Polar Research Vessel
Operational Requirements and Summary of Technical Studies

Presentation to UNOLS

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Why a New Antarctic Research Vessel ?

- National need to expand global warming studies in polar regions
- Global climate change models point to southern oceans as critical component
- Lease of existing research vessel expires in 2012
- Scientific facilities and capabilities insufficient aboard existing research vessel

Nathaniel B. Palmer in ice

Statement of Work

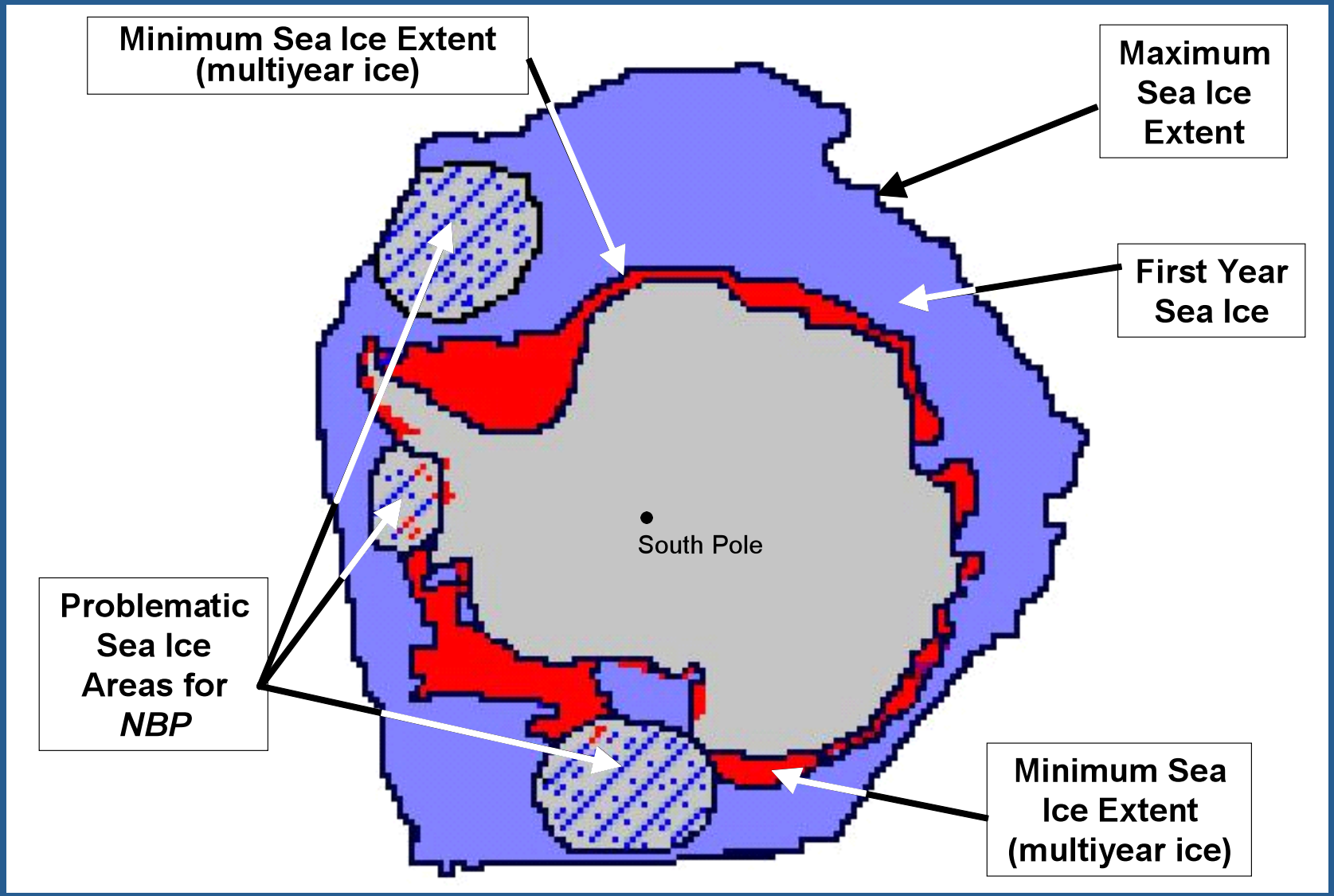
- Translate a set of science and operational requirements into criteria for the PRV taking into account the experience gained by U.S. and foreign vessels engaged in polar research
- Perform a feasibility study of the vessel in sufficient detail to arrive at a ship size, general arrangement drawings and a cost estimate
- The work will be done in conjunction with a science oversight committee

