THE GLOSTEN ASSOCIATES
Consulting Engineers Serving the Marine Community

Regional Class Research Vessel (RCRV) Green Ship Design Alternatives

Presented by: **Tim Leach, PE The Glosten Associates**

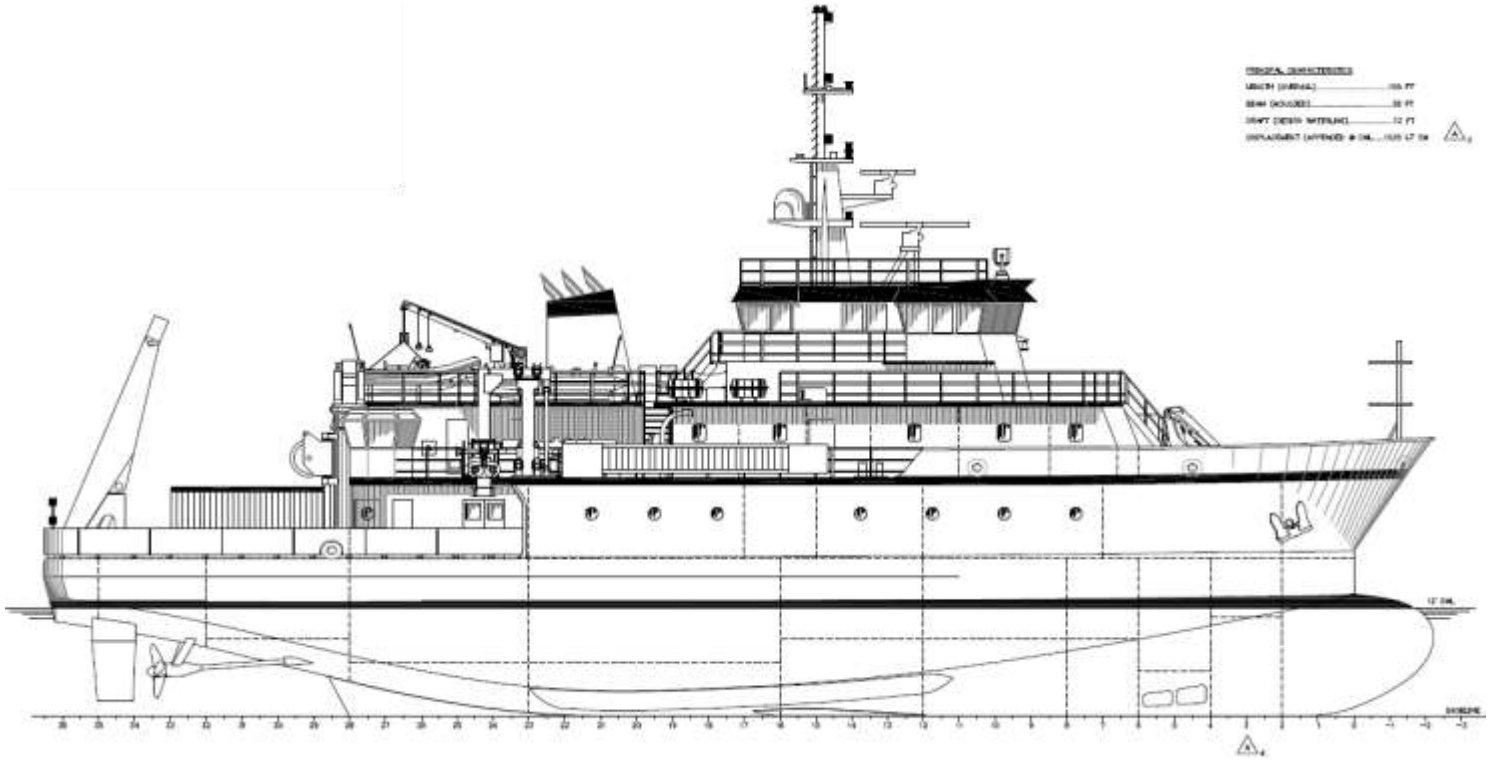
Green Boats and Ports
For Blue Waters

8-9 April 2014
University of Rhode Island

Regional Class Research Vessel History and Status

RCRV Brief History

- Design competition in 2006 for ONR
  - Set of science missions requirements
  - Design build approach
  - 155’ LOA limit
  - Project canceled at end of competition (2008)



