

DIRECTORATE FOR
GEOSCIENCES

OFFICE OF POLAR PROGRAMS

Antarctic Research Vessel (ARV)

UNOLS Fleet Improvement Committee (FIC) Meeting

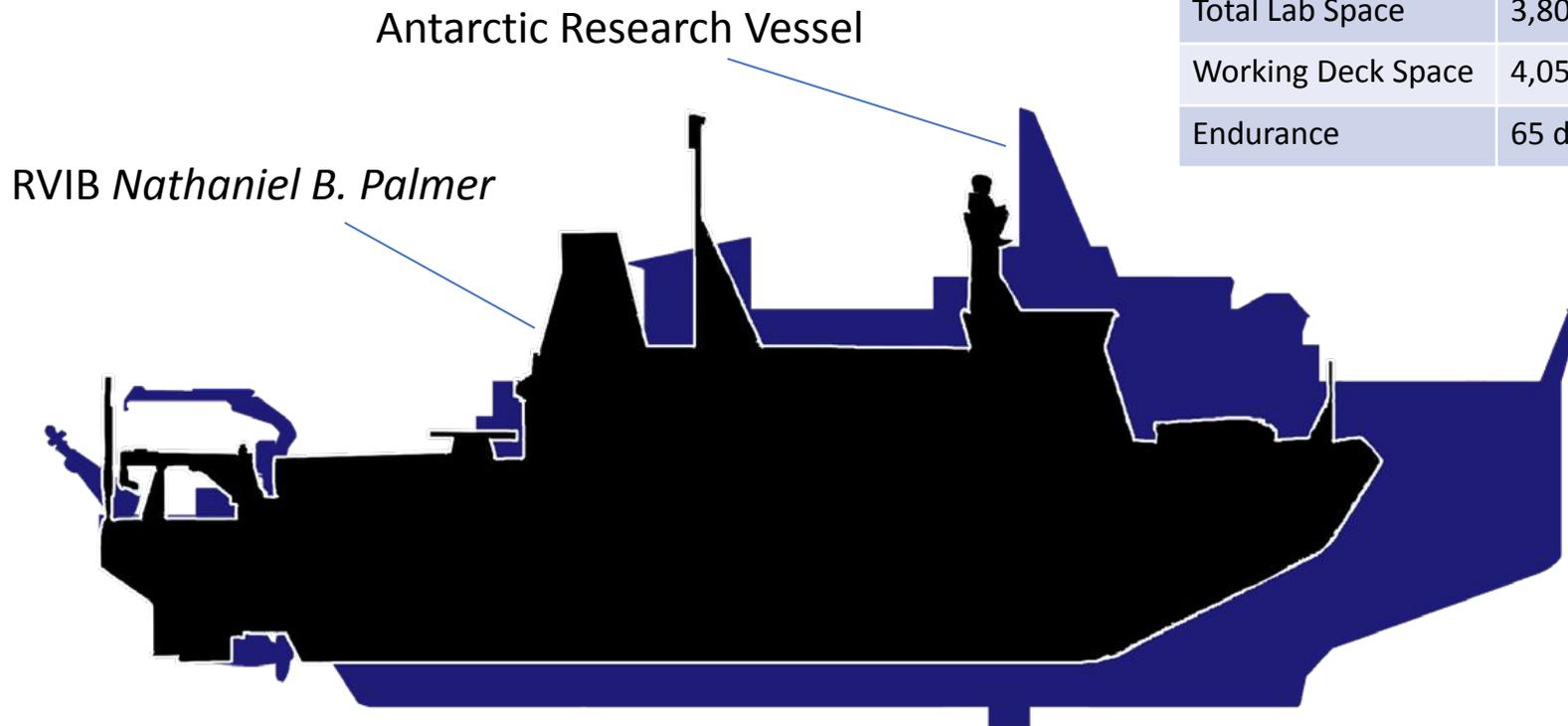
16 November 2022

NSF ARV Team

Stephanie Short, ARV Program Lead

Tim McGovern, ARV Program Manager

Mike Prince, ARV Project Manager



	<i>Nathaniel B. Palmer</i>	Antarctic Research Vessel	
Length	309 ft	365 ft	Bigger
Sci/Tech Berthing	45	55*	More scientists
Total Lab Space	3,805 sq ft	4,497 sq ft	More lab space
Working Deck Space	4,054 sq ft	7,197 sq ft	More deck space
Endurance	65 days	90 days*	Longer endurance

**AND greater icebreaking capability
≥4.5 ft @ 3 kts (Polar Class 3)***

*Key Performance Parameter

90 Day Endurance – DRM



KPP: Endurance of ≥ 90 without replenishment

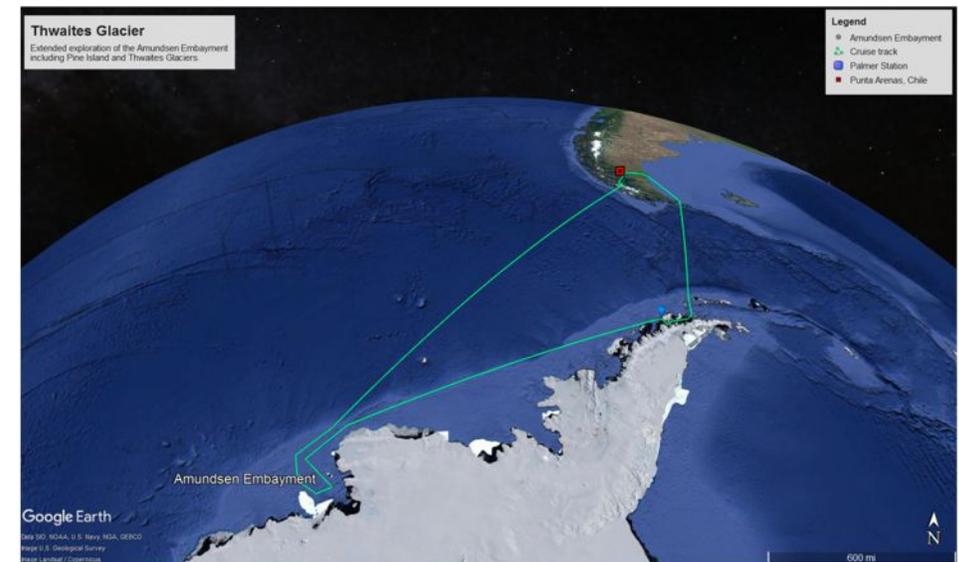
Requirement to be evaluated against a Design Reference Mission (DRM).

The DRM would include 55 scientists/techs, icebreaking and ice transit, station work including DP and deployments and transits to areas of interest around Antarctica.

Three DRMs developed with input from Antarctic Science Program Managers and Current NBP Science Planners. Current evaluation is that DRM 1 & 3 are achievable, DRM 2 achievable at less than 90 days.