Science and Operational Requirements

Critical New Research Requirements

- Enhanced icebreaking capabilities 1.4m (4.5 ft) at 3 kts
- Increased endurance (to 80 days) and 20,000 miles at 12kts
- Increased accommodations (for 50) and lab space
- Moon pool for geotechnical drilling - provides access to the water column through a controlled interface (no ice, limited surge, and turbulence)
- Ability to tow nets and research instrumentation from the stern during icebreaking
- Acoustically quiet
- Hull form designed for the installation of bottom mounted sensing instruments and operation during icebreaking

ANTARCTICA - Desired Enhanced Performance



Additional Science and Operational Requirements

- Capability to conduct autonomous underwater vehicle remotely operated vehicle (AUV/ROV) operations
- Jumbo piston coring (JPC) capacity for 50 m
- Compliance with International Maritime Organization (IMO) guidelines for Arctic vessels
- Reduced air emission from diesel engines and incinerator and other features for a “greener” ship
- Provision for a helicopter flight deck and hangar
- Space for 6 portable lab containers
- 2.4 m (8 ft) wide passageway on the Main Deck and inter-deck elevator
- Aloft, enclosed platform for science observations

Ice Classification

American Bureau of Shipping (ABS)
International Association of Classification Societies (IACS)

Location	ABS A2	IACS PC4/5	ABS A3	IACS PC3
Arctic Offshore Shelf	Independently August through October	PC4: Year-round operation in thick first-year ice (1.2 to 2.0 m) which may include old ice Inclusions PC5: Year-round operation in medium first-year ice (0.7 to 1.2 m) which may include old ice inclusions	Independently July through December	Year-round operation in second-year ice which may include multi year ice inclusions.
Central Arctic Basin	Independent operation not allowed Escort by A4 or Higher, July through November		Independently July through September for short term, short distance Escort by A4 or higher, July through November	
Antarctic	Independently March through April NBP operates independently all year in first-year ice		Independently February through May PRV can operate independently all year in first-year ice and enter areas with second year ice	

Notional Operating Profile	
Activity	**Days**
Science operations away from port and in-transit	265
In-port preparations for science operations	35
Repair and maintenance	65
Total Days	365

Results from Project Technical Studies

Special Technical Studies

1. Towing in ice – seismic operations and nets. Recommend a hull form, stern arrangement, and propulsion system that improves towing in ice.

2. Bathymetry in ice – Recommend a hull form and appendages that promote improve ice management and reduce bubble sweep down over the acoustic windows for the multi-beam swath bottom mapping system, sub-bottom profilers, ADCP, fish finding sonars and other acoustic sensors.

3. Geotechnical drilling – Recommend a hull form, propulsion system, thruster system, and drilling arrangement for shallow water drilling in land, fast ice and open water.

4. Establish requirements for a moon pool to deploy and recover ROVs and AUVs in ice and consider CTD/rosette deployment through the moon pool.

5. Evaluate increased icebreaking capability and evaluate one or more propulsion concepts to satisfy mission requirements and develop recommendation.

6. Examine compliance with new IMO requirements for Arctic vessels including provision for no pollutants carried directly against the outer shell.