Regional Class Research Vessel History and Status

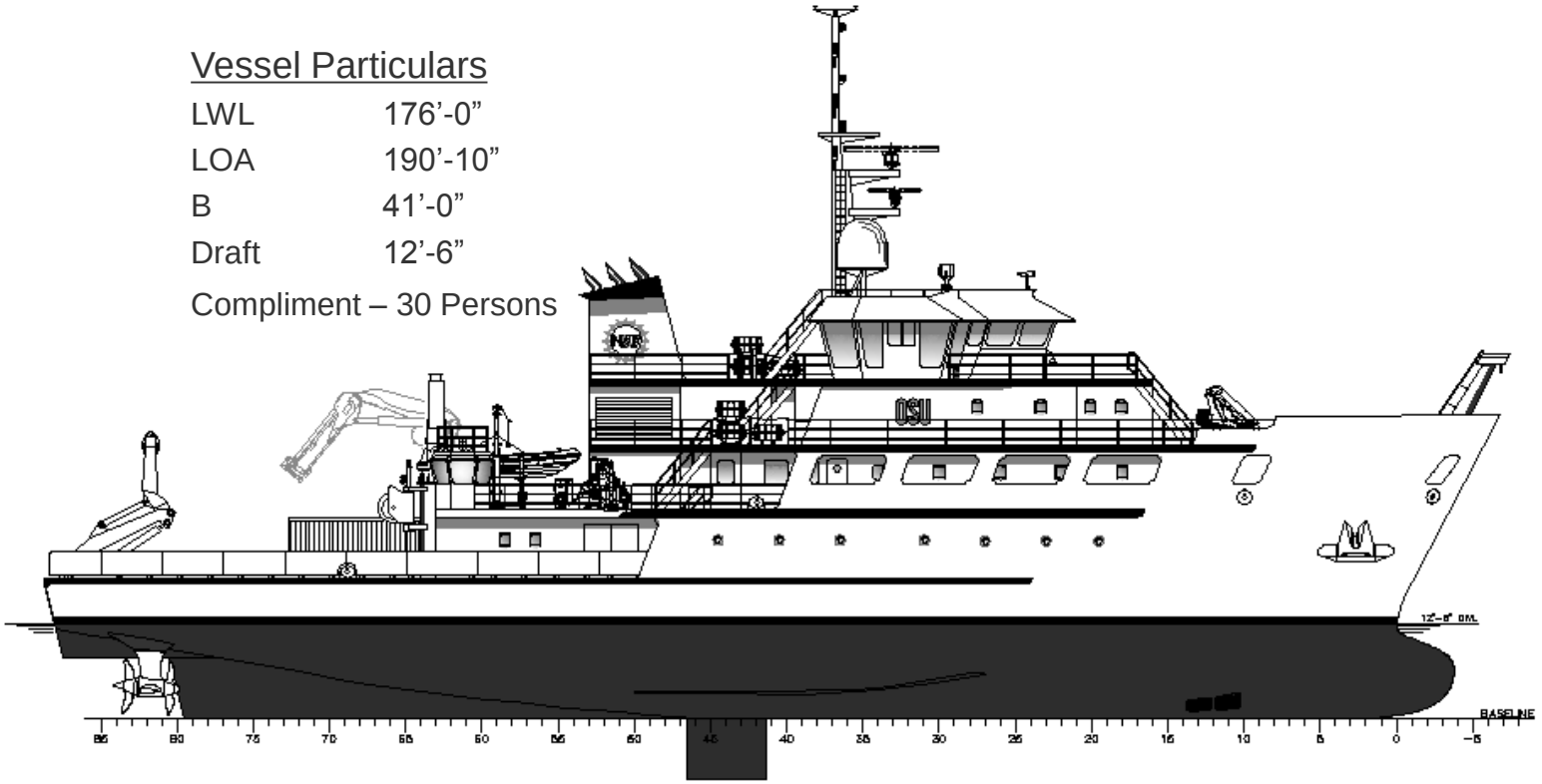
RCRV Brief History

- 2012 – NSF Selected an institution to develop design
  - Competitive bid
  - OSU selected
- Currently in Preliminary Design phase

Vessel Particulars

LWL	176’-0”
LOA	190’-10”
B	41’-0”
Draft	12’-6”

