

Regional Class Research Vessels

Innovations in Research Vessel Design

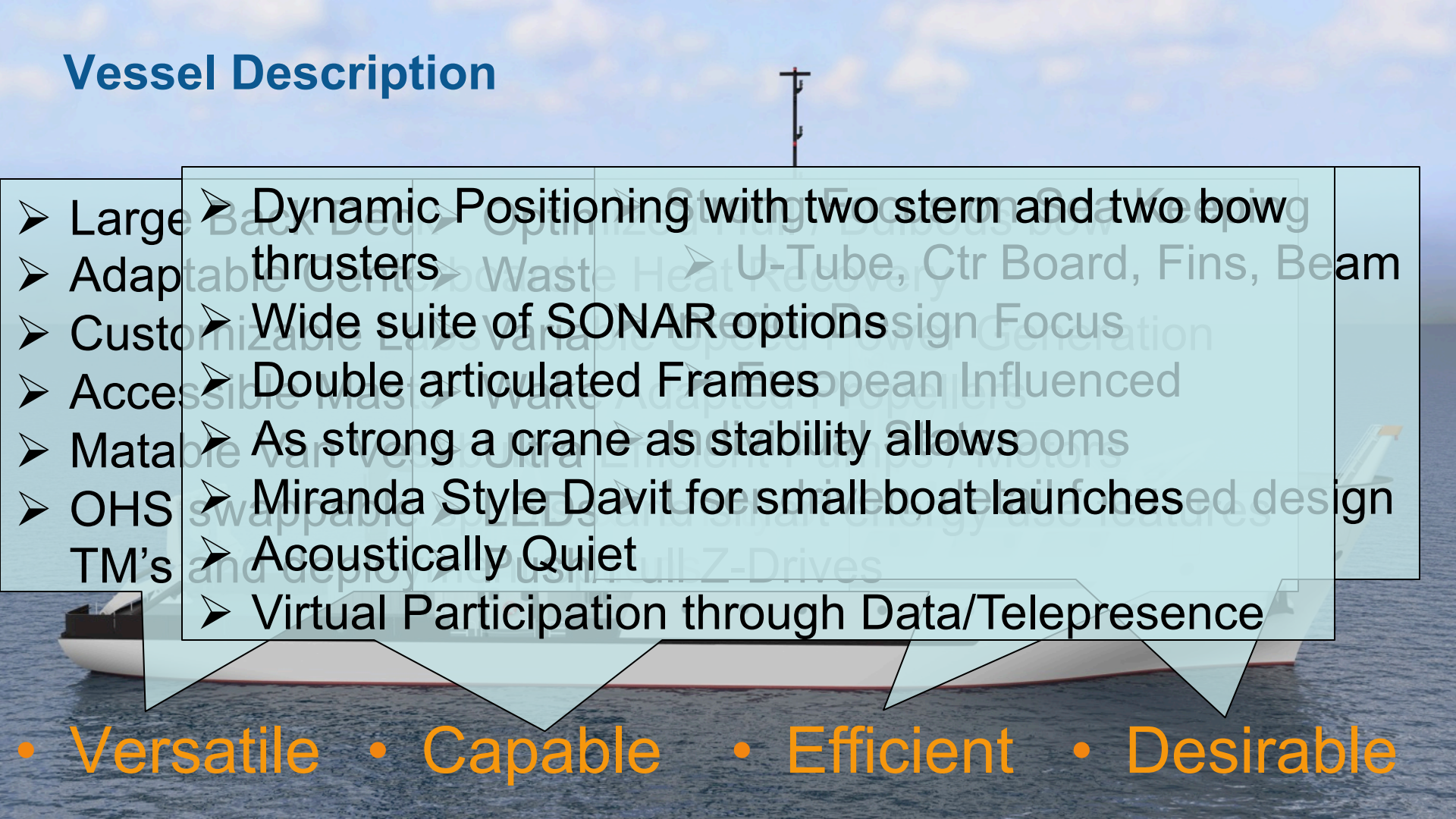
UNOLS Fleet Improvement Committee

26 March 2015

*“She will be the finest liner of her type ever built...
It is our intention to incorporate every modern idea
that will pass the stern scrutiny of practicability.”*

-William Francis Gibbs,
Naval Architect and designer of S.S. United States.