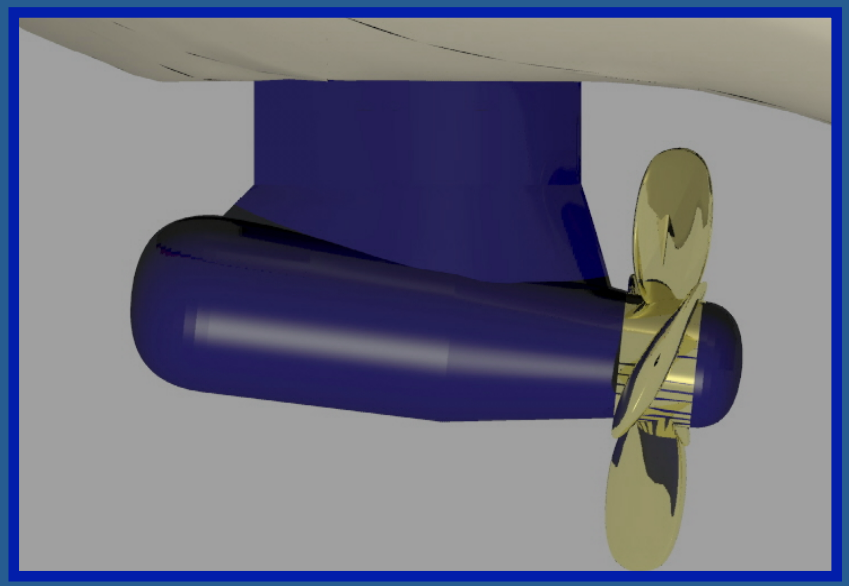
7. Investigate and recommend an approach to improve the ship's self-generated noise signature to improve scientific acoustic sensor performance.