Compliment – 30 Persons



Regional Class Research Vessel
Green Design Process

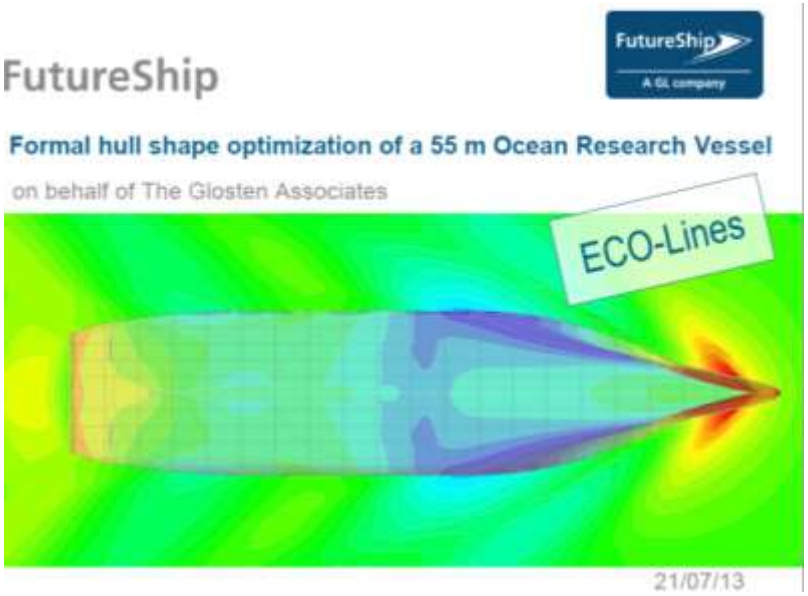
Areas Considered

- Hull
- Power Generation / Propulsion
- Auxiliary Systems
- Pollution Control
- Outfitting

Regional Class Research Vessel
Green Design Process - Hull

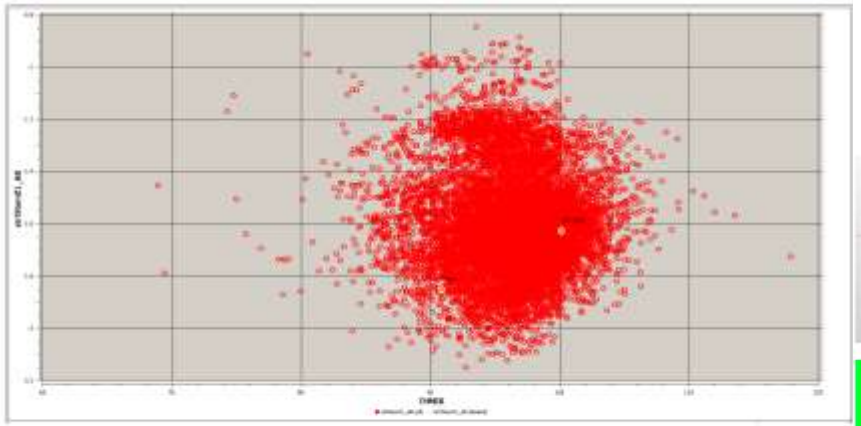
Green Ship Alternatives – Recommended for RCRV

Item	Recommendation	Benefit/Rationale
Hull		
Hull Optimization	Incorporated	Reduction in resistance
Hull Coatings	Recommend hard coating	

