

Greening the UNOLS Fleet

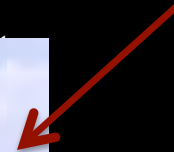
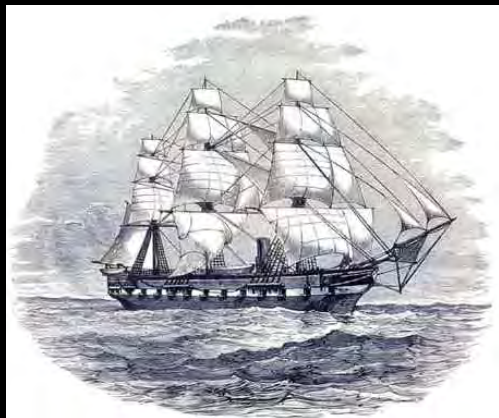
INMARTECH 2018

October 18, 2018

Bruce Corliss

Graduate School of Oceanography

University of Rhode Island



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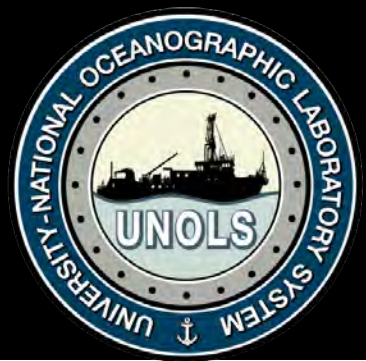


<http://www.geology.19thcenturyscience.org/books/hmsc.jpg>



2010 UNOLS GOAL

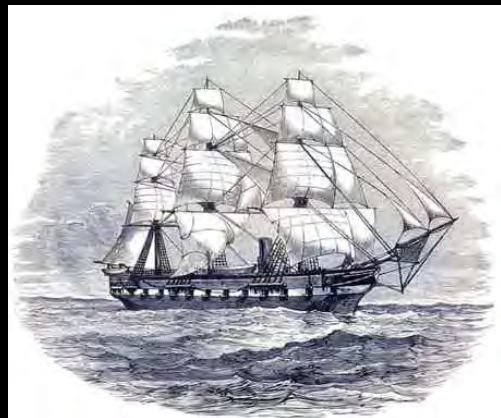
"Greening the Fleet – UNOLS should explore how to make the present and future fleet more environmentally sustainable. New and existing technologies and practices should be used in the construction, operation, and recycling of research vessels and UNOLS should take a leadership role in promoting a green U.S. research fleet, as we move forward in developing the academic fleet."



Greening the Research Fleet

January 10-11, 2012

Nicholas School of the Environment
Duke University



?????



<http://www.geology.19thcenturyscience.org/books/hmsc.jpg>

THE
UNIVERSITY
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OF OCEANOGRAPHY

THINK BIG  WE DO



GREEN BOATS AND PORTS FOR BLUE WATERS

A Workshop to Promote Environmental
Sustainability of Boats and Ports
April 8-9, 2014

Green Boats and Ports for Blue Waters III

April 5 - 6, 2016

URI Graduate School of Oceanography



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*Green Boats and Ports
for Blue Waters IV*

*Portland, Oregon
August 29 – 30, 2018*

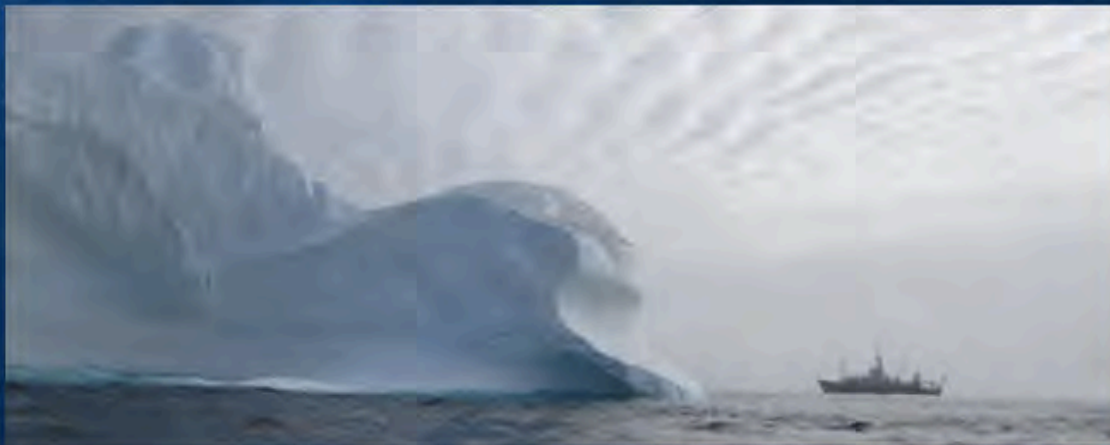


Supported by Peterson Cat, Port of Portland, NOAA, USGS, USCG, BOEM,
NSF, ONR

GREENING THE FLEET INITIATIVE

2012-

[HOME](#) / [SHIPS/FACILITIES](#) / [GREENING THE FLEET INITIATIVE](#)