8. Analyze and recommend an approach on methods to reduce emissions from diesel engines and the incinerator.

Podded Propulsion

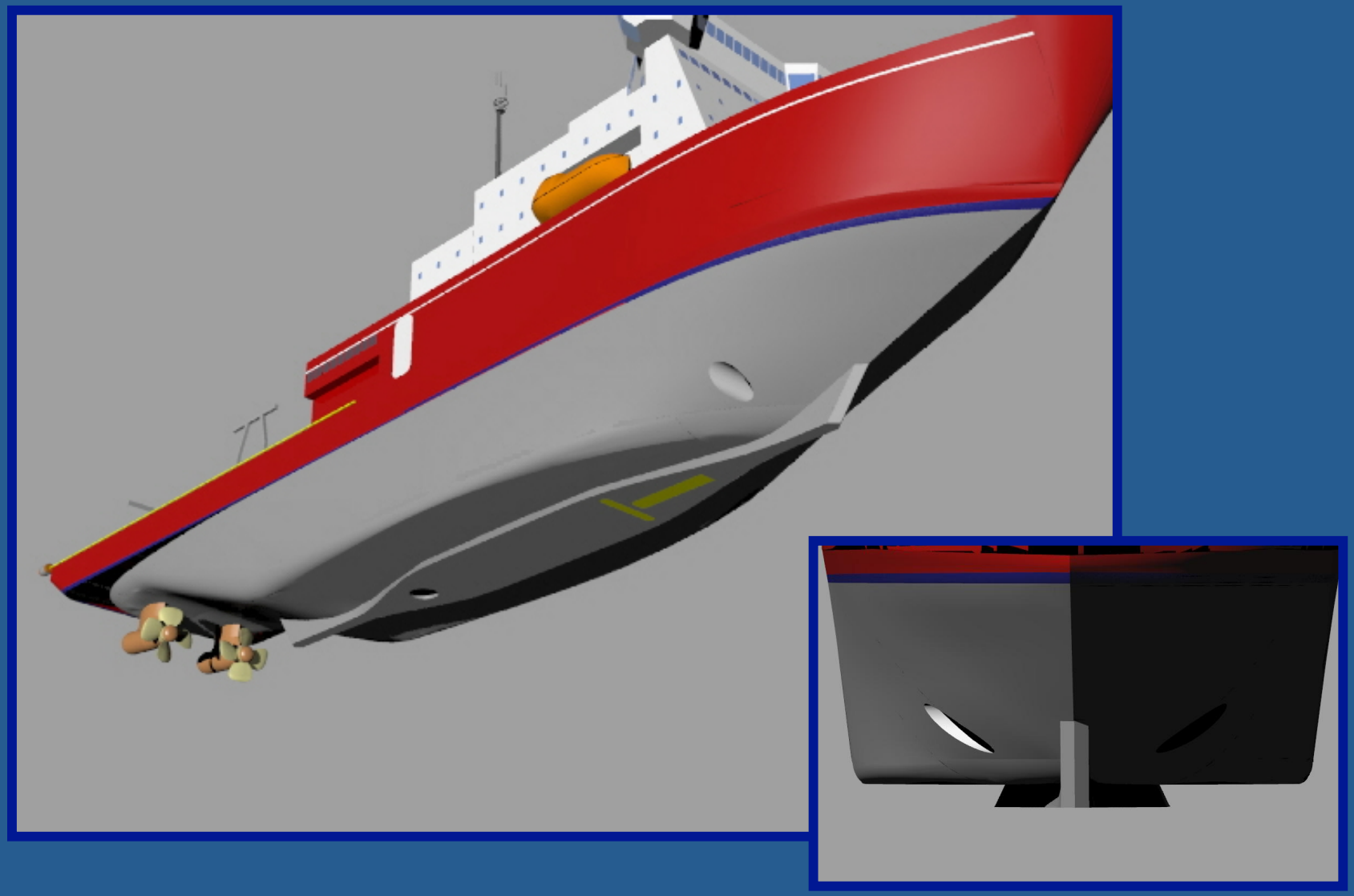
- MV Botnica showing the clear track achievable with podded propulsion systems