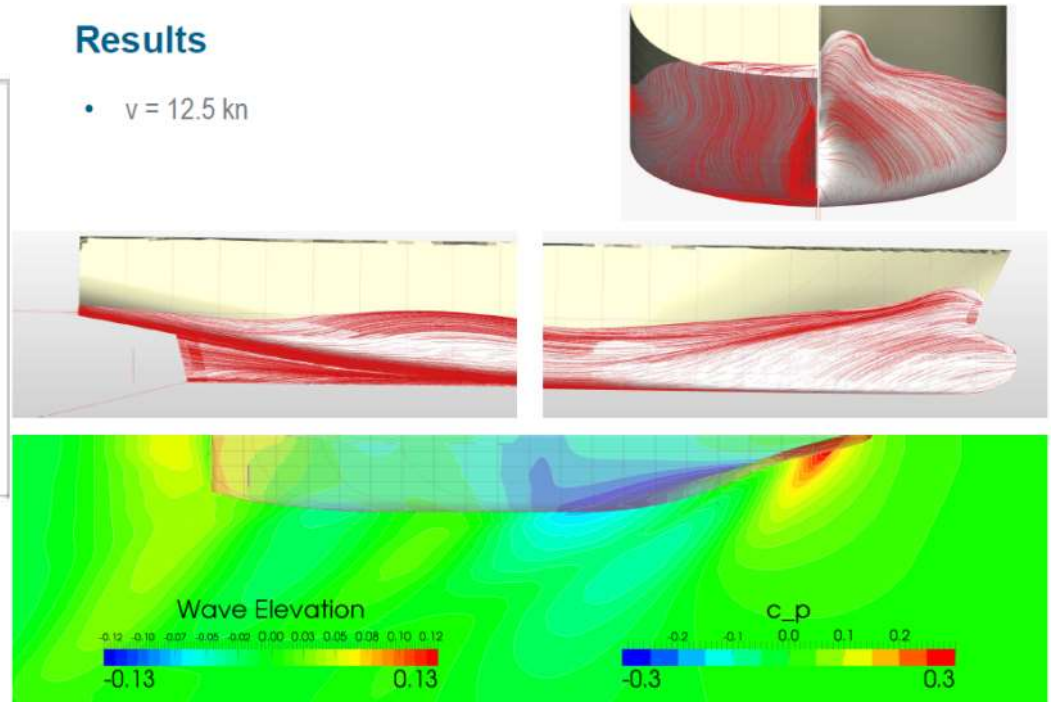


Regional Class Research Vessel
Green Design Process - Hull

Item	Recommendation	Benefit/Rationale
Hull		
Hull Optimization	Incorporated	15% reduction in resistance at cruise speed

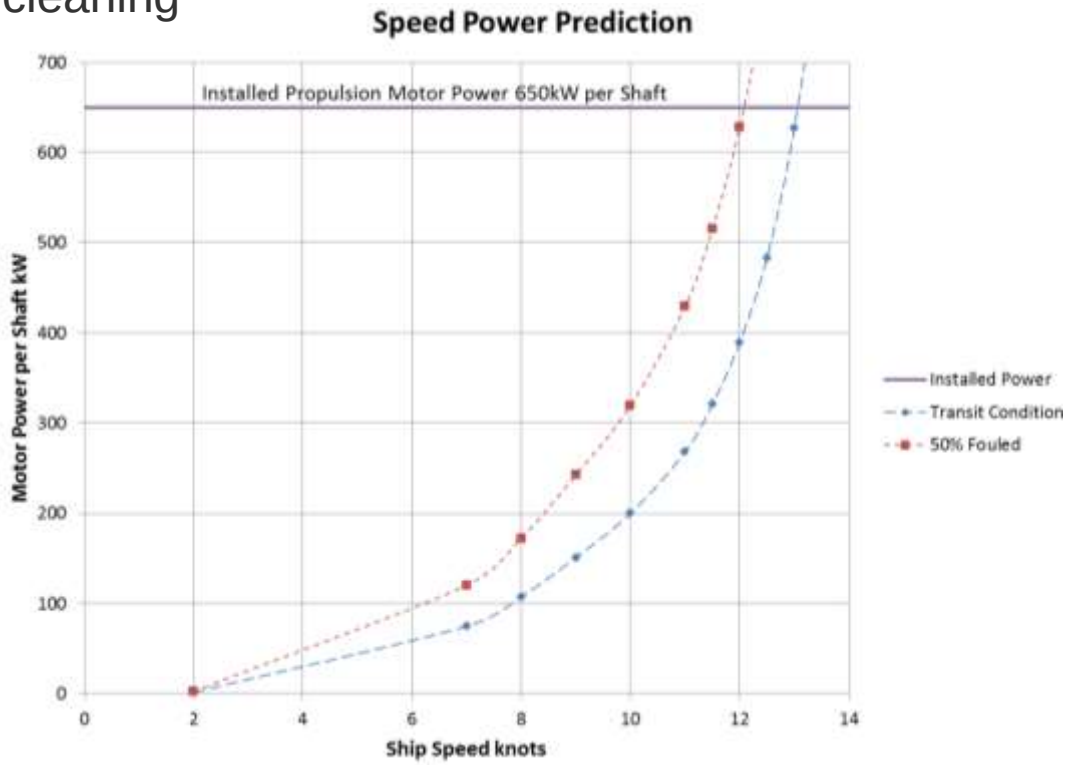


- weighted thrust (THMIX) vs. distance of most critical transducer stream line to water line at bow region (UpperStrtHeight) AB (12.5 kn)