Vessel Description

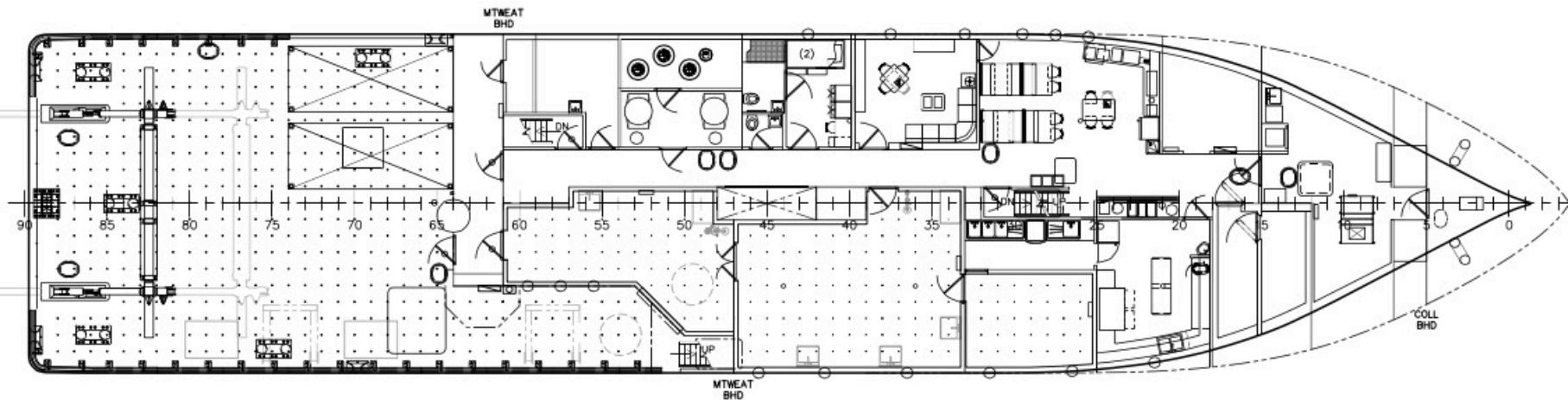
- 
- Large
 - Adaptable
 - Customizable
 - Accessible
 - Matable
 - OHS
 - TM's
- Dynamic Positioning with two stern and two bow thrusters
 - Wide suite of SONAR options
 - Double articulated Frames
 - As strong a crane as stability allows
 - Miranda Style Davit for small boat launched design
 - Acoustically Quiet
 - Virtual Participation through Data/Telepresence

• Versatile • Capable • Efficient • Desirable

Other Design Drivers

- ABS Ice Class: C0
- ABS DP Class: DPS-1
- Enviro Certified: Green Marine & IAPH
Environmental Ship Index
- ADA Informed design components

General Arrangement

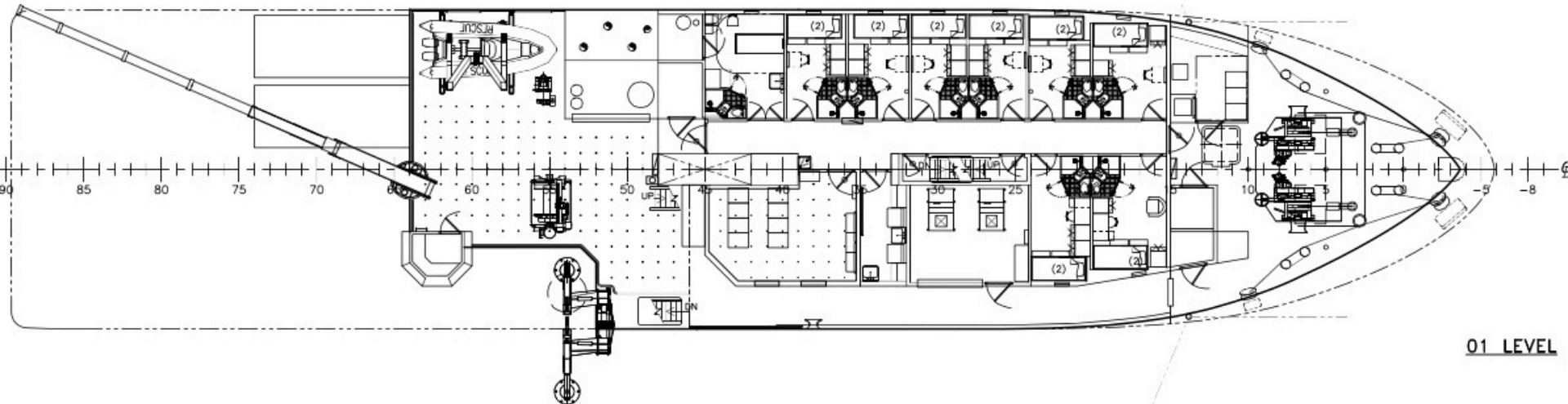


Main Lab	520 ft ²
Wet Lab	275 ft ²
Computer Lab	175 ft ²

Main Deck (aft of house)	2,100 ft ²
Main Working Deck (including side deck)	2,373 ft ²
Side Deck Length	77 ft
Space on the port side for two vans (mated to superstructure)	