FEATURED INFORMATION

UNOLS continues to promote efforts that make the present and future fleet environmentally sustainable

Ships/Facilities

UNOLS Vessels

Small Research Vessel

In 2012, a UNOLS-sponsored workshop was held to develop sustainability guidelines for oceanographic research vessels. The meeting included presentations from marine architects, designers, builders, related private businesses and representatives of the federal government and foreign research vessel operators. UNOLS continues to promote the recommendations of the Greening the Research Fleet Workshop to help make the present and future fleet more environmentally sustainable.

Objective: An Assessment of Current Technologies, Designs and Practices for Environmentally Sustainable Research Vessels and Port facilities

Composition: Representatives from UNOLS Council, RVOC, RVTYEC, FIC, NSF, Navy, NOAA, Marine Architects and Naval Designers, marine scientists and the private sector

Format: 1.5 days workshop with invited presentations on various aspects of green ships and ports: design, technology, best practices.

Funding: UNOLS, NSF, ONR, BOEM, USGS, USCG

Host institutions: Duke Univ., URI; OSU

Other: 11th Hour Racing, Braemer Energy, Utilidata, Peterson Cat, Port of Portland



Green Boats and Ports for Blue Oceans

OBJECTIVES

- 1) Promoting environmental sustainability within UNOLS;
- 2) Development of guidelines for construction, operation and recycling of vessels and future port development;
- 3) Promote environmental awareness on UNOLS ships by scientists;
- 4) Ocean Class and Regional Class Vessel Construction

Ocean sustainability: Solutions to environmental problems



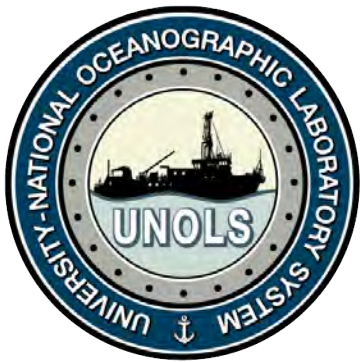
Creating a Green Fleet

Life Cycle of a Vessel:

- 1) Construction
- 2) Operation
- 3) Recycling



Hornblower Yachts- San Francisco: Ferry Design



Construction and Operation

- 1) Hull and design
- 2) Propulsion, fuel and lubricants
- 3) Power systems
- 4) Fluids; water and sewage
- 5) Interior: cabins, labs, galley and mess areas (Leadership in Energy and Environmental Design-LEED)

Important Topics

- Energy Monitoring and Conservation
- Noise Pollution
- Compliance
- Recycling
- Emerging Technologies
- Port Sustainability
- Certification



Green Workshop Findings

1. Sail-assist vessels with a small environmental footprint can be used for particular operations.
2. Hybrid power systems and new technologies should be considered as options for future vessels.
3. Vessel energy management consisting of detailed energy audits and on-going monitoring can be carried out with existing vessels.
4. Biofuels and bio-lubricants and an environmental management plan can reduce a vessel's environmental impact and may be appropriate for some vessels.

WIND

Solar Sailor:

*Solar wings used as solar collectors and as sails



<http://www.solarsailor.com/>



The Derek M. Baylis is one of the first modern hybrid concept research vessels, and along with the rotor ship Alcyone (Cousteau) serves as one end-member of a range of prototypes for our vessel design. The vessel LOA is 65'

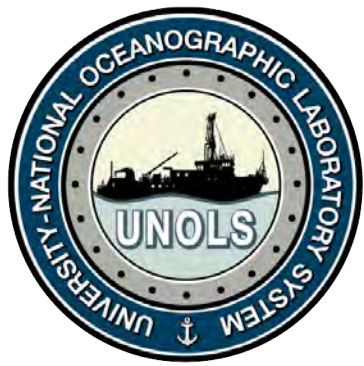
Speed under power: 10 knots

Speed under sail: 18+ knots

Fuel consumption (power) at 9 knots = 1.6 gph.

We used this vessel in 2010 for a 21 day cruise, mapping the northern San Andreas Fault.

Total fuel consumption 489 gallons in 21 days!