Regional Class Research Vessel
Green Design Process - Hull

Item	Recommendation	Benefit/Rationale
Hull		
Hull Coating	Recommend hard coating with frequent in water cleaning	No biocide toxin release



Regional Class Research Vessel
Green Design Process – Power / Propulsion

Green Ship Alternatives – Recommended for RCRV

Item	Recommendation	Benefit/Rationale
Power Generation / Propulsion		
Variable Speed Generators	Incorporated	Estimated 5-15% reduction in fuel consumption
Permanent Magnet	Recommended	Increased motor efficiency
Wake Adapted Propellers	Recommended	Increased propeller efficiency, decreased underwater radiated noise

Regional Class Research Vessel
Green Design Process – Power / Propulsion

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Power Generation / Propulsion		
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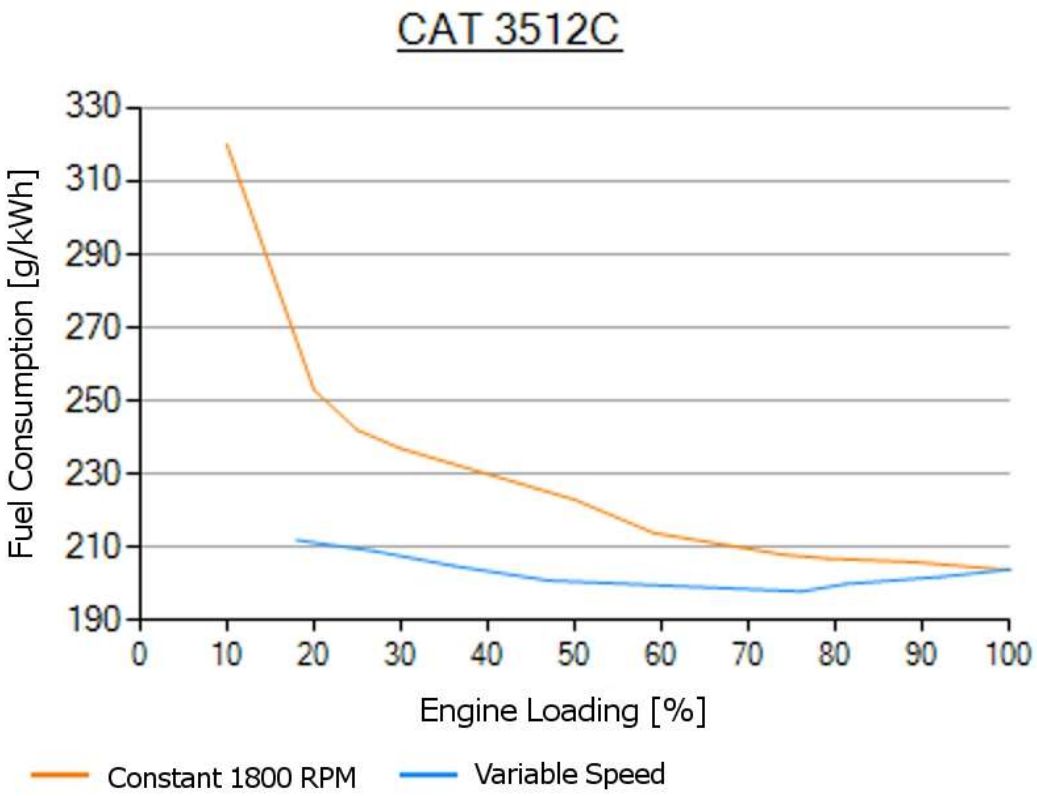
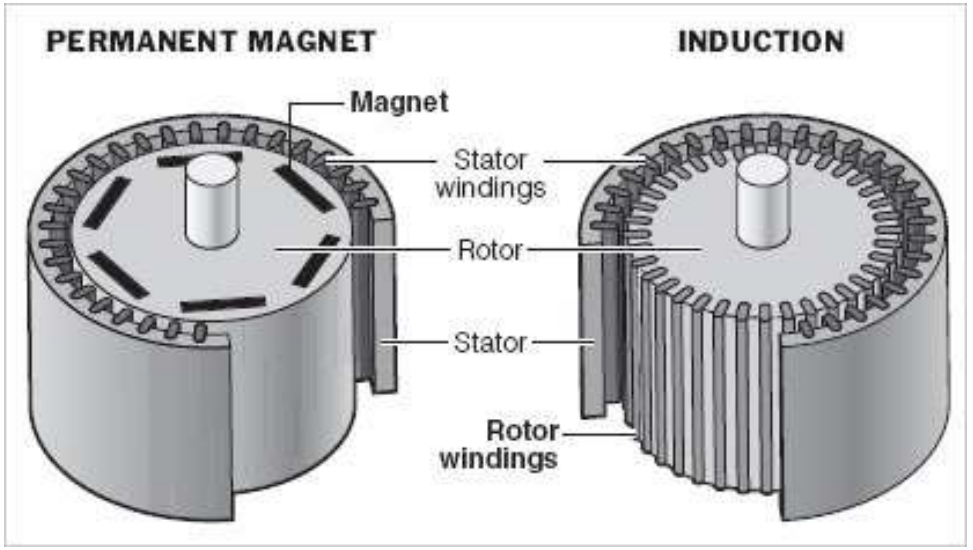