Podded Propulsion System



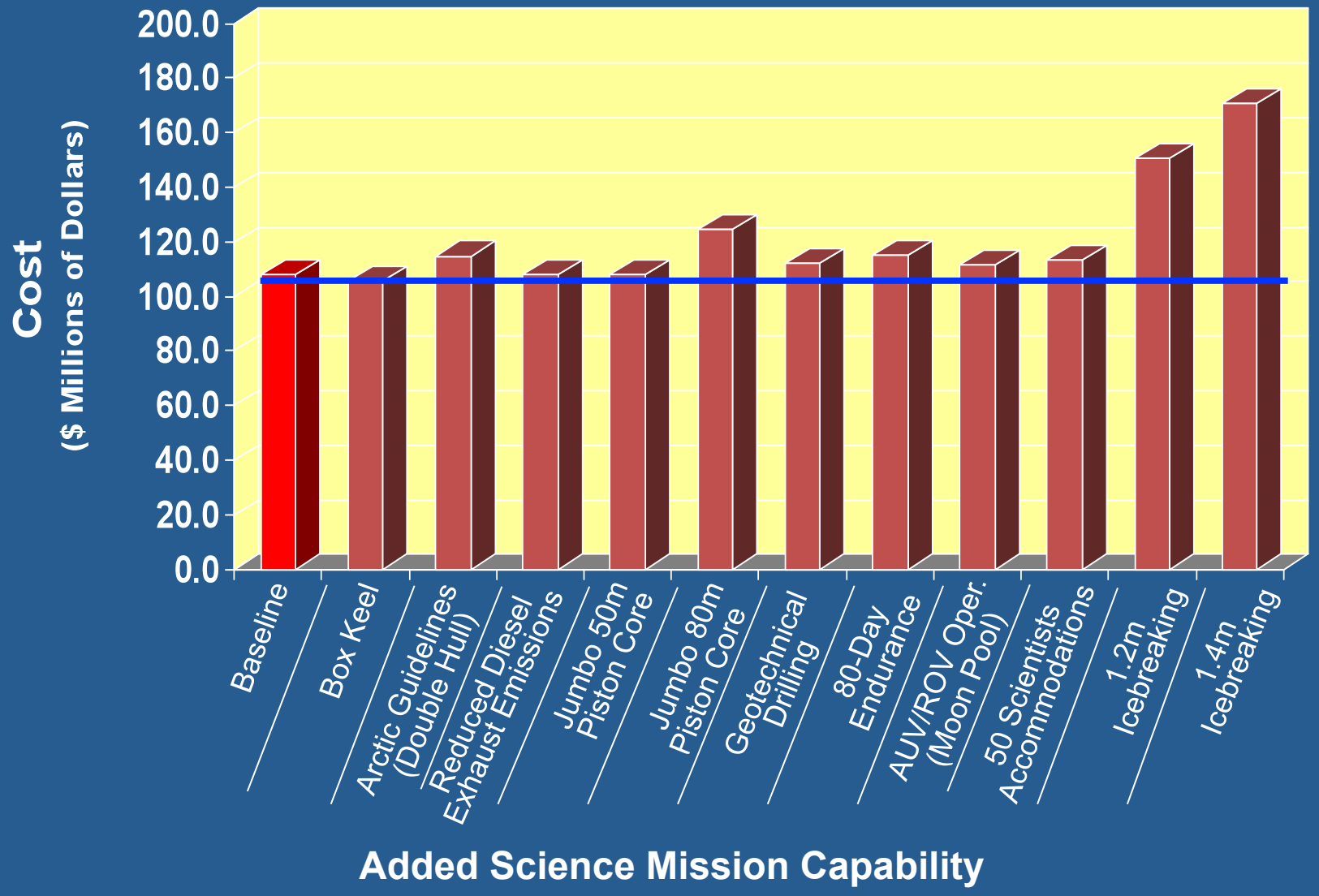
- Direct drive diesels are hard to fit into a ship with a large moon pool – electric plant provides flexibility
- Diesel generators can be “floated” on isolation mounts for low noise/ vibration
- Twin azimuthal propulsors give greater maneuverability in ice and open water station keeping
- However other viable alternatives still are under consideration

Underwater view of PRV box keel with bottom mapping sensors



Environmental Features Incorporated in PRV

Sensitivity Studies



Enhanced Capability and Features of New Generation Polar Research Vessel

- 62% increase in displacement
- 79% increase in shaft power
- 50% increase in icebreaking capability
- 128% increase in space available for laboratories
- 32% increase in accommodations for scientists
- 33% increase in endurance
- 69% increase in construction cost
- 50% increase in design service life of vessel