Design Reference Missions (DRM)	Open Water Transit	In Ice	Station work & DP	Total Days
1 - Thwaites – Pine Island Bay	26	12	52	90
2 - Larsen C	22	23	45	90
3 - Wilkes – George V Coast	48	12	30	90

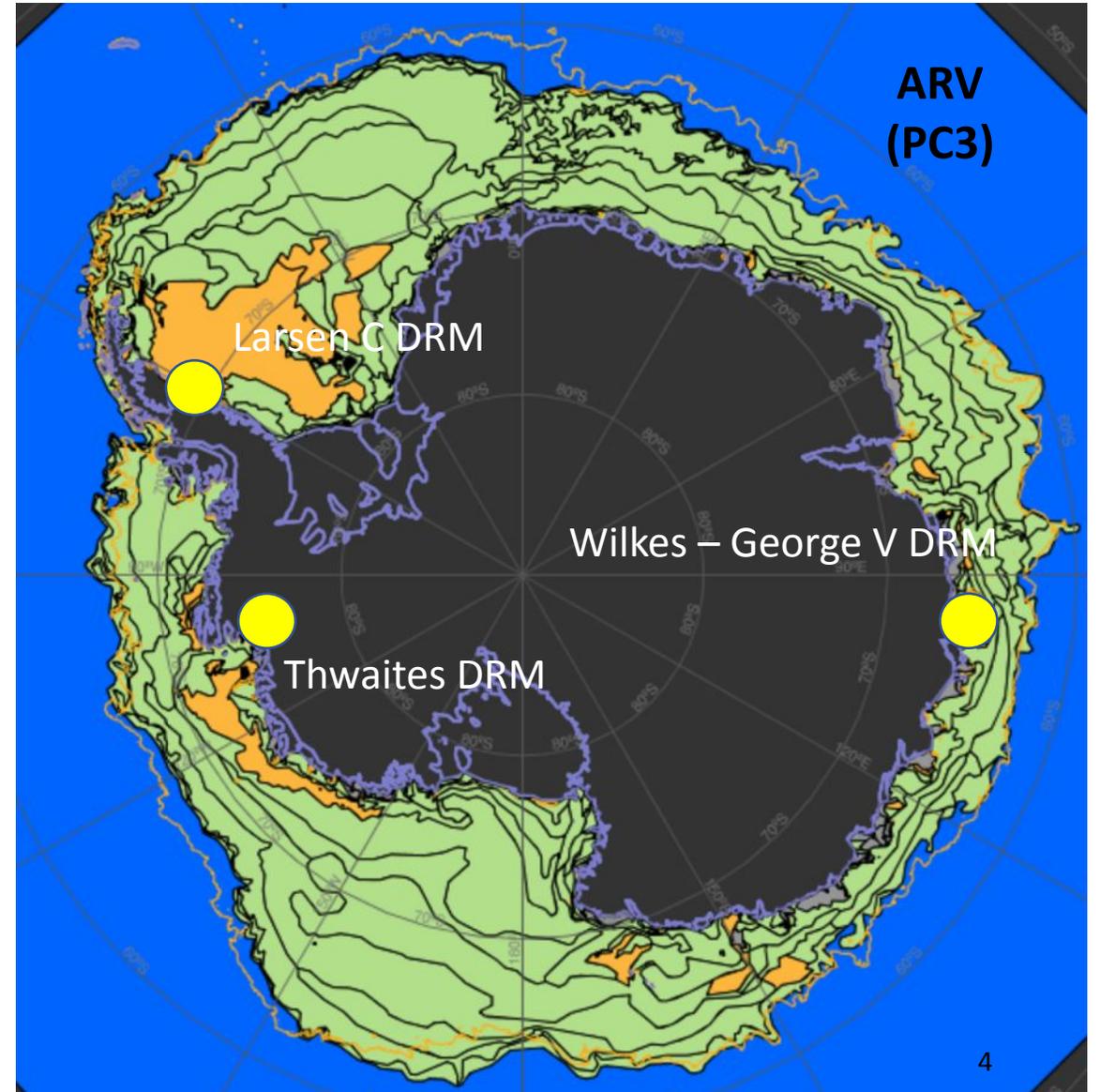
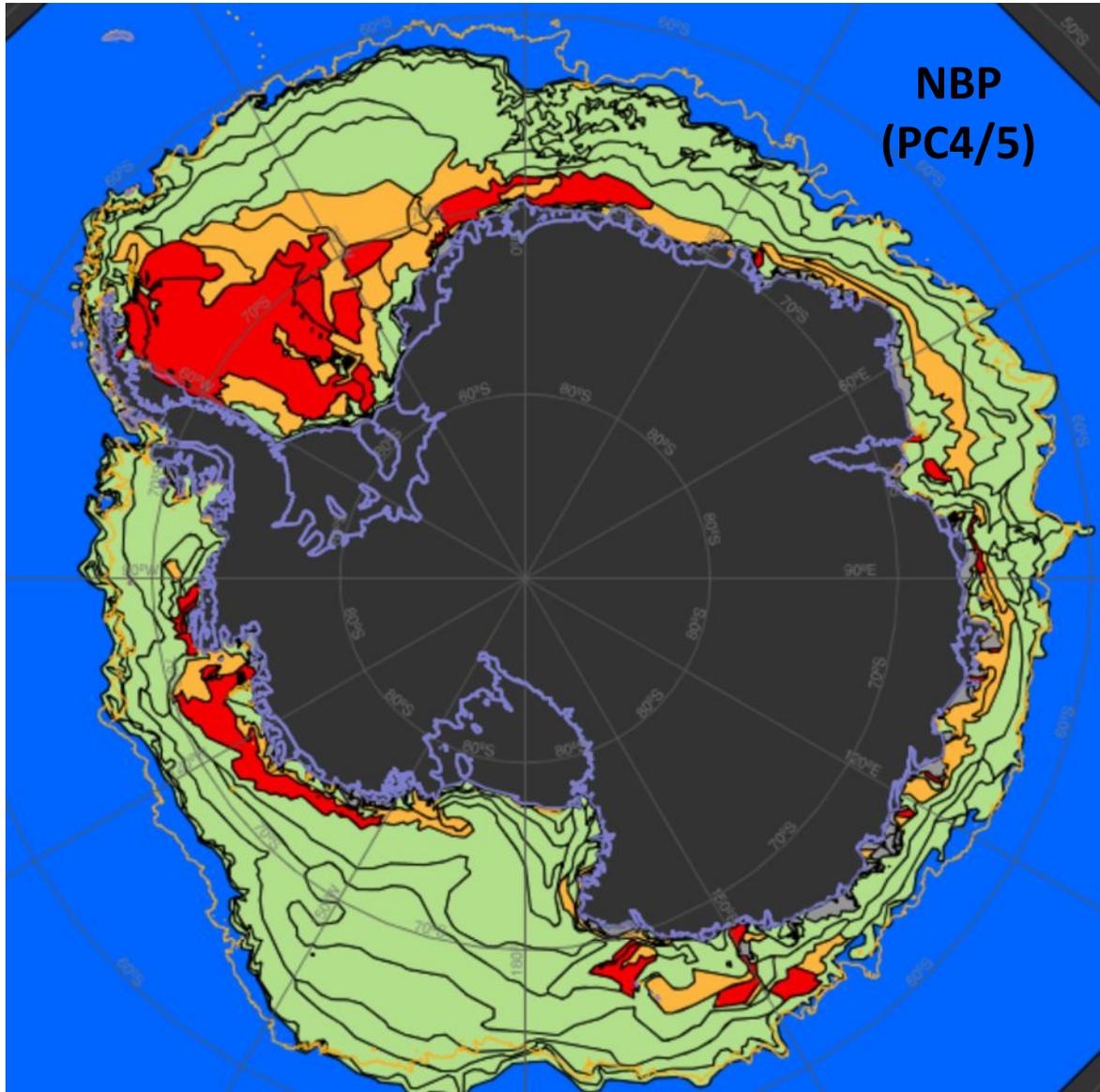
Figure 1: Future Thwaites Glacier Cruise Track



PC3 & Icebreaking KPP



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Key Characteristics and Capabilities



LOA	365' (111 m)
LBP	349' (106 m)
Beam (max)	80' (24 m)
Draft	32' 6" (9.9 m)
Displacement (full load w/345 LT SLA)	13,004 LT
Accommodations with one ADA stateroom	55 Science 29 Crew
Range	17,000 nm
Endurance	90 Days
Speed	11-12 kts cruise 14 kts Max