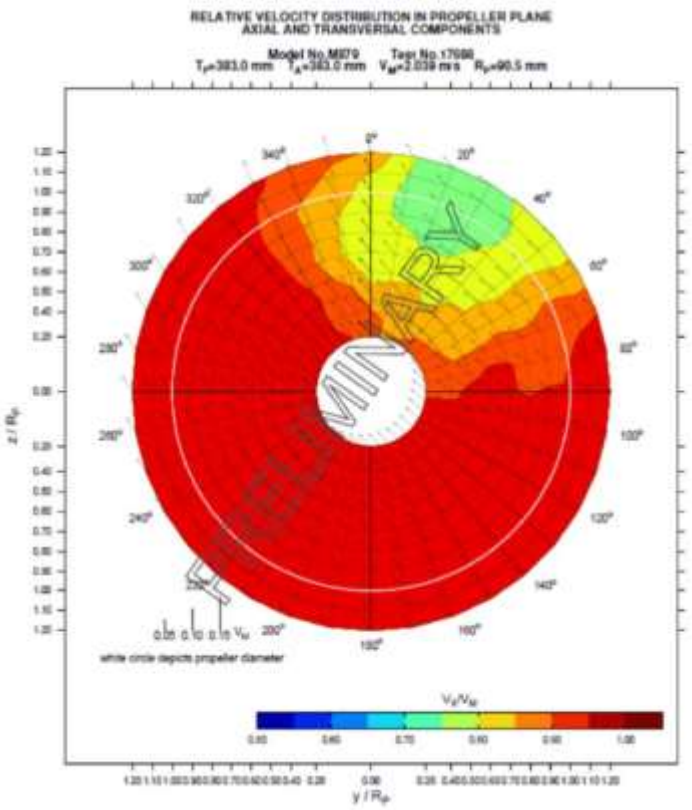
Regional Class Research Vessel
Green Design Process – Power / Propulsion

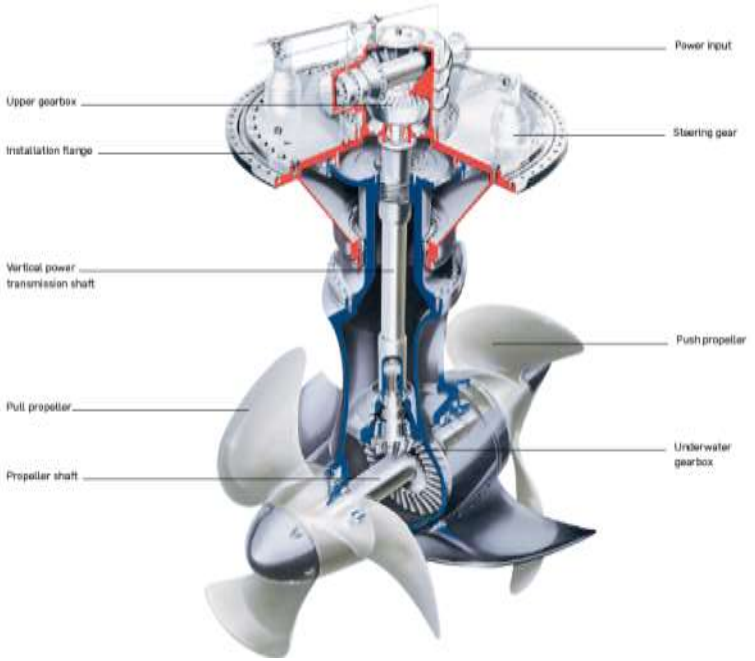
Item	Recommendation	Benefit/Rationale
Power Generation / Propulsion		
Permanent Magnet Motors and Alternators	Recommended	Increased motor efficiency