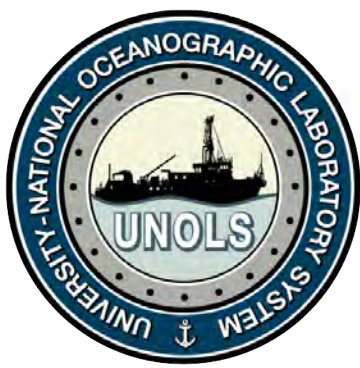
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Foss Marine, Seattle

Carolyn Dorothy: First hybrid tugboat





Green Workshop Findings

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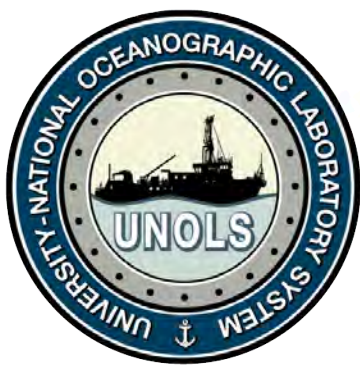
Presentation Topics

- Energy Efficiency and Cost
 - Engine
 - Motors
 - HVAC
- Baseline: Cost and Consumption
- Methods to Reduce Energy Cost

Power Systems



The *M/V Auriga Leader* has 328 solar panels to provide power for the ship's main electrical grid. (<http://www.inhabitat.com/2009/07/06/auriga-leader-cargo-ship-gets-power-from-solar-panels/>)



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BIOFUELS: Ethanol and Biodiesel

Objective: convert Great Lakes vessels with petroleum-based fuels to renewable and environmentally friendly products

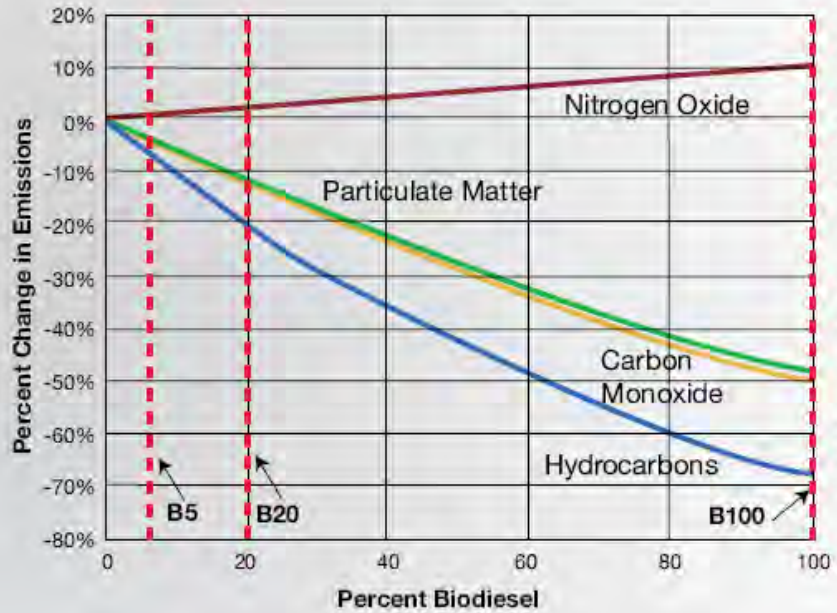


NOAA GREEN SHIP INITIATIVE Development of Biodiesel and Bio-Products in Marine Applications

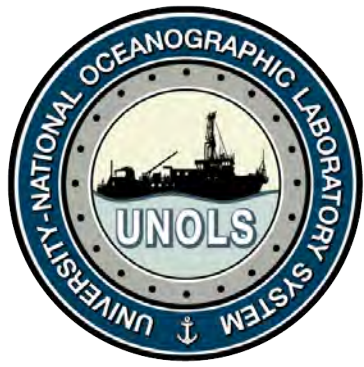
Environmental Research That's Environmentally Friendly

There were many motivating factors for undertaking the Green Ships project. These include:

- ◆ Reducing ecosystem impact of ship-based research activities.
- ◆ Reducing workplace health and safety hazards.
- ◆ Advancing renewable technologies.
- ◆ Lessening dependence on fossil fuels.



Source: US EPA Report 2002, Document #EPA420-P-02-001



Green Boats and Ports Findings

5. Development of environmental classification system similar to LEEDS will be helpful (Environmental Ship Index, Green Marine)

LEED Project Checklist

Sustainable Sites

14 Possible Points

Prereq 1	Construction Activity Pollution Prevention <i>Reducing Pollution during Yacht Construction</i>	Required
Credit 1	Site Selection	1
Credit 2	Development Density & Community Connectivity	1
Credit 3	Brownfield Redevelopment	1
Credit 4.1	Alternative Transportation, Public Transportation Access	1
Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
Credit 4.3	Alternative Transportation, Low Emitting & Fuel Efficient Vehicles	1
Credit 4.4	Alternative Transportation, Parking Capacity	1
Credit 5.1	Site Development, Protect or Restore Habitat	1
Credit 5.2	Site Development, Maximize Open Space	1
Credit 6.1	Stormwater Design, Quantity Control	1
Credit 6.2	Stormwater Design, Quality Control	1
Credit 7.1	Heat Island Effect, Non-Roof	1
Credit 7.2	Heat Island Effect, Roof	1
Credit 8	Light Pollution Reduction	1

