



Glosten

PROJECT MEMORANDUM

**Antarctic Research Vessel
Single Staterooms for Scientists**

30 September 2020

TO: Chris Chuhran, Leidos
FROM: Tim Leach
JOB/FILE NO. 19136.01

References

1. McGovern, T. (letter) [National Science Foundation], “ARV Concept Design and Preliminary Performance Specification,” 27 August 2020.
2. *ARV Concept Design, General Arrangement*, Drawing No. 19136-000-001, Rev P2.
3. *ASC Research Vessel Replacement Program, Concept Design Report*, Glosten Inc., Rev. -, 27 May 2020.

Introduction

In Reference 1, “NSF requests exploration of providing single berthing staterooms for science, likely with shared heads, to determine feasibility and impact on vessel size and layout.”

This memo explores the impact on vessel size by assessing the space allotted for science staterooms in the current arrangement (Reference 2) and estimating the increase in vessel size that would be required to make all science staterooms single berthing. Note that a new vessel arrangement has not been thoroughly explored.

Changing the berthing requirements to singles for the science party will require tradeoffs to the arrangement and/or size of the vessel. It appears possible to accommodate all singles for the science party without increasing the internal volume of the vessel, in exchange for reducing the area of science spaces. If internal volume is increased either by adding superstructure volume to a similar sized hull or by increasing the overall length of the vessel, then all singles can be achieved without losing science space area.

The following sections describe the design impacts of possible single and double stateroom arrangements.

Arrangement Change Descriptions

In the current design, all science staterooms are located on the 02 deck, with most staterooms designated as having double berths. The current arrangement improves upon many UNOLS vessels by providing additional space and a head for each double stateroom. An example of the current double berth arrangement is shown in Figure 1.

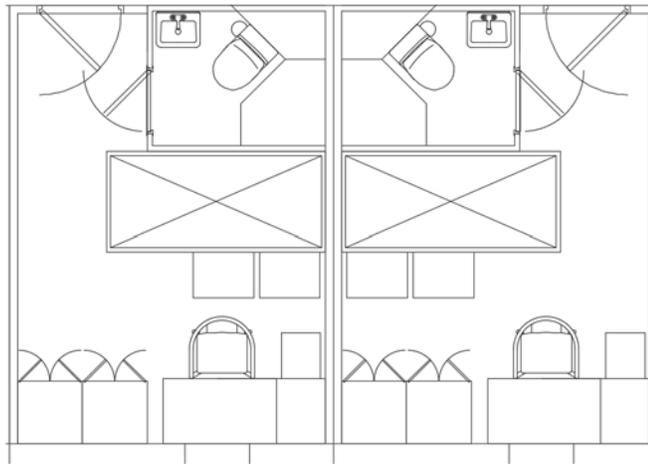


Figure 1: Double science stateroom layout

To reduce the impact on vessel size by moving to single staterooms we have assumed a stateroom that is effectively as wide as a single bunk with a shared head, as shown in Figure 2.

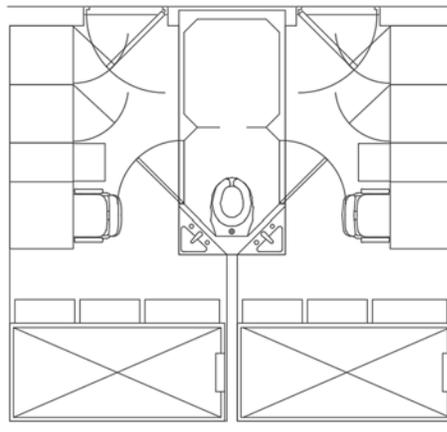


Figure 2: Single science stateroom layout

The assumed single berth stateroom longitudinal dimension is approximately 7 ft., whereas the assumed double berth stateroom is 9.75 ft.

Arranging the single staterooms in the space that is currently allocated to doubles results in fewer berths on each side of the vessel, as shown in Figure 3.