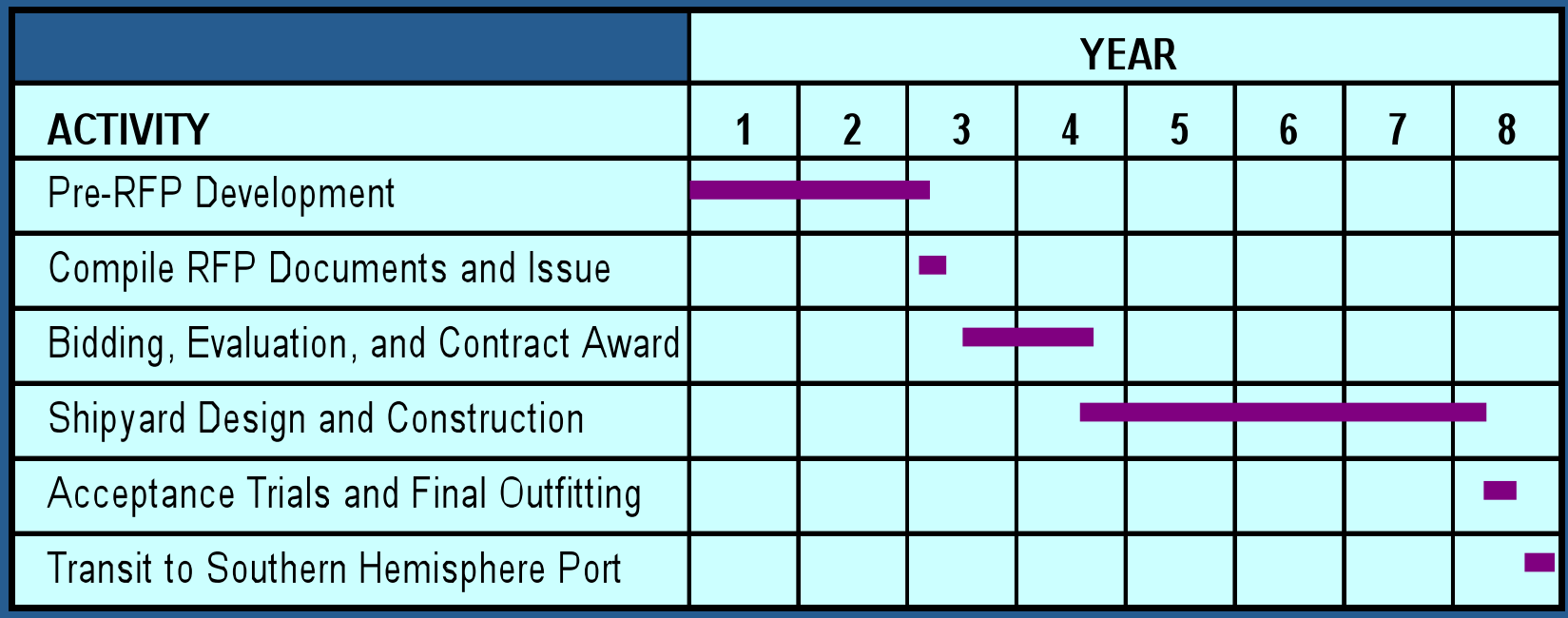
New Generation Polar Research Vessel

How did the Planned PRV Procurement Differ from the NBP

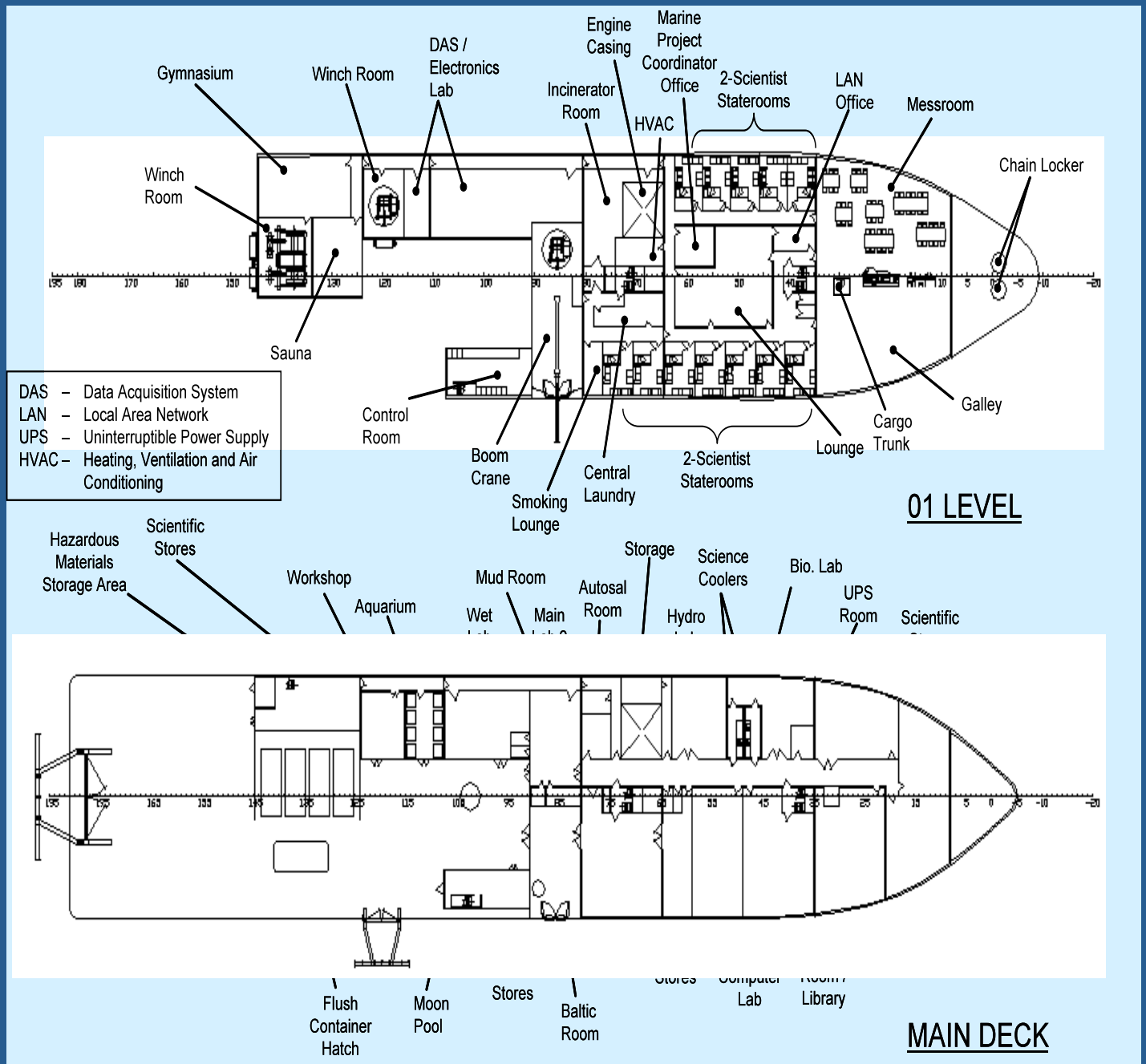
- NBP procurement had limited design guidance in the RFP technical specifications and bidders were to submit competing designs at all levels of detail including science spaces

- The PRV procurement would contain significantly more details in the specification, including a conceptual design of the vessel and guidance drawings of laboratory spaces that reflect the preferences of the science community