Water Efficiency

5 Possible Points

Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1
Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1
Credit 2	Innovative Wastewater Technologies <i>Reducing potable water consumption and grey water generation</i>	1
Credit 3.1	Water Use Reduction, 20% Reduction	1
Credit 3.2	Water Use Reduction, 30% Reduction	1

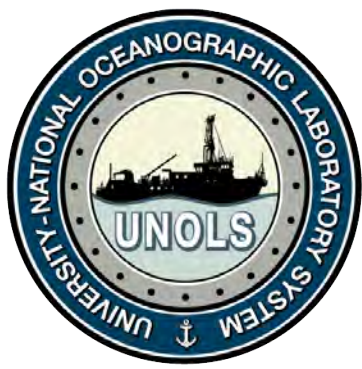
Energy & Atmosphere

17 Possible Points

Prereq 1	Fundamental Commissioning of the Building Energy Systems <i>Ensuring that the energy-related systems are performing as designed.</i>	Required
Prereq 2	Minimum Energy Performance <i>Establishing a minimum level of energy efficiency.</i>	Required
Prereq 3	Fundamental Refrigerant Management <i>Eliminating ozone depletion by using non-CFC refrigerants.</i>	Required
Credit 1	Optimize Energy Performance <i>Achieving energy cost savings by improving efficiencies.</i>	1-10

LEED Criteria Applied to Boat Building

(From: Peters, M., 2009, The Large Green Yacht, Part 2, *Professional Boatbuilder*, #117, February/March, 26-43.)

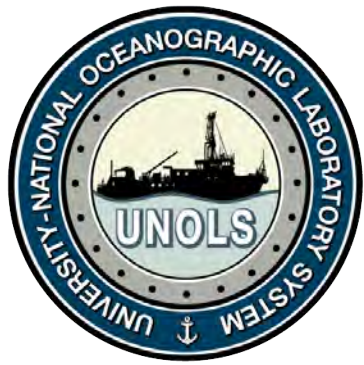


RECYCLING

Green Passport

- IMO's Guidelines on Ship Recycling (2003): Green Passport- inventory of material in ship's structure, systems, and equipment that may be hazardous to health and the environment
- Maintained through the life of the ship
- Green Passport can be used to formulate a safe and environmentally sound plan for decommissioning a ship
- Raises awareness of hazardous material

(RINA Green Star: ballast water; chemicals)



Green Boats and Ports Findings

5. Development of environmental classification system similar to LEEDS will be helpful (Environmental Ship Index, Green Marine)
6. Environmental sustainability of UNOLS support facilities should be considered in parallel with ship sustainability.