Characteristics

- Large Configurable Labs
- Science Sea Water System
- Baltic Room – CTD Operations
- Science Staging Bay – Back Deck Operations
- UAV/Aviation Deck and forward Hanger
- Marine Mammal and Sea Bird Observation Area (enclosed)
- Science Container Hold (8ea 20' ISO containers)
- Box Keel sonars w/ Ice Windows
- Retractable Center Board (Drop Keel) sonars w/o Ice Windows
- Science Support Small Boats (4)

Capability

- 40m – 50m Piston Coring System
- Coring and Oceanographic Traction Winches
- Primary and Secondary Hydrographic Winches
- CTD Launch and Recovery System (LARS)
- 20 ton Stern and Starboard A-Frames
- 7,000+ sq ft Aft Working Deck
- 170 ft open Starboard Deck
- 8,000+ sq ft Main Deck Lab space

Classification

ABS ✕ A1
Oceanographic

AMS
ILM

ACCU
BWT+

Unrestricted service
CCO-Polar

HAB++(WB)
ENVIRO

ESS-LIBATTERY
HYBRID IEPS

ILM
UWILD

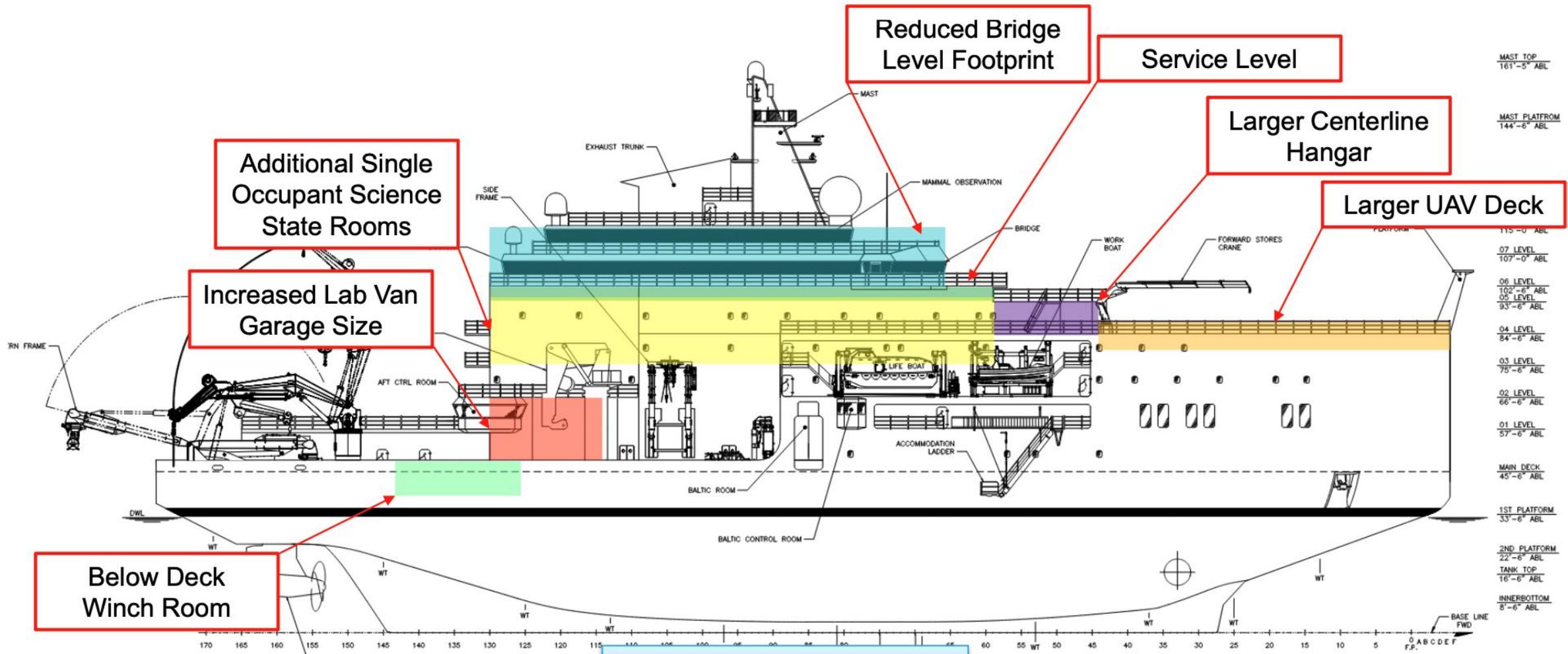
Ice Class
PC3

NIBS

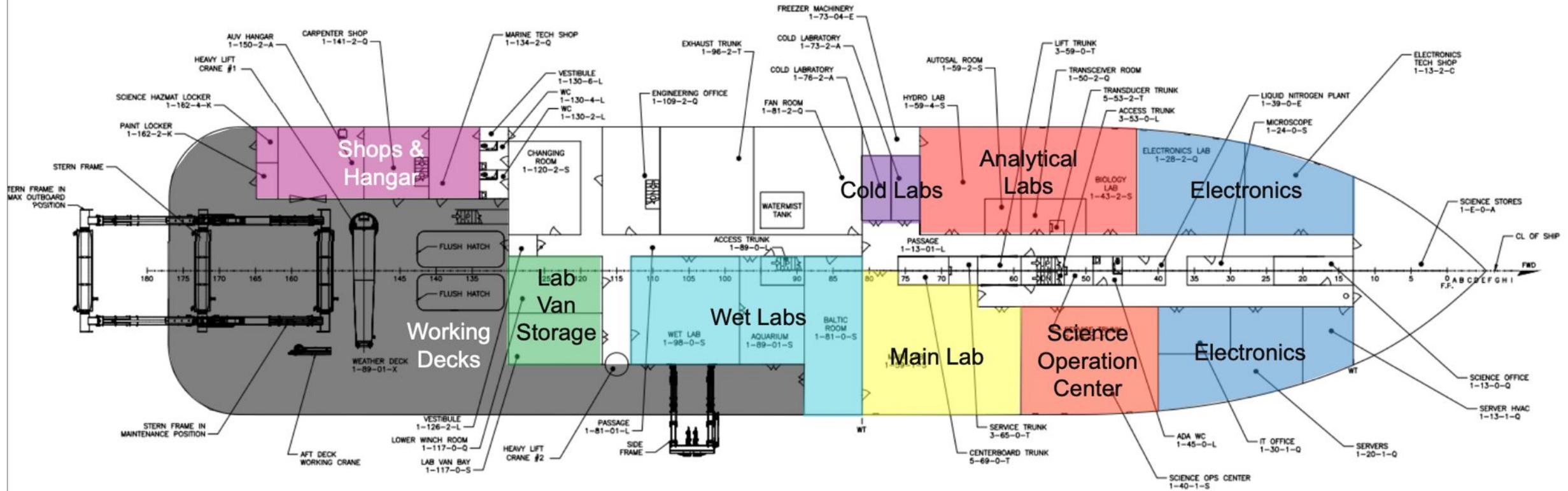
DPS 1

CS 2

General Arrangement – Recent Changes



General Arrangement – Main Deck



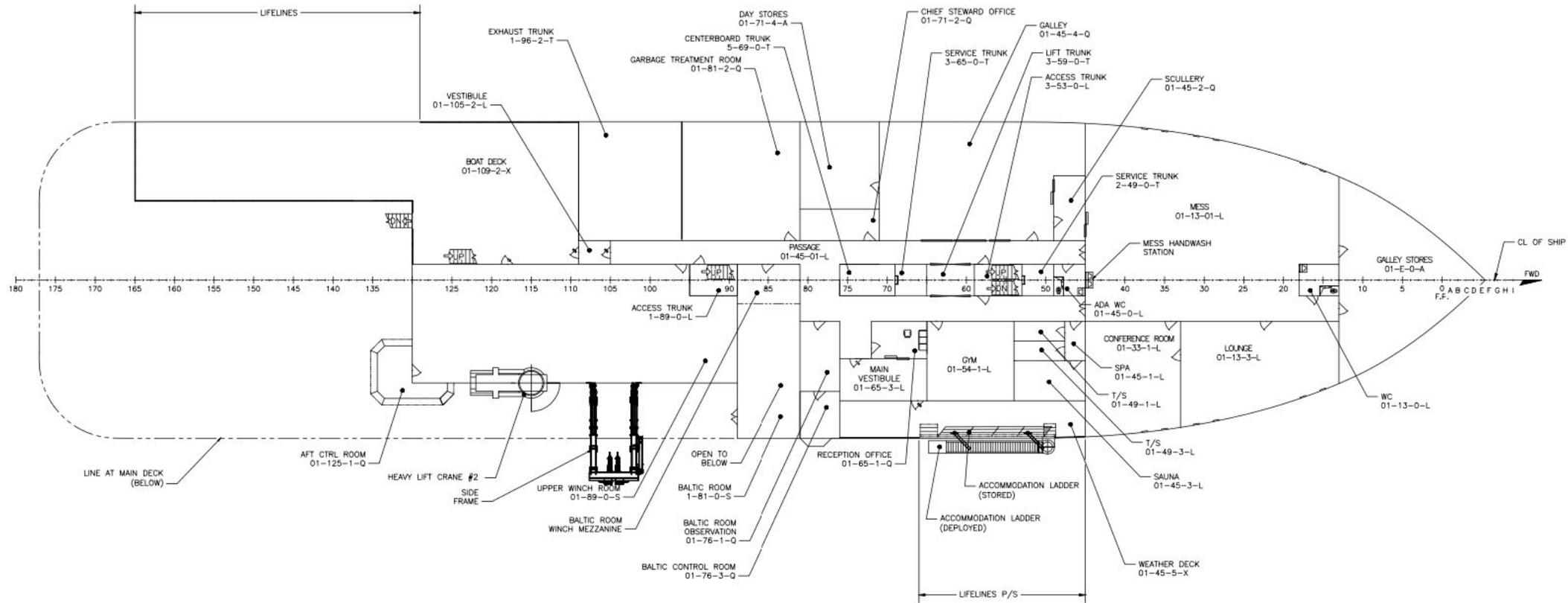
Over 7,000 sq. ft aft working deck

Lab & Science Support Spaces

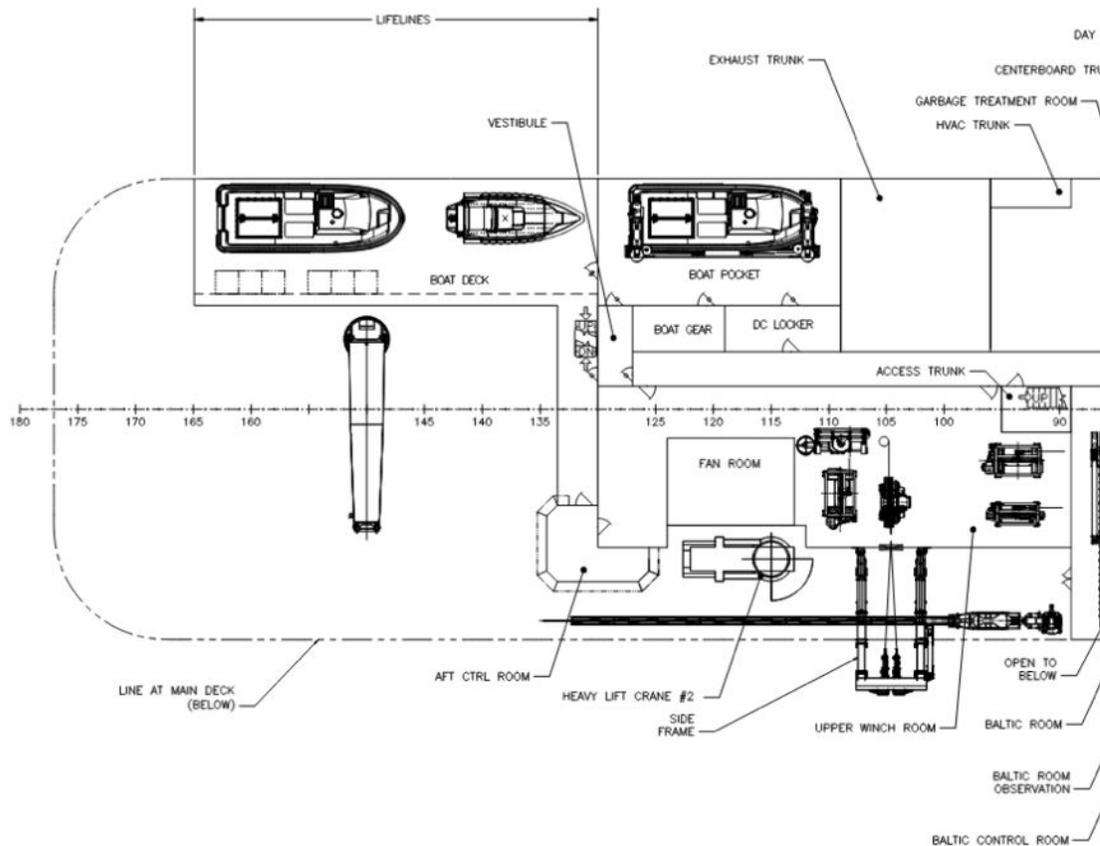


Lab Space	Area (sq. ft.)		Science Support Space	Area (sq. ft.)