General Arrangement

01 Level



Telepresence Center 235 ft²
Winch Deck Area 550 ft²

Science Berths

8 Double Staterooms
(includes accessible stateroom on Main Deck)

Marine Technician

1 Double Stateroom

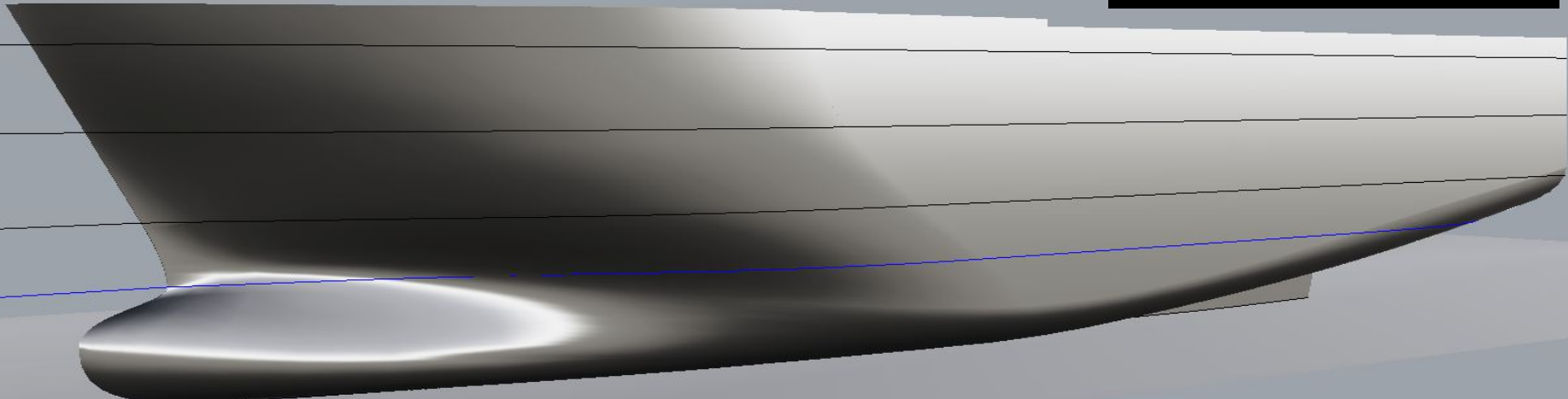
Hull Form

- Modified Bulbous Bow
 - Increases fuel efficiency by up to 6% at cruise speed
- Weight: Greater requires more power
 - Lightweight Construction Materials

Length of Waterline	178' - 0"
Breadth, Molded	41' - 0"
Depth, Molded	19' - 0"
Design Draft	12' - 6"

Hull Coefficients

Prismatic	0.622
Maximum Section	0.931
Block	0.579
Waterplane	0.803





17679 - 7.0 Kn



17679 - 7.0 Kn

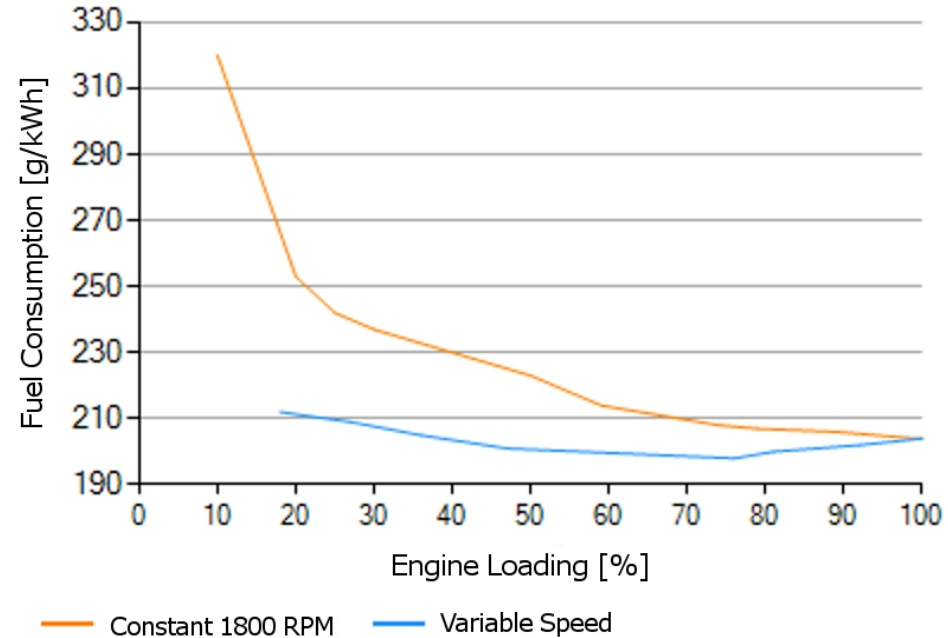
7.0 Knots

Variable Speed DC Power Generation

• Increase Fuel Efficiency

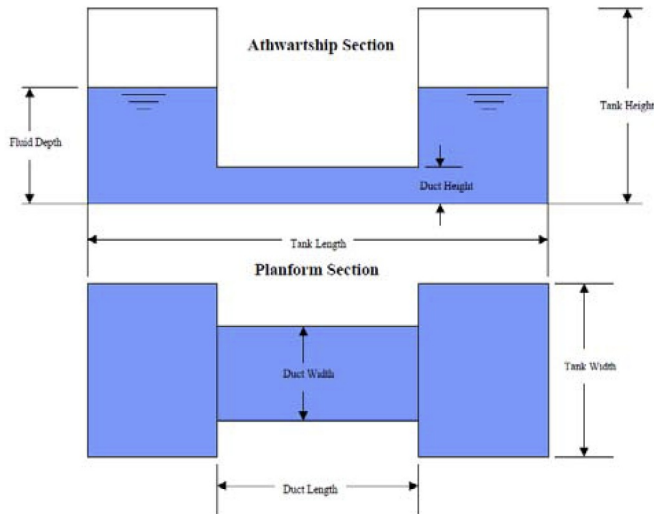
- Variable Speed Power Generation
- Power electronics produce 60Hz power
- Optimal operating point
- Increased fuel economy, especially at light loads
- Observations indicate 5%-15% fuel savings