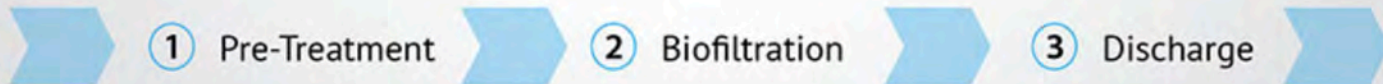
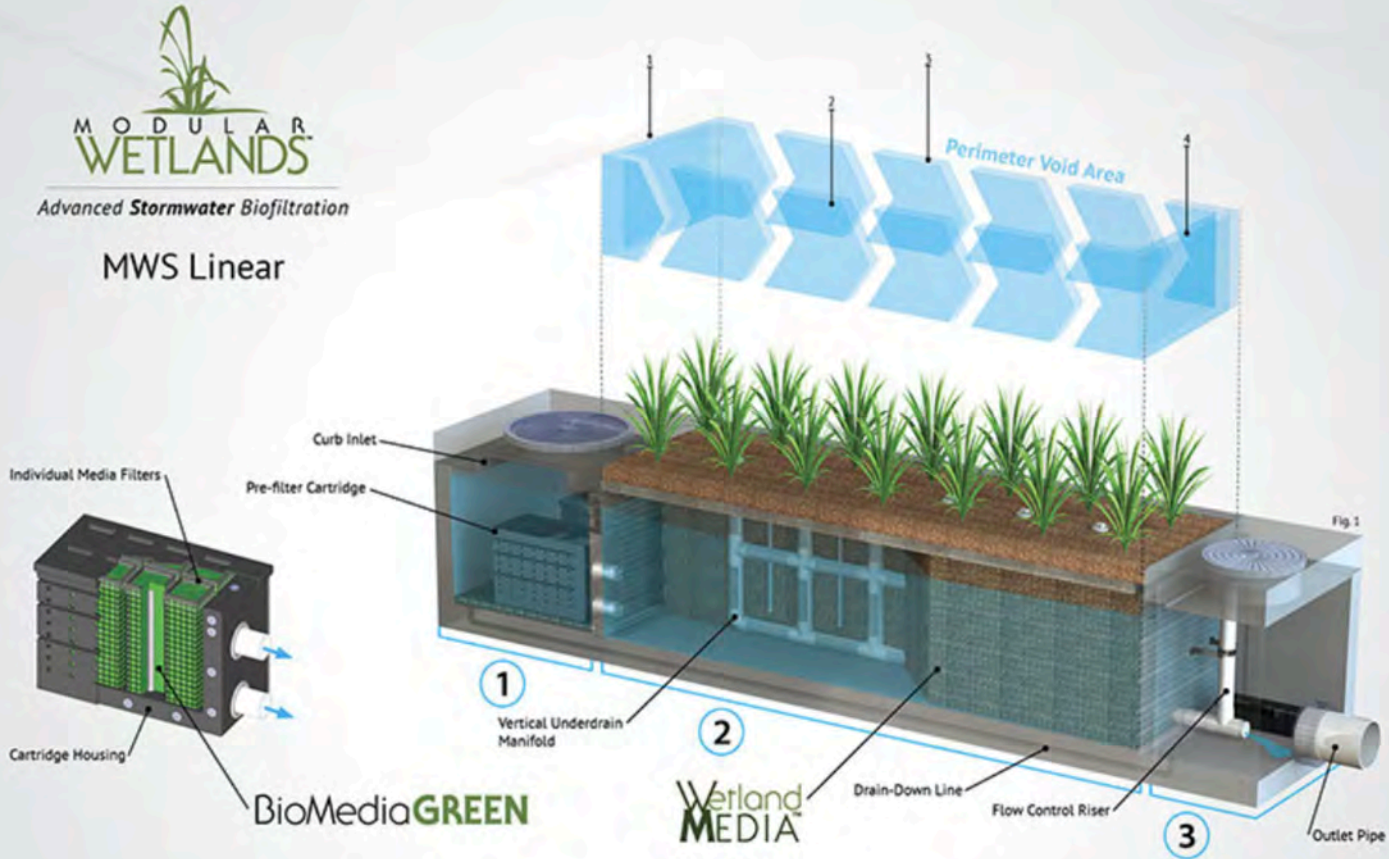
Around the Pier: Scripps Now Powering Point Loma Ship Facility with the Sun