Main Lab	1,520		Microscope Room	192
Science Operations Center	1,131		AutoSal Room	100
Wet Lab	900		Liquid Nitrogen Plant	
Aquarium	420		Transceiver Room	180
Biology Lab	758		Science Storeroom (main deck)	
Hydro Lab (Bio-Chem Analytical Lab)	737		Science Hold (1 st and 2 nd Platform)	8 Vans
Electronics Lab	792		Van Bay (Main Deck)	3 Vans
Marine Mammal Observatory	1,142		Aft Staging Hanger (main deck)	480
Atmospheric Lab	1,661		Forward Hanger (AUV/Aviation Deck)	1,300
Meteorology Lab	338		UAV/Aviation Deck	
Cold Lab (Cold Science Storage) (2)	144 ea.		ET, MT, Carpentry Shops, Server Room	
Conference Room(s), Telepresence			Changing Room, Office Space	

General Arrangement – 01 Deck



PLAN 6-5B RSV #5
01 LEVEL
57'-6" ABL



Winches

Oceanographic Traction Winch – 2 drums: 12k m 9/16" & 10k m .681 F/O or .680 Coax EM (Below Deck)

Coring Traction Winch – 1 drum: 7k to 10k m 3/4" synthetic cable w/100k lb. breaking strength. Winch line pull 80k lb.

Hydro/CTD winches (2) – 10k m 1/4" to 1/2" .322 EM, F/O or wire rope. Either winch serves Baltic Room or Stbd. A-Frame

Handling Devices & Cranes

Stern A-Frame – 40k lb. SWL – 180-degree range of motion.

Stbd. Side A-Frame – 40 lb. SWL – serve coring & hydro winches.