CAT 3512C



Sea Keeping

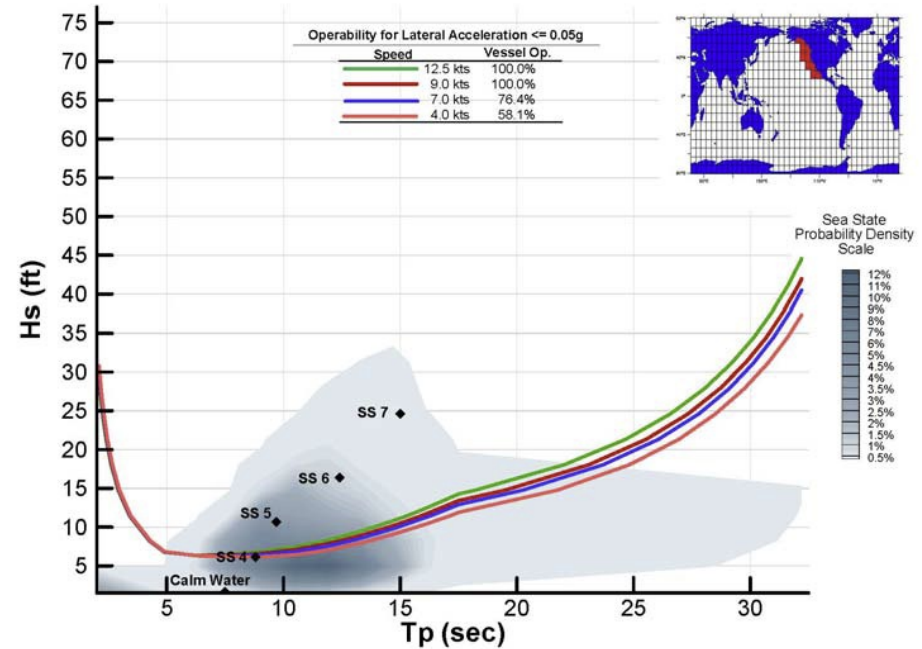
U-Tube Anti-Roll Tank



Operability

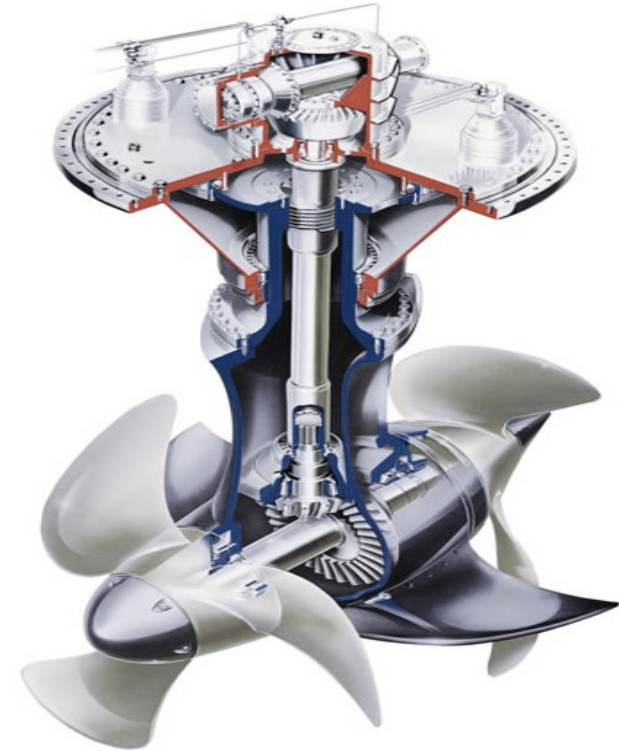
Max Roll Displacement	3°RMS
Max Pitch Displacement	2°RMS
Max Lateral Acceleration	0.05g
Max Vertical Acceleration	0.15g

Limiting Criteria - RMS Lateral Acceleration (g) in Galley
Beam Seas
North Pacific Coastal Conditions
Annual Joint Probability Distribution of Significant Wave Height and Modal Wave Period