on OCTOBER 7, 2012 · 2 COMMENTS



Nimitz Marine Facility installs photovoltaic system

Bioclean Modular Wetland



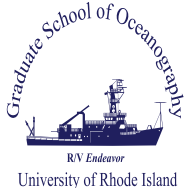


**The University of Rhode Island
Narragansett Bay Campus**

The Ocean University Initiative

Campus Master Plan

OCEAN ENGINEERING



Master Plan Components for a Green Campus

10 year; \$285M

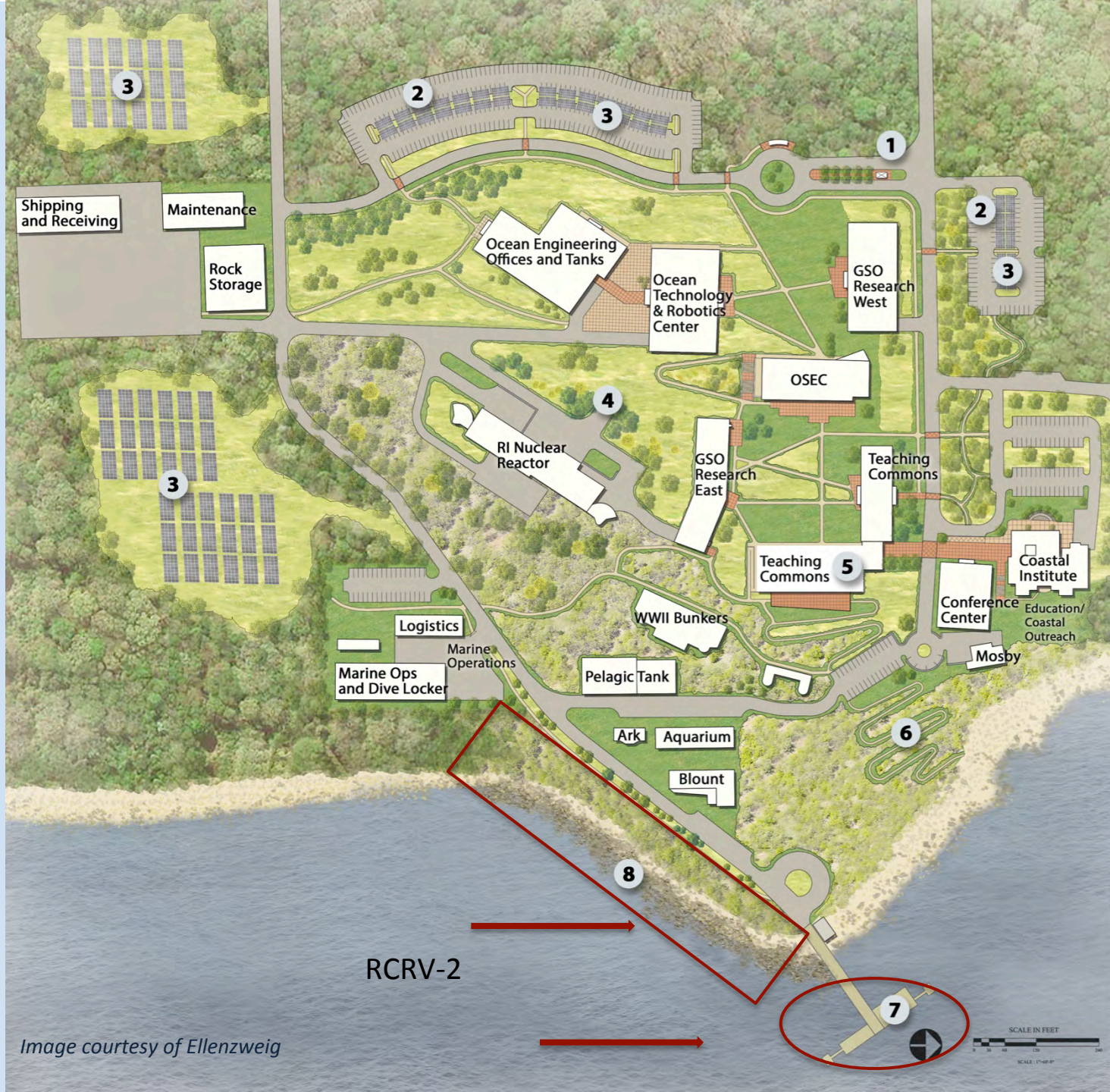
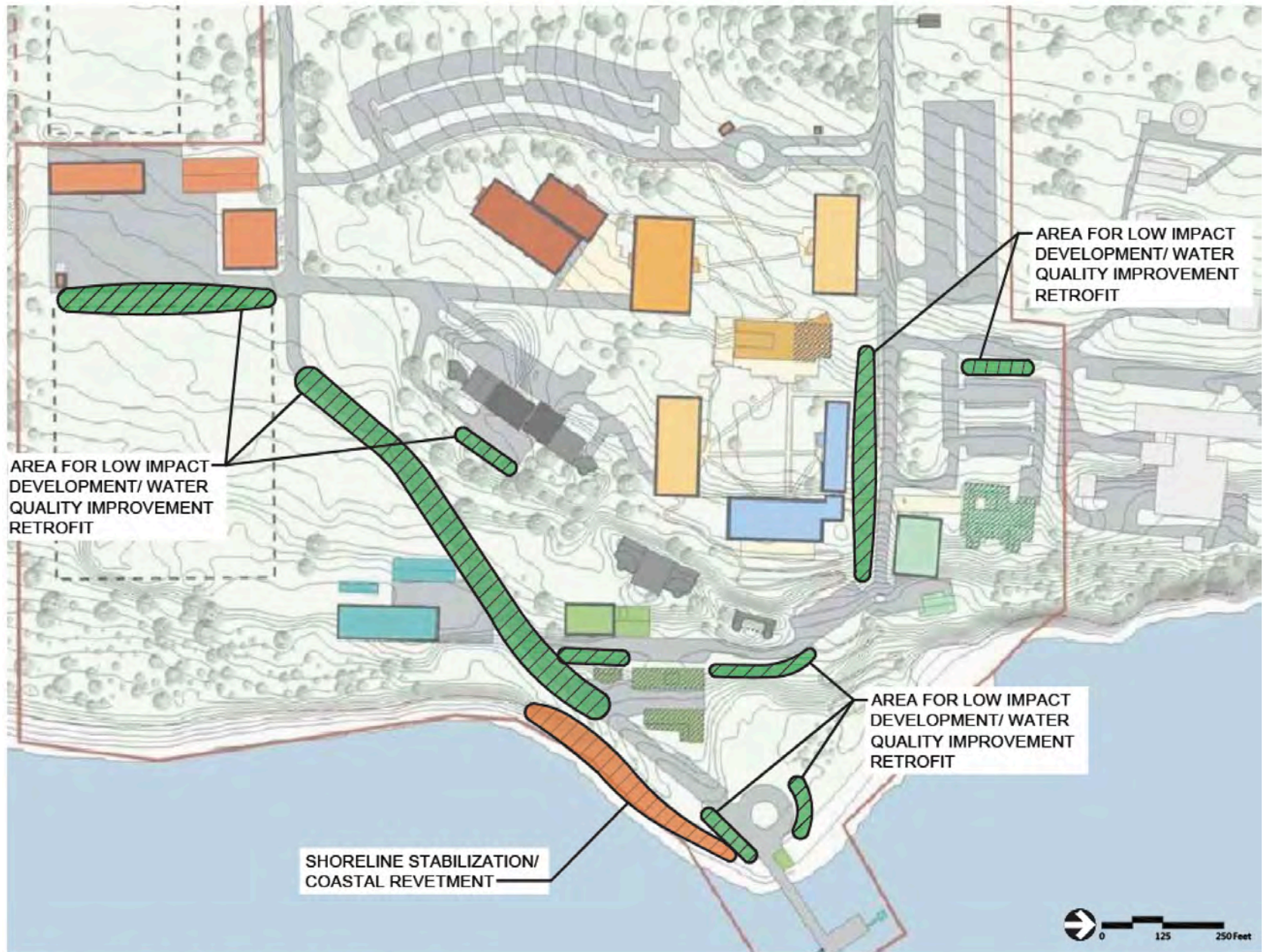