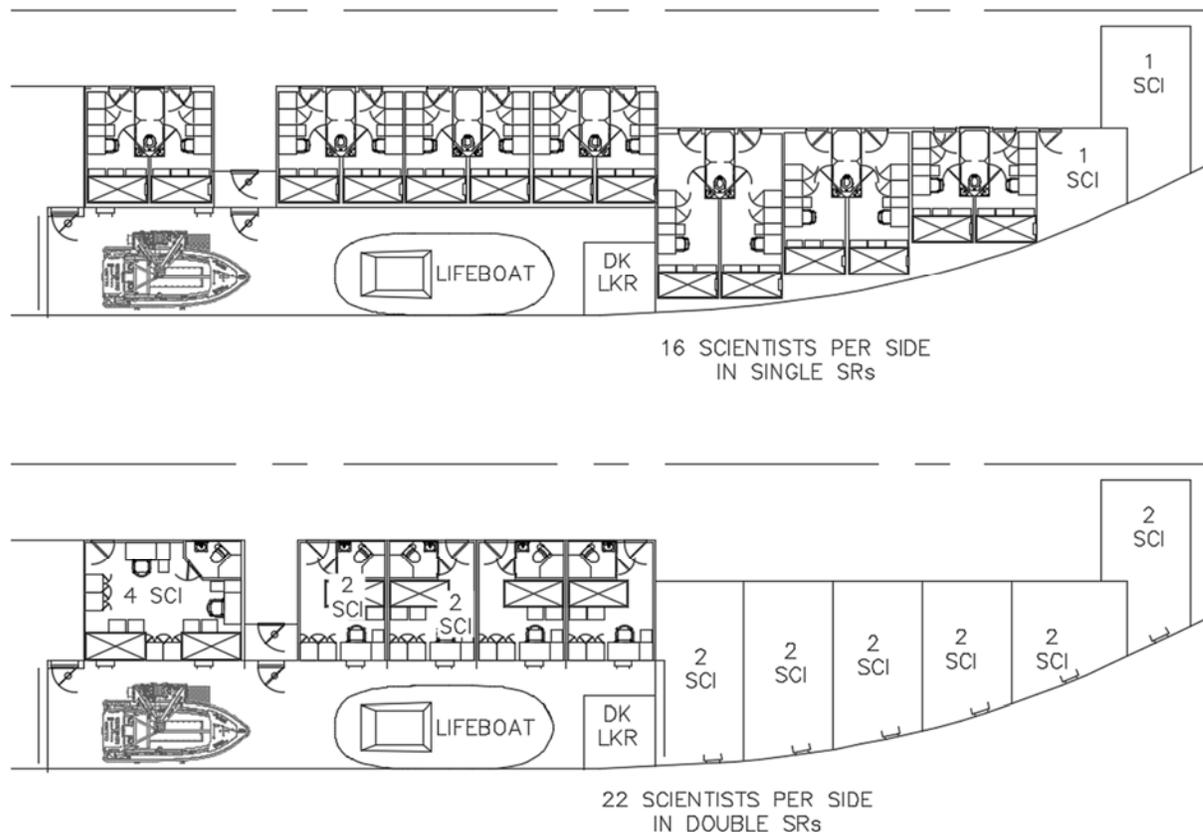


Figure 3: Comparison of single and double staterooms.

As is shown in Figure 3, without an increase in vessel size or other changes to the vessel there would be a loss of 6 berths per side, for a total reduction of 12 berths on the 02 deck. To increase the number of berths to the original value, 12 additional single staterooms are required.

If the desire is to maintain the full complement in singles for all voyages there are two basic options to retain the number of berths that are required. One is to increase the overall length of the vessel, the second is to increase the length of just the superstructure.

Vessel Lengthening

For consideration of vessel lengthening we have assumed adding berths to both the 02 and 03 decks will be acceptable. The 03 deck would then have a mix of science and crew berthing. Therefore, 6 staterooms would be added to each deck, 3 staterooms on each side. As the single staterooms are 7 ft. long each, an increase in vessel length of approximately 21 ft. would be required.

It may be possible with the added length to add staterooms on other decks, particularly the 04 deck, which could reduce the length increase. Additionally, the crew gym area could likely be converted to two single staterooms. Taking this into account, we believe the minimum vessel length increase that would not affect science spaces or additional common areas and would have the science party in singles staterooms instead of double staterooms is approximately 14 ft.

If the lounge/conference area on the 01 deck was moved to the main deck, in exchange for some lab space, and that area on the 01 deck was converted to single staterooms, an increase in length of approximately 7 ft. would be sufficient to have single staterooms for scientists.

Superstructure Lengthening

As discussed above, 12 additional staterooms are required to maintain science berth numbers if all science staterooms are singles. If we assume the crew gym is converted to two staterooms, 10 more are needed. It is assumed lengthening the superstructure by 14 ft. would allow four additional staterooms on both the 02 and 03 decks. Therefore, at least two additional staterooms would be required on the 04 deck, which would require lengthening the 04 deck by only 7 ft.