CTD Lars – Baltic Room

2 Heavy Lift cranes – Stbd & Port Main Deck – 65' reach - Load Charts being developed – 20k lb. 20 ft beyond side.

Aft Deck Portable Crane – 4,000 lb.

Forward Crane (UAV deck) – 4,000 lb.

Science Small Boats

20 – 30' RHIB (2) – Open Boat w/large payload, low dead rise hull, air collar/fendering system, bow pulpit, light davit, bolt pattern for mounting instruments.

~ 30' Science Survey Work Boat – Handling system, light winch, instrumentation, acoustic systems, Navigation and Safety Systems.

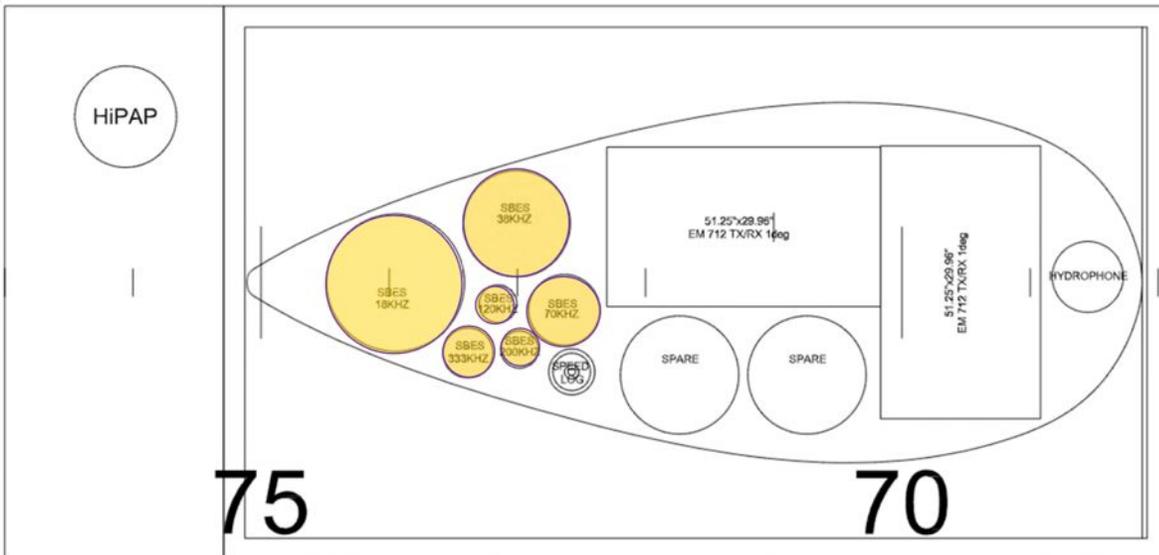
~ 30' Landing Craft – looking at innovative solutions



Acoustic Systems

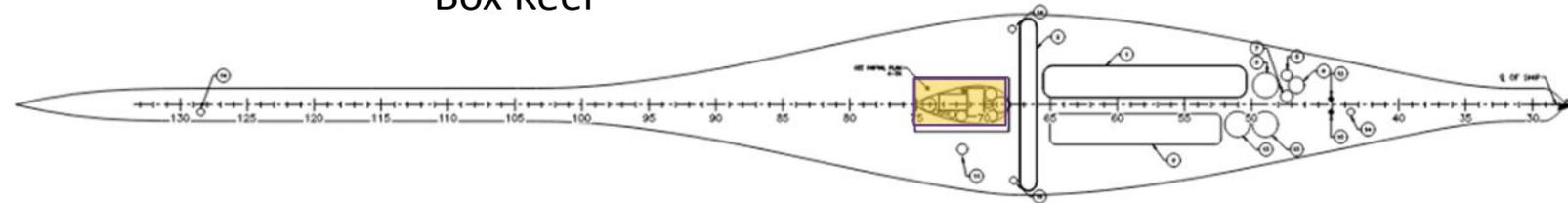


Drop Keel



Drop Keel Systems	Box Keel Systems
EK-80 Bio-Acoustic System – 18, 38, 70, 120, 200 & 333 kHz	ADCP – 38, 75, 150, & 300 kHz
EM-712 Multibeam – 1 x 1 array	EM-124 Multibeam - 1 x 1 array
2 Spare Transducer Wells	SBP 29 Sub-Bottom Profiler (uses EM124 receive array)
Hydrophone, Speed Log	USBL – HiPAP 502P
Fwd. Looking SONAR & Camera	Hydrophones, cameras
Possible Side Scan SONAR	Possible additional Spares

Box Keel



Preliminary Design Rendering



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Preliminary Design Rendering



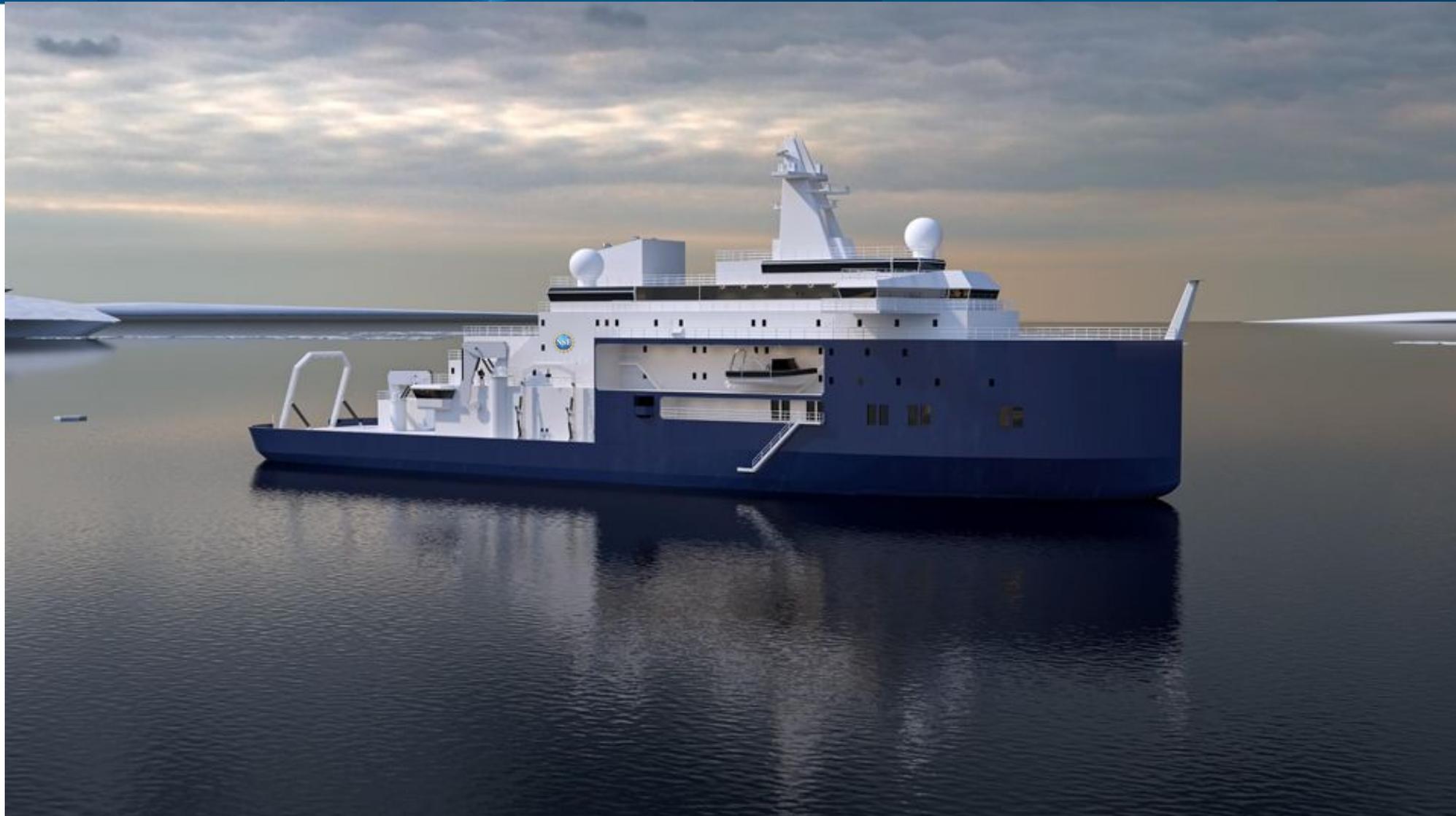
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Preliminary Design Rendering