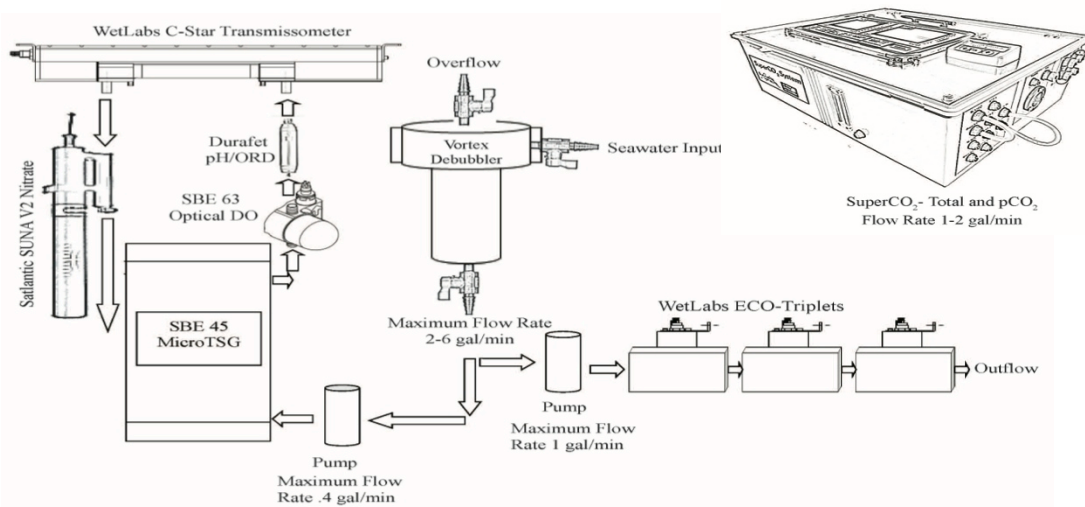
Propeller

- Using Schottel STP Twin Propeller
 - Push/Pull, ducted, single shaft
 - Lower RPM (reduces cavitation, increases efficiency)
 - Greater surface area (increases efficiency and bollard pull)
- 4 Propellers are individually “wake adapted” for maximum efficiency.
 - Think of prop as a “wing” not a “screw”