Image courtesy of Ellenzweig

Master Plan Recommendations



Stormwater Quality Improvements

Coastal Buffer

A coastal buffer area should be established as the first line of defense to any coastal flooding that may occur, to increase campus resiliency, and to create a sustainable and low maintenance plant community. This will be a densely planted native plant community able to withstand periodic flooding and providing important habitat value. Pathways crossing through this area will provide access to the beach area as well as provide a unique and memorable experience of the landscape.

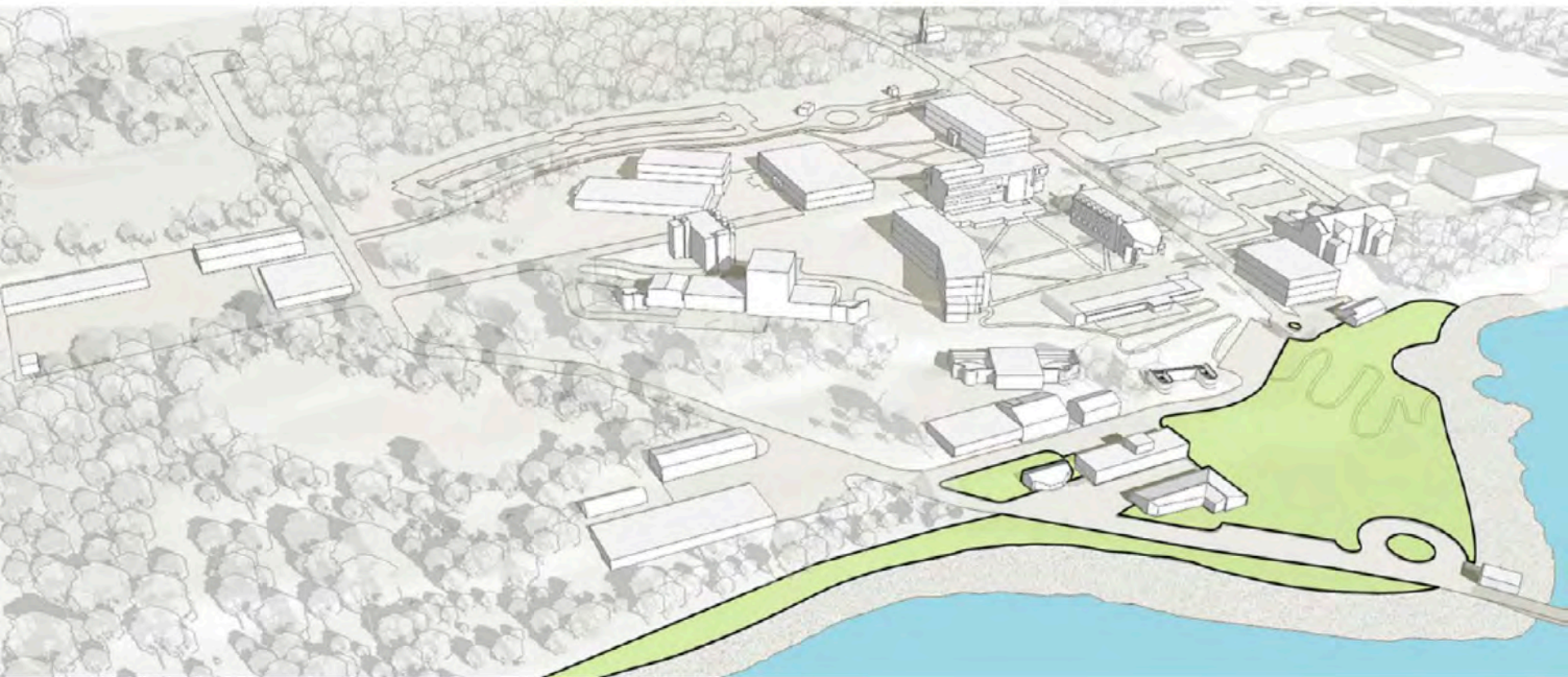
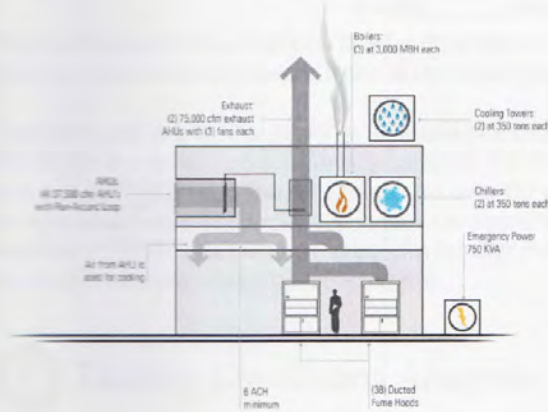