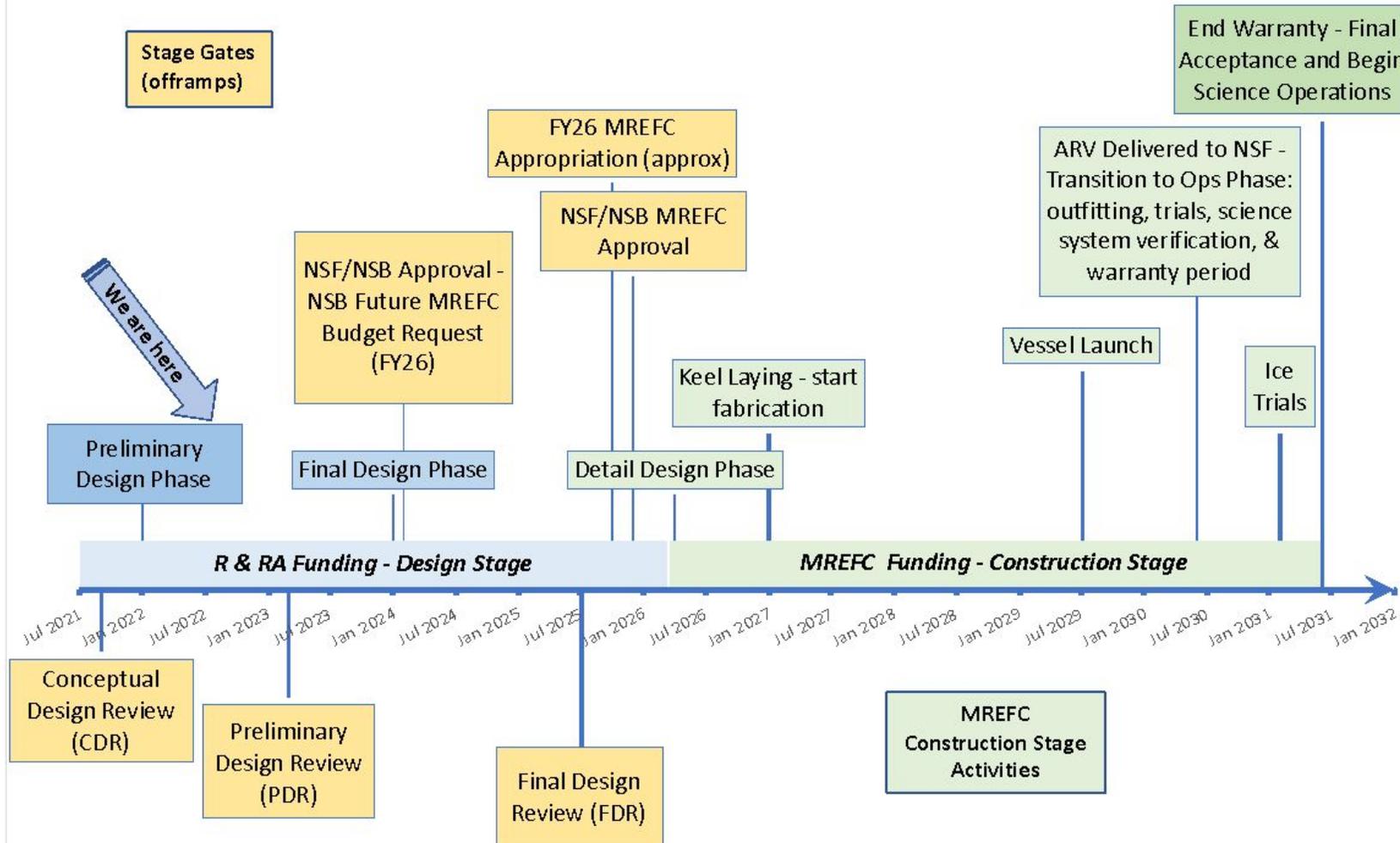
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ARV Schedule



ARV Project Timeline
Rev - November 2022 - Preliminary Design Phase



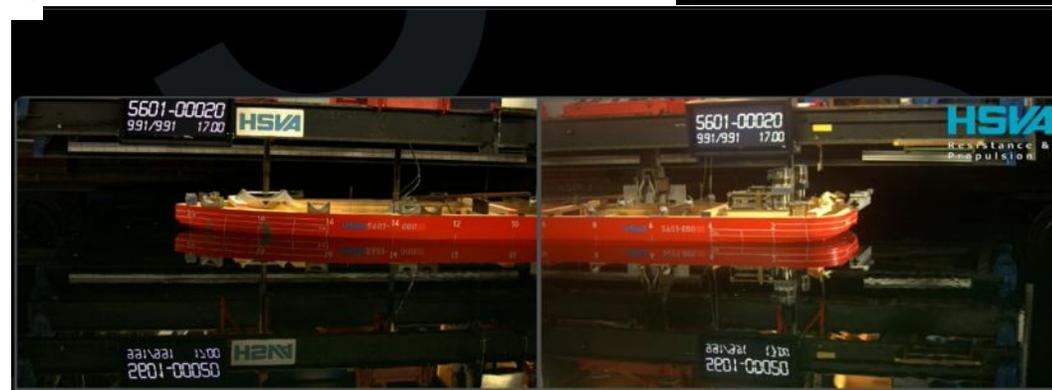
Model Testing - HVSA in Hamburg, Germany



Testing currently ongoing
Model scale is 21.336

Table 1: Model Test Subjects

Capability	Requirement
Open Water Performance	Speed and Powering Maneuvering Seakeeping Bubble Sweepdown
Ice Performance	Transit ahead and astern through ice Turning, and maneuvering through ice Transit through ice ridge formations
Propeller Design	Propeller performance in non-cavitating conditions Propeller performance in cavitating conditions



NSF has contracted with Leidos, the current Antarctic Support Contractor, to develop the Concept and Preliminary Design for ARV. Final Design and Construction will be awarded after Preliminary Design based on an open competition for a Vessel Integrator.