A Continuous & Robust Sampling Platform

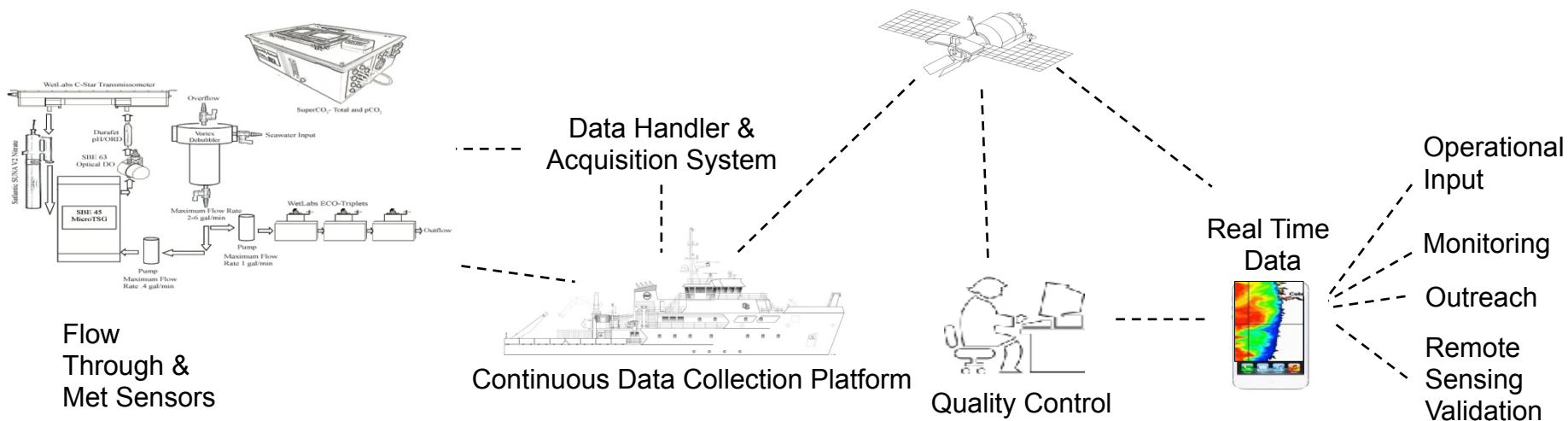
Flow Through Sensors



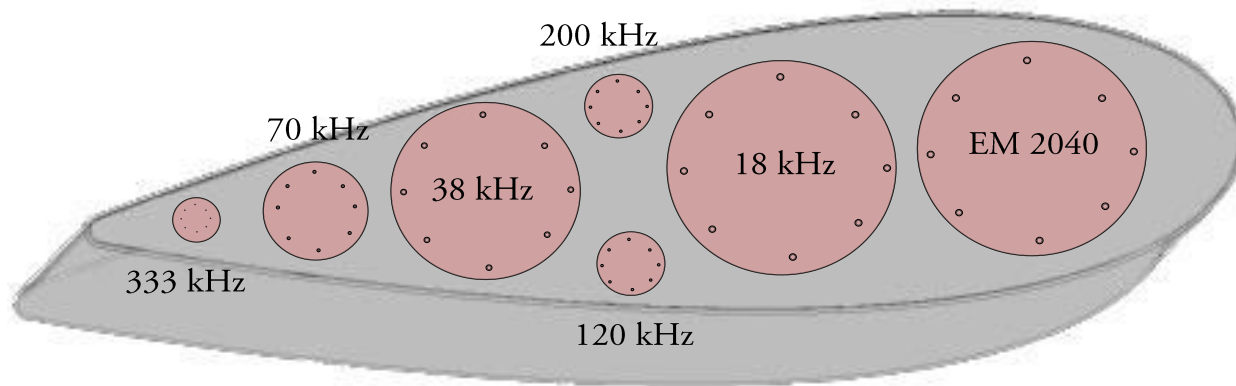
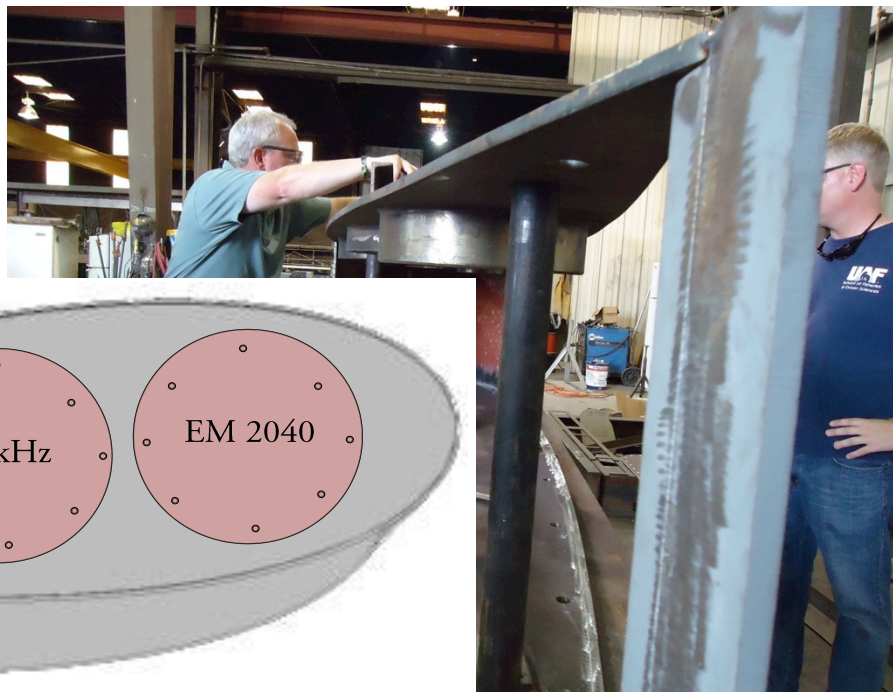
Data Stream

- ❑ Surface Salinity
- ❑ Surface Temperature
- ❑ Light Transmission
- ❑ Dissolved Oxygen
- ❑ pH/ Oxidation Reduction Potential
- ❑ Chlorophyll
- ❑ Phycoerythrin or Rhodamine
- ❑ Phycocyanin
- ❑ Colored Dissolved Organic Matter
- ❑ Turbidity- Red, Blue and Green Scattering
- ❑ Nitrate
- ❑ Total CO₂ and pCO₂
- ❑ Irradiance

Linking Scientists to Quality Real Time Data



RCRV Centerboard Concept



New R/V *Sikuliaq* Stern A-Frame Design



**UNOLS
“Standard
Bolting
Flange”**

**Removable
/ Swappable
Wings**

**Rotating
Trunnion
Style Cross
Beam**

**Built to
UNOLS
“App B”
Standards
(DLT=120kip)**

A little inspiration



Pre-OSU Interior Design Consultant

Representative
Crew State Room
(Grumpy AB not
included)