Project Timeline



Above water features of PRV

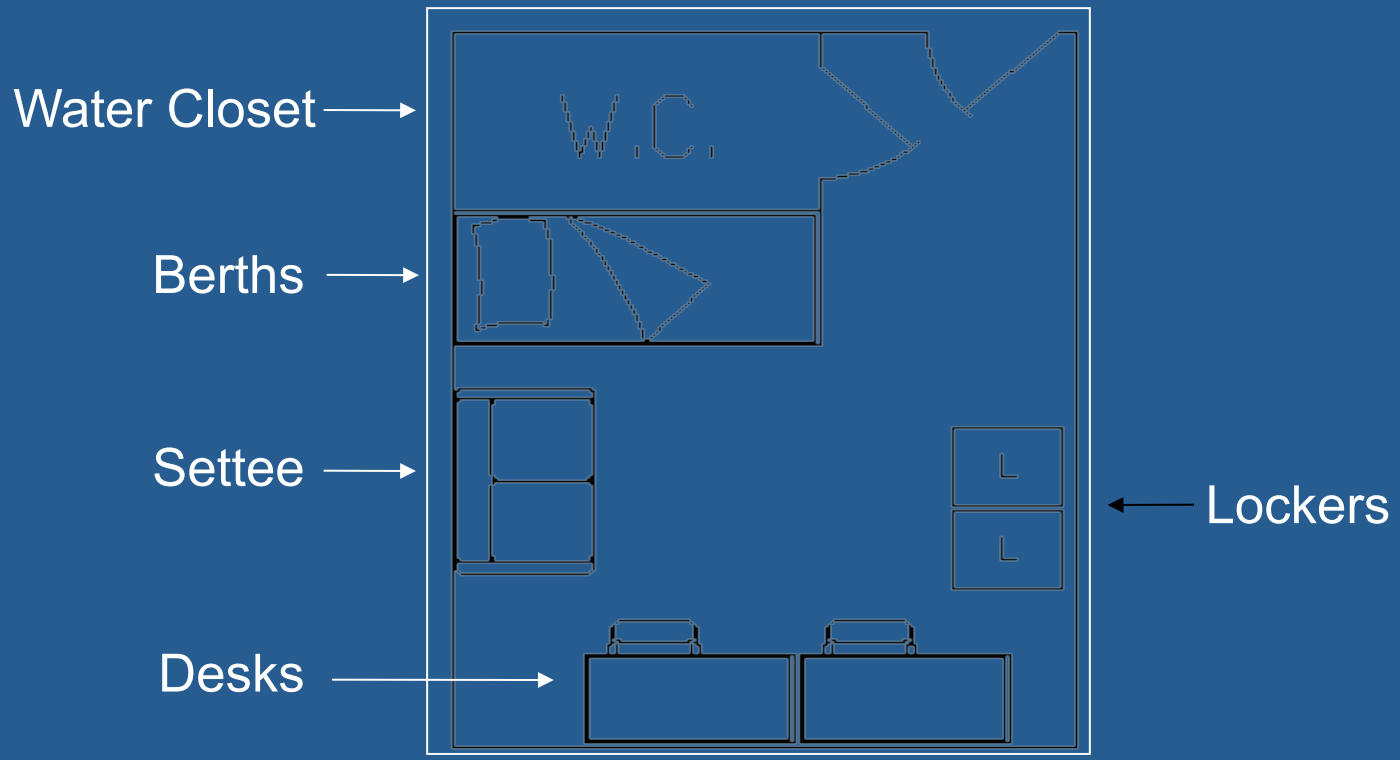

Gymnasium
Winch Room
DAS / Electronics Lab
Engine Casing
Marine Project Coordinator Office
Incinerator Room
HVAC
2-Scientist Staterooms
LAN Office
Messroom
Chain Locker
Winch Room
Sauna
Control Room
Boom Crane
Smoking Lounge
Central Laundry
2-Scientist Staterooms
Lounge
Cargo Trunk
Galley
DAS – Data Acquisition System
LAN – Local Area Network
UPS – Uninterruptible Power Supply
HVAC – Heating, Ventilation and Air Conditioning
01 LEVEL
Hazardous Materials Storage Area
Scientific Stores
Workshop
Aquarium
Mud Room
Wet
Main
Autosal Room
Storage
Science Coolers
Hydro
Bio. Lab
UPS Room
Scientific
Flush Container Hatch
Moon Pool
Stores
Baltic Room
Computer Lab
Library
MAIN DECK

Features of Main Deck and 01 Level

needs to be updated

- Combined moon pool and Baltic room with 22 ft deck height
- Control room overlooks moon pool and boom crane
- 8 ft-wide corridor through laboratory spaces
- Garage door between Baltic room and starboard-side deck
- Removable lower section of geo-tech drill rig
- 01 Level winches service moon pool, starboard A-frame and boom crane
- Dedicated microscope room

Two-Person Science Cabin



Principal Characteristics

LOA	115 m	Draft	9 m
LWL	104 m	Displacement	11,200 LT
Beam	23 m	Propulsive horsepower (total, twin propellers)	16,700 kW