Regional Class Research Vessel
Green Design Process – Power / Propulsion

Item	Recommendation	Benefit/Rationale
Power Generation / Propulsion		
Wake Adapted Propellers	Recommended	Increased propeller efficiency, decreased underwater radiated noise





Schottel Twin Propeller

Regional Class Research Vessel
Green Design Process – Power / Propulsion

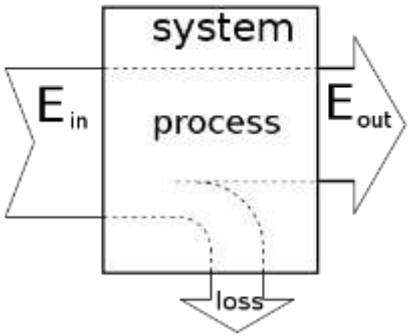
Green Ship Alternatives – Not Recommended for RCRV

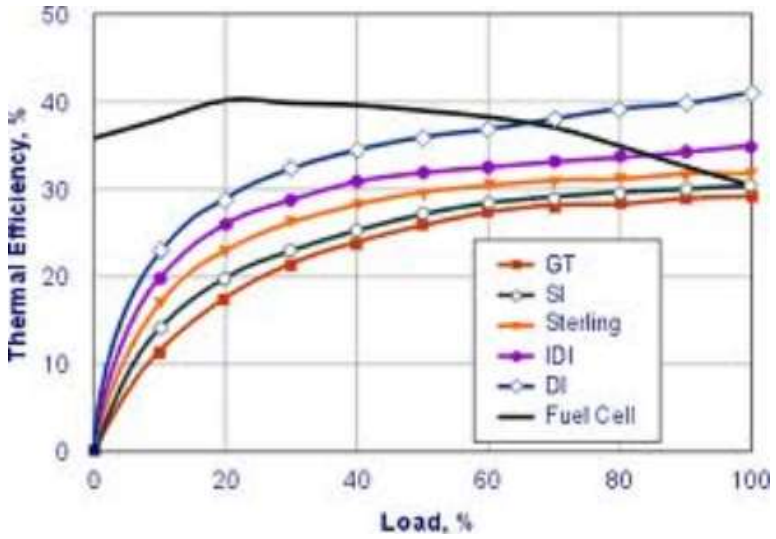
Item	Recommendation	Benefit/Rationale
Power Generation / Propulsion		
Battery Hybrid	Not Recommended	Minimal benefit with variable speed generators. Adds cost & weight.
Alternative fuels, LNG	Not recommended	Integration of LNG system incompatible with vessel design
Alternative fuels, Biodiesel	Not recommended	Biodiesel up to B20 may be possible, minimal design impact more significant fuel planning impact.

Regional Class Research Vessel
Green Design Process – Auxiliary Systems

Green Ship Alternatives – Recommended for RCRV

Item	Recommendation	Benefit/Rationale
Auxiliary Systems		
Waste heat recovery	Incorporated	Provides heat for HVAC, water makers, and domestic hot water. ~350 kW electrical savings
Climate Control – Waste heat heating	Incorporated	Can replace electric heat for large heaters, 70+ kW electrical savings