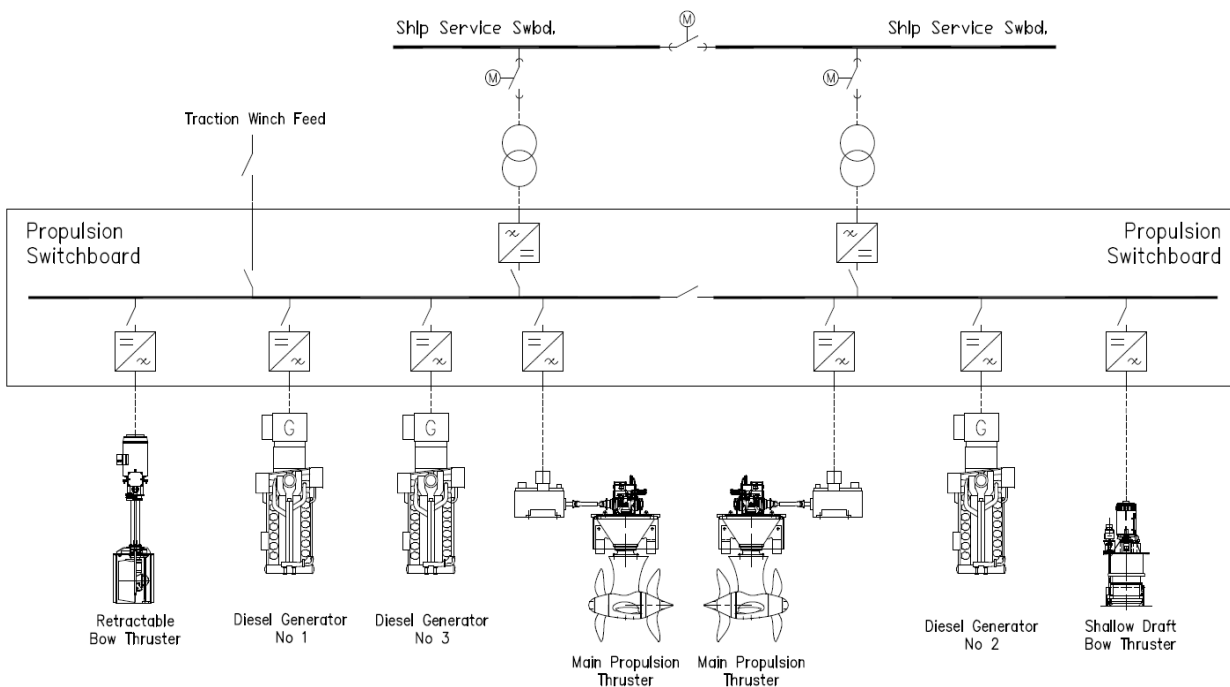


Conclusions

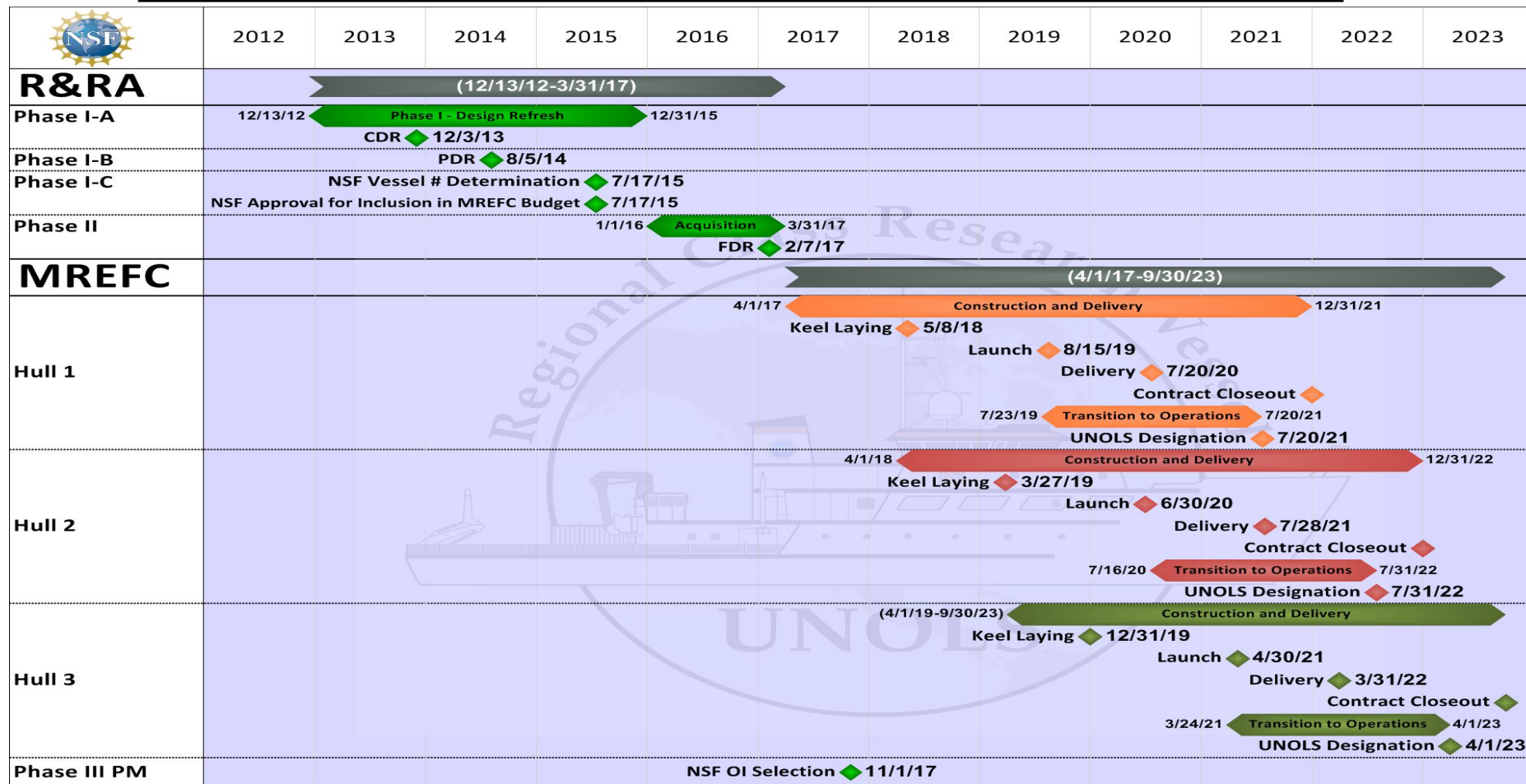
- RCRV: Regional Class Research Vessels to meet national coastal ocean priorities within the 21st Century
- Much input from the science community has led to several innovations in the next generation RCRV science support systems.
- Close monitoring of the maritime industry has led to the incorporation of several next generation technologies used to improve efficacy and performance.