Lengthening the 02 and 03 decks in this manner will reduce the open area on the 01 deck. A new arrangement has not been explored but the consequences could include a reduction in the aft open deck space on the main deck. It appears the side deck length could be maintained for coring operations, but it may be necessary to reduce the distance between the aft end of the house and the transom by 7 to 14 ft.

Lengthening the superstructure without increasing hull volume will have an adverse effect on stability and motions. The longer superstructure increases weight up high, raising the center of gravity and increasing windage and icing area. The effects of such an increase have not been evaluated, but reduced GM will increase vessel motions.

As with the vessel lengthening, if science space on the main deck is given up in favor of common spaces such as the lounge/conference room, staterooms could be added to the 01 deck. This would reduce the overall lengthening by approximately 7 ft., and also reduce the effects on the 01 and main decks.

Summary of Findings

This section summarizes the design impacts of four possible options for modifying the ARV Concept Design Rev(P2) to accommodate additional single crew staterooms. The concept design currently has the following staterooms:

	Complement	Singles	Doubles
Current Arrangement (Rev P2)	31 Crew 52 Science	31 Crew 2 Science	25 Science

Option 1 – Reduced Crew

The concept design achieved 31 crew, but only 20 are required per reference 3. Additional single science staterooms could be achieved by reducing the crew complement to the minimum required (20) and repurposing the excess single crew staterooms to single science staterooms.

Objective:

- Maintain design as-is and determine maximum single science staterooms.

Design Impacts:

- Reduced crew complement to 20.
- Increased single science staterooms from 2 to 24.
- Could increase single science staterooms further by converting crew gym to single crew staterooms.

	Complement	Singles	Doubles
Current Arrangement	20 Crew	20 Crew	
(Rev P2) - Reduced Crew	52 Science	24 Science	14 Science

Option 2 – Maintain Vessel Envelope

Objective:

- Provide single staterooms for all members of the science party.
- Maintain the volumetric envelope of the hull and superstructure.
- Maximize single staterooms by reducing science space volume.

Design Impacts:

- Crew gym and lounge converted to single staterooms.
- Mess and galley moved to the main deck, displacing ~2,200 ft² of science spaces.
- Reduced crew stateroom capacity from 31 to the recommended 29.
- Reduction in science party from 52 to 50.

	Complement	Singles	Doubles
Rev P2 Envelope	29 Crew	29 Crew	
Modified Arrangement	50 Science	50 Science	None

Option 3 – Vessel Lengthening

Objective:

- Provide single staterooms for all members of the science party.
- Maintain the crew spaces and staterooms.
- Maintain the internal science spaces and deck size of the concept design.

Design Impact:

- Vessel will likely increase in length by 7 to 14 ft.

	Complement	Singles	Doubles
Lengthen Vessel 14 ft	31 Crew	31 Crew	
	52 Science	52 Science	None

Option 4 – Superstructure Lengthening

Objective:

- Provide single staterooms for all members of the science party.
- Maintain the crew spaces and staterooms.
- Maintain existing science spaces (no repurposing or volumetric reduction).

Design Impacts:

- Superstructure will likely increase in length by 7 ft. to 14 ft.
- Aft deck and/or 01 deck open space will reduce

	Complement	Singles	Doubles
Lengthen superstructure	31 Crew	31 Crew	None
	52 Science	52 Science	

Recommendations

Adding an ‘objective’ and ‘threshold’ to the performance specifications for single science party staterooms is recommended. This will allow the architects to balance the number of single staterooms with the other tradeoffs, which include science space volume and overall vessel size and cost.

The ‘threshold’ value should include two or three larger single staterooms or staterooms with sitting rooms for the science leads. Additionally, there should be at least two additional singles to address odd number gender issues.

A recommended ‘objective’ is that all the science party have single staterooms.

The single staterooms should have shared heads at a minimum, with a preference indicated for private heads, since shared heads can cause gender and lock-out issues. A requirement should be that at least one stateroom has a private head to address odd number gender issues.

A drawback of allowing for a mix of singles and doubles is that those in doubles may resent not being in a single stateroom, negatively impacting morale. Similarly, the double staterooms will be more desirable when the vessel is not full and they are used as singles, since they will have more space and have bunks away from the hull or passageway.