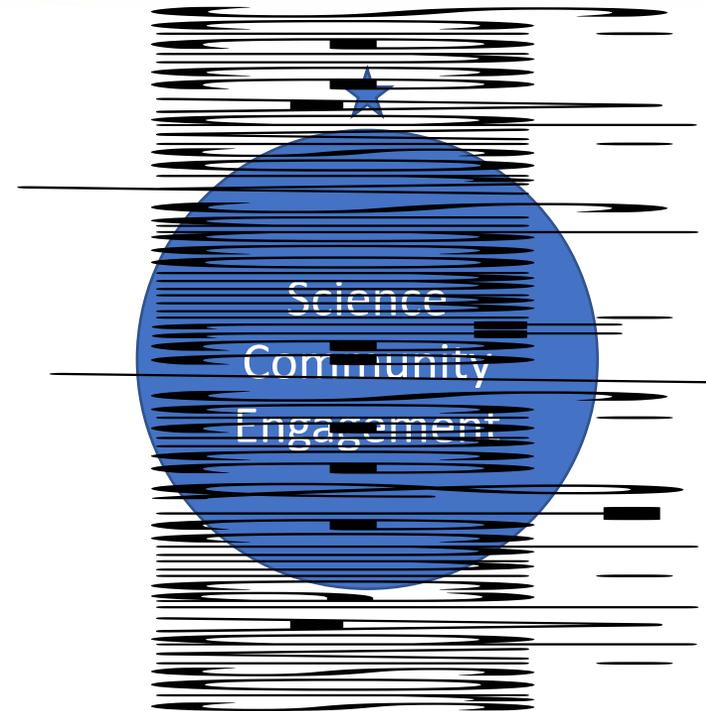
- Leidos Project Management Team:
 - Ethan Norris - Project Director
 - Christopher Chuhran - Program Manager
 - Hollie Anthonysz - Project Manager
 - Ross Hein - Project Science Mission Coordinator
 - Michael Minnig - Project Engineer
 - Lisa Avila - Project Administrator
- Design & Engineering Team (Leidos):
 - Gibbs and Cox – Ship Design
 - Maritime Systems Division – Systems Engineering
- ASC Mission Support – Operational Requirements
- Consultants / Subcontractors:
 - Noise Control Engineering (NCE)
 - Glostn – Naval Architect & Marine Engineering
 - Dan Oliver (Vessel Operator Consultant)
 - Marc Willis (Vessel Construction Consultant)
 - Spar Associates (Cost & Schedule)
 - HSVA (Model Test Basin)

Science & Technical Advisors (STAs)

2-10 individuals

Broad range of scientific & technical backgrounds, including:

- ✓ USCG icebreaker development & operations
- ✓ Naval Sea Systems Command shipbuilding
- ✓ Academic institution researchers
- ✓ Scientific technical managers
- ✓ Research vessel operators



Science Advisory Subcommittee (SASC)

- Dr. Bruce Appelgate, UCSD/Scripps
- Ms. Alice Doyle, UNOLS
- Dr. Amy Leventer, Colgate University
- Dr. Carlos Moffatt, Univ of Delaware
- Dr. Patricia Quinn, NOAA/PMEL; AC*
- Dr. Clare Reimers, OSU
- Dr. Deborah Steinberg, VIMS

Communications



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New Antarctic Research Vessel

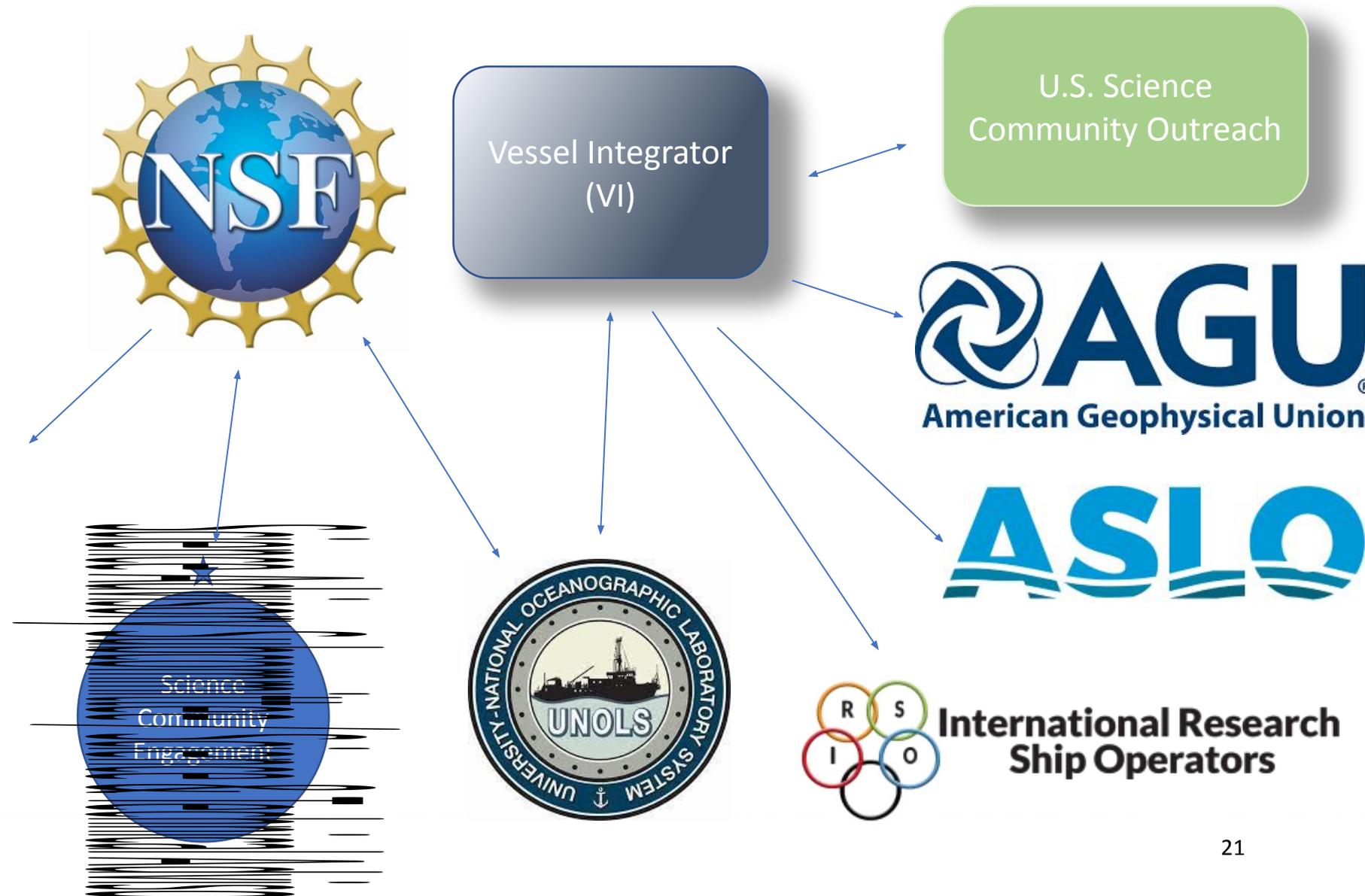
Advanced Icebreaking Research Vessel Development Beginning

JULY 22, 2021

The Director of the National Science Foundation (NSF) recently approved for the Office of Polar Programs Antarctic Research Vessel (ARV) project to move forward into the initial stages of the Major Research Equipment and Facilities Construction (MREFC) program. This is a major step forward in the development of an advanced icebreaking research vessel to replace the U.S. Antarctic Program (USAP) flagship research vessel, the R/VIB *Nathaniel B. Palmer*. The R/VIB *Nathaniel B. Palmer* has operational limitations and is reaching the end of its lifetime.

The R/VIB *Nathaniel B. Palmer* has granted scientists access to ice-covered seas surrounding Antarctica for nearly 30 years, giving NSF-supported researchers a leading role in advancing the understanding of Antarctica and the Southern Ocean. The unique region offers an unparalleled laboratory for scientific discoveries in fields such as climate change, biology, and oceanography.

If the design is approved and the project is fully funded, the new vessel would begin operations in 2030. Below is a conceptual rendering of the new ARV.



New Antarctic

Planning for the Next Generation of

What's New?

