V Kronprins Haakon moonpool arrangement
https://www.hydro-international.com/content/article/the-making-of-rv-kronprins-haakon

Moonpool Pros

The primary benefit of a moonpool is launch and recovery of some equipment in conditions that would otherwise be limited by rough seas or ice cover.

If decks are awash launching through the moonpool in a sheltered Baltic room provides safety benefits. However, standing waves in the moonpool itself could cause some issues with launch and recovery without a system to capture and lower the device.

Additionally, when operating in ice covered waters, a moonpool could simplify launch and recovery of equipment. Doing so over the side of the vessel would require clearing of ice via channel breaking and/or propeller wash.

Moonpool Cons

As shown in Figure 1, the handling systems for a modern moonpool are complex, including door actuation (top and bottom), an elevator system to safely launch and recover equipment, multiple pieces of equipment for load handling, and multiple winches and wiring runs. In addition to the handling system complexity, there will need to be two door systems, as well as systems to de-ice the moonpool. This complexity adds capital cost and increases maintenance requirements.

Moonpools have a significant impact on arrangements. Generally speaking, to minimize motions the moonpool should be located close to midship and centerline. The space required to house the moonpool and related handling equipment on the main deck and the deck above can be significant. On the R/V *Kronprins Haakon*, the space extends from the port deck edge to almost

the starboard deck edge. This means fore and aft access on the main deck must pass through the Baltic room with effectively no access past the room on the deck above the main deck.

There is a significant impact below the main deck as well. The trunk housing the moonpool will need to be even wider than the moonpool to all the moonpool doors to open inward and maintain the clear space. The midship location desired for the moonpool interferes with space that would typically otherwise be the main machinery space. This complicates the machinery space arrangement, impacting cost and operability. The moonpool also reduces stores space below the main deck. As the ships machinery and stores are mostly fixed for a given mission requirement, the volume lost to the moonpool trunk could reduce the capacity for containers stored below deck as well as other science stores.

Rough estimates of the capital cost of an IBRV moonpool are between $2.5M and $3.5M. This includes increases in steel, handling equipment, and support systems. This does not account for increased difficulty in routing systems around the moonpool. A deeper study will be required to quantify increased life-cycle cost. There will be increases in bottom cleaning and painting with some surfaces of the doors difficult to access leading to potential corrosion issues. Additionally, increased handling equipment will increase maintenance and demand on the crew to keep the moonpool operable.

Summary

The primary benefits of omitting the moonpool from the IBRV design are added volume for other purposes and added flexibility in arrangements . This increased flexibility should result in better science space access to the working deck.