

August 17, 2021

**To:** Timothy McGovern  
National Science Foundation

**From:** Chris Chuhran  
Leidos

**Subject:** ARV Conceptual Design Technical Deliverables

**Attachments:** (1) 19136 Concept Design Report Rev B, Glosten August 2021  
(2) General Arrangement Drawing, Glosten 19136-000-001, Rev -, April 2021  
(3) USCG Compliance Study, Glosten, 19136-000-01, Rev -, April 2021  
(4) Propulsor Study, Glosten, 19136-000-02, Rev 0, April 2021  
(5) Deck De-Icing Systems Study, Glosten 19136-000-09, Rev -, April 2021  
(6) Underwater Radiated Noise Requirements Study, Glosten 19136-000-10, Rev -, April 2021  
(7) Piston Coring Study, Glosten 19136-000-04, Rev -, April 2021  
(8) Climate Study, Glosten 19136-000-04, Rev -, June 2021  
(9) Seakeeping Study, Glosten 19136-00-05, Rev -, May 2021  
(10) Ice Environment Study, Glosten 19136-000-06, Rev -, April 2021  
(11) Power Systems Study, Glosten 19136-000-03, Rev -, July 2021  
(12) Green Ship Alternatives Study 19136-000-07, Rev -, June 2021  
(13) Autonomous Vehicle Handling System, Glosten 19136-000-08, Rev -, May 2021  
(14) Bubble Sweeplown Requirements Study, Glosten 19136-000-12, Rev -, April 2021  
(15) Performance Specifications, Glosten 19136, Rev P4, August 2021  
(16) Document Requirements List, Glosten 19136 Rev P2, August 2021

**Reference:** (a) Antarctic Research Vessel Project Execution Plan, August 2021

### ***Introduction***

The FY 20 capital project, ARV CDR Preparation (WBS 5.E.1.01) work scope includes development of a conceptual design in support of NSF intention to replace the RVIB Nathaniel B. Palmer. The conceptual design and supporting documents were developed by Glosten under subcontract to Leidos. The purpose of the conceptual design is to determine feasibility and cost estimation based on requirements provided by NSF.

**Work Scope Definition**

Requirements were provided to Glosten by Leidos to develop the concept design. The requirements were the Ad Hoc Subcommittee Report (Aug 2019).

A Scope of Work (SOW) was developed for Glosten to perform the following:

- Vessel Requirements Matrix: Cross Reference NSF RFI, Leidos Vessel Studies and the Ad Hoc Report, develop requirements and summarize in matrix form. This document is a part of the PEP (Appendix 16).
- Conceptual Design: Develop a concept design with sufficient detail to allow for an updated cost estimate. This will include steel weight, general arrangements, major equipment definition, fuel endurance, waste holding capacity, polar class definition, crew and scientist berthing capacity and science mission systems definition.
- Performance Specification: Develop a 3-digit SWBS specification, include a documentation requirements list to identify vessel designer deliverables.
- Trade Off Studies: Analyze various ship design and operation aspects to influence design decisions for cost, performance and risk considerations. The following trade-off studies were developed by Glosten:

Trade-Off Studies	
USCG Compliance	Climate
Propulsors	Seakeeping
Deck De-Icing Systems	Ice Environment
Underwater Radiated Noise Requirements	Power Systems
Piston Coring	Green Ship Alternatives
Autonomous Vehicle Handling System	Bubble Sweepdown Requirements

**Design Development**

The design progressed through weekly progress meetings held between Leidos and Glosten. Initial focus was on requirements definition, understanding threshold and objective criteria and identifying requirements that were not previously defined with NSF.

A series of workshops were conducted where Glosten was able to “interview” ASC staff, UNOLS subject matter experts and vessel operators to gain a better understanding of current ship operations and current and future research vessel needs. Focus areas included science spaces, overboard handling, electronics, IT and mission planning. This allowed Glosten to better understand the context of requirements that had been provided.

Glosten has provided a Concept Design Report (Attachment 1) to capture design decisions and evolution.

The conceptual design has also been reviewed by members of the NSF Office of Polar Programs, including the trade-off studies. Input from NSF has been incorporated into the design.

The result of this effort is this concept design are depicted in the General Arrangements Drawing (attachment 2), the trade-off studies (attachments 3 – 14) and the Performance Specification and Documentation Requirements List (attachments 15 and 16).

The conceptual design was used to develop a point cost estimate and many other planning tools as described in reference (a).

### ***Contributors***

The design team represents a significant amount of design and operational experience which has been leveraged into this design process. This includes experience on many US government research vessel construction projects over the last two decades, including the R/V Sikuliaq, R/V Neil Armstrong, R/V Sally Ride, Regional Class Research Vessel and several foreign designs as well the management of the USAP research vessels RVIB Nathaniel B. Palmer and ARSV Laurence M. Gould. Contributors to this effort are listed in the table below.

ARV Conceptual Design Contributors		
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