JUL 22, 2021

New Antarctic Research Vessel

Advanced Icebreaking Research Vessel Development Beginning

[Read More](#)



New Antarctic

Planning for the Next Generation of Oceanographic Research Vessel

Ship Design

Current Science Missions

Key performance parameters, operational requirements, and other information found here.

Science Mission Requirements (PDF)

Placemat

The ARV Preliminary Design Placemat is a key document in the development of the ARV. It lists overall hull dimensions, internal

DIMENSIONS	
Length Overall	345 ft
Length BP	325.5 ft
Beam Overall	73.5 ft
Beam LWL	72 ft
Draft FLD Load Line	28 ft
Draft Full Load	28 ft
Draft Lightship	17 ft

PERFORMANCE	
Open Water	11 kt T / 12 kt O
Cruse	8.5 kt
Quiet	8.5 kt

ACCOMMODATIONS	
Ships Crew	29
Deck	15
Engineering	9
Stores	5
NSF Science Party	2
ADA Accessible	2
Scientists	30
Waterwater (days)	20T / 40O

PROVISIONS	
Freeze	90 days
Chill	45 days
Dry	90 days

AVIATION	
UAV Launch/Recovery	150 lbs
UAV Hangar	No IP-5
UAV Workshop	150 sq ft

COMMUNICATIONS	
HF Terminal	1
C-Band SAT	1
UHF SATCOM	1
GMDSS	1
INMARSAT F	1

Design placemat of the new Antarctic Research Vessel
Credit: NSF, Leidos Inc.

New Antarctic Research Vessel (ARV)

Planning for the Next Generation of Oceanographic Research Vessel



Documents Library

Concept Design

- Conceptual Design Memo
 - [Leidos ARV Conceptual Design Memo](#)
- Concept Design Reports (Glosten Documents)
 - [19136 Concept Design Report](#)
 - [19136 Science Berthing Study Project Memorandum](#)
 - [19136.01 ARV Deck De-icing Systems Study - Status Update 09/29/20](#)
 - [19136.01 ARV Ice Environment Study - Status Update 09/25/20](#)
 - [19136.01 ARV Jumbo Piston Coring Study - Status Update 09/25/20](#)
 - [19136.01 - Manning Study](#)

Trade Off Studies

- [19136-000-01 ARV USCG Compliance Study Report](#)
- [19136-000-02 ARV Propulsor Study Report](#)
- [19136-000-03 ARV Power Systems Study Report](#)
- [19136-000-04 ARV Climate Study Report](#)
- [19136-000-05 ARV Seakeeping Study Report](#)
- [19136-000-06 ARV Ice Environment Study Report](#)
- [19136-000-07 ARV Green Ship Alternatives Report](#)
- [19136-000-08 ARV Autonomous Vehicle Handling Study Report](#)
- [19136-000-09 ARV Deck De-icing Study Report](#)
- [19136-000-13 ARV Triple Propulsor Report](#)

Applicable UNOLS Guidelines and Reports

- [American Disabilities Act \(ADA\) Guidelines for UNOLS Vessels](#)

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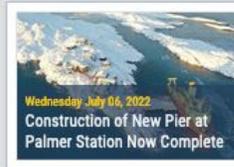
May 18, 2022

What is Future USAP?



Future USAP is a part of the United States Antarctic Program (USAP). Funded by the National Science Foundation, Future USAP is dedicated to long range investments in Antarctic infrastructure.

News and Updates



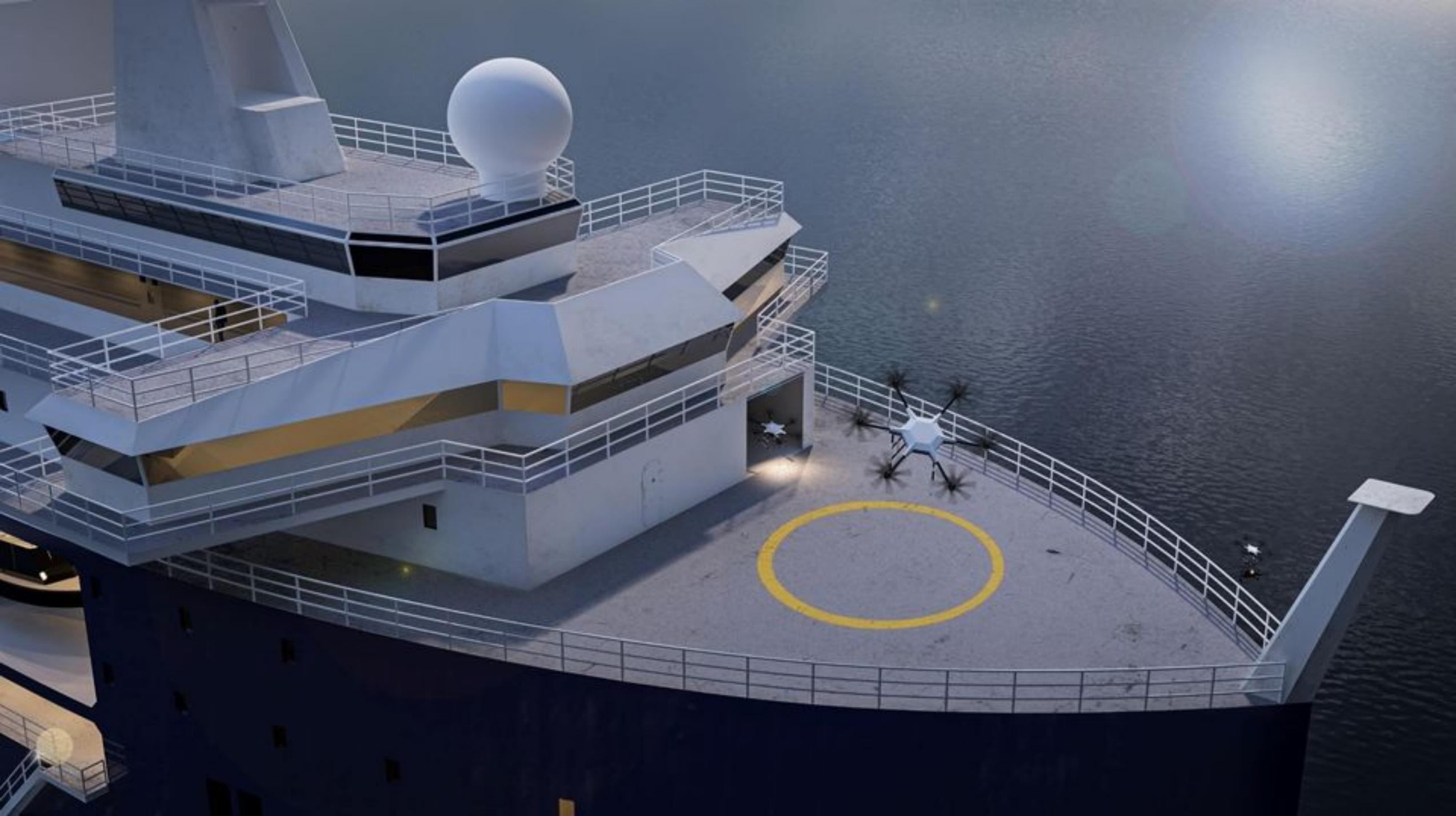
Wednesday - July 06, 2022
Construction of New Pier at Palmer Station Now Complete

future.usap.gov/arv

- ❖ ~20 years of sustained scientific demand
- ❖ Continued ability to support cutting edge NSF research for the next 40 years
- ❖ Enhanced capabilities over existing USAP research vessel
- ❖ Competent approach and highly qualified team









Questions? Comments?