Regional Class Research Vessel
Green Design Process – Auxiliary Systems

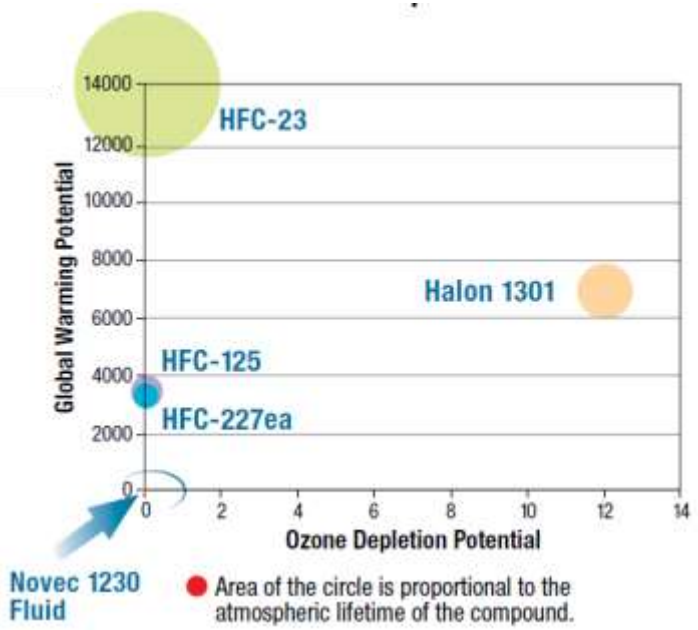
Green Ship Alternatives – Recommended for RCRV

Item	Recommendation	Benefit/Rationale
Auxiliary Systems		
VFD pumps and fans	Consider further during PDR	Electrical savings, possible noise attenuation concern
Premium efficiency motors	Recommend (where appropriate)	3-10% electrical Savings for each motor
LED Lighting	Consider further during PDR	Lower energy use, higher upfront cost

Regional Class Research Vessel
Green Design Process

Green Ship Alternatives – Recommended for RCRV

Item	Recommendation	Benefit/Rationale
Auxiliary Systems		
Novec 1230 fire suppression	Incorporated	Minimum application of greenhouse gas
Non-ozone depleting refrigerants	Incorporated	Minimize environmental damage



Regional Class Research Vessel
Green Design Process – Auxiliary Systems

Green Ship Alternatives – Not Recommended for RCRV

Item	Recommendation	Benefit/Rationale
Auxiliary Systems		
Climate Control – Heat pump	Not recommended	Less efficient than waste heat heating, equivalent to chiller A/C
Solar system	Not recommended	Minimal benefit with available installation area

Regional Class Research Vessel
Green Design Process – Pollution Control

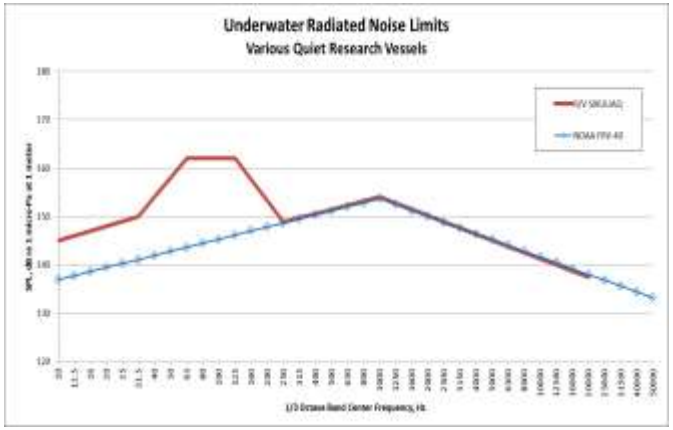
Green Ship Alternatives – Recommended for RCRV

Item	Recommendation	Benefit/Rationale
Pollution Control		
Biologic MSD	Incorporated	Clean effluent
5 PPM OWS	Incorporated	Minimize oil discharge
Fuel overflow system	Incorporated	Minimize risk of accidental fuel oil discharge
Environmentally acceptable lubricants	Recommended	Minimize impact of accidental oil discharge

Regional Class Research Vessel
Green Design Process – Pollution Control

Green Ship Alternatives – Recommended for RCRV

Item	Recommendation	Benefit/Rationale
Pollution Control		
Minimize underwater radiated noise	Incorporated	Minimize noise pollution
Ballast water treatment system	Incorporated	Required, reduces spread of invasive species
EPA Tier 4 engines	Incorporated	Reduce engine air emissions
Solid waste storage	Incorporated	No incinerator air emissions



Regional Class Research Vessel Green Design Process

Great ship!

Good efforts to reduce impact in design!

- **How does this get calculated?**
- **How do we compare to other ships?**
- **How does this get recognized?**