BACKUP SLIDES

Propulsion System / Power Generation



Scenario	Total Load kW	# Gens On-Line	% Gen Load
Transit Summer	1242	2	79%
Transit Winter	1300	2	84%
Transit Temperate	1216	2	78%
Full Speed	1760	3	73%
Heavy DP	1446	2	93%
Towing	1195	2	77%
In Port	248	1	37%
Emergency	143	E-Gen	97%









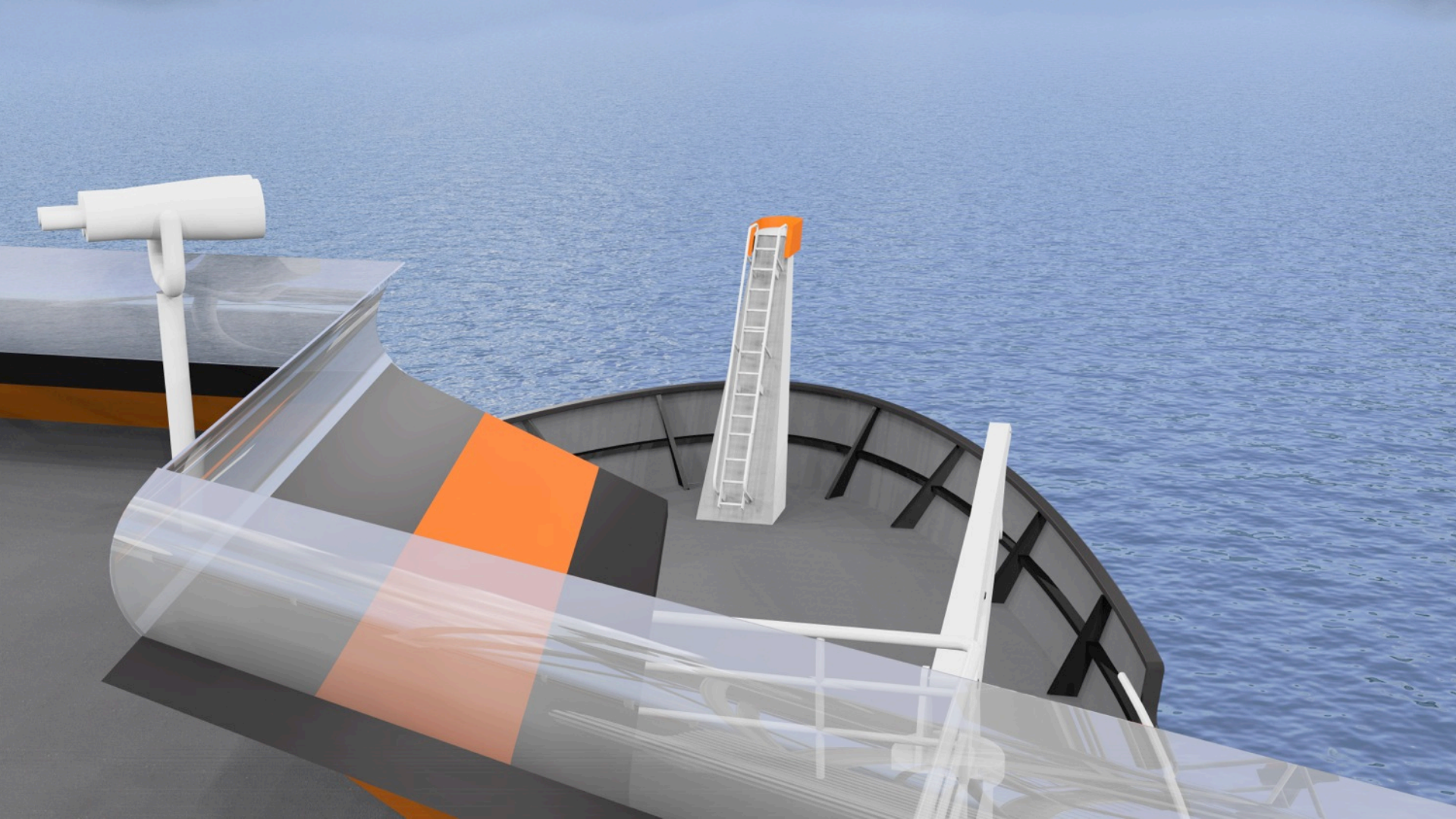












Green Ship Initiatives

Top Three Green Ship Initiatives

- Hull form optimization (reduced powering by ~10% from baseline hull)
- Variable Speed Generators (space reduction, 5-15% reduction in fuel consumption)
- Waste Heat Recovery (~350kW savings)



Other Green Ship Initiatives

- Wake adapted propellers, Twin propeller Z-drives
- Permanent magnet alternators and Z-drive motors, premium efficiency motors, VFD pumps & fans, LED Lighting
- Fire suppression (Novec 1230), non-ozone depleting refrigerants
- Biologic MSD, 5PPM oily water separator, fuel overflow system, environmentally acceptable lubricants, ballast water treatment, EPA Tier 4 engines, solid waste storage
- Hull coating – no biocide toxin release
- Biodiesel is a fuel option that can be used.