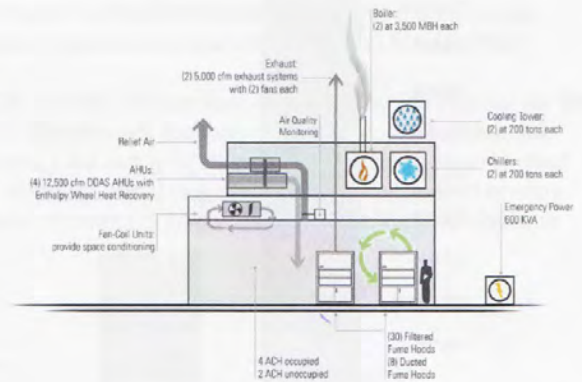
Diagram showing the location of proposed coastal buffer in the context of the proposed Master Plan

Net Energy Feasibility Study

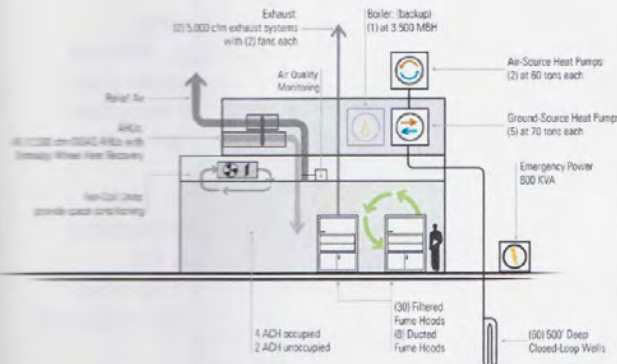
OPTION 1



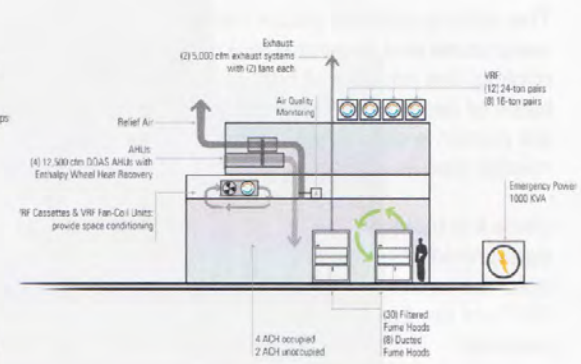
OPTION 2



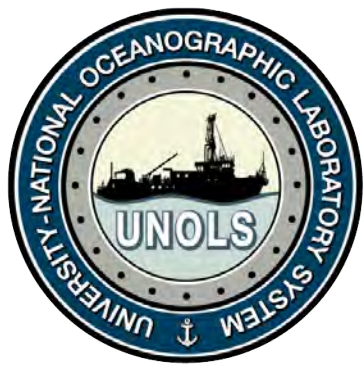
OPTION 3



OPTION 4



Net Energy Feasibility Study: Wet labs



Green Boats and Ports Findings

5. Development of environmental classification system similar to LEEDS will be helpful (Environmental Ship Index, Green Marine)
6. Environmental sustainability of UNOLS support facilities should be considered in parallel with ship sustainability.
7. Environmental sustainability can be enhanced by incorporating both technological innovation and attitude changes (green culture) amongst ship operators and users.

Solar Reflective Paints:

Reduces the HVAC loads by 30% in average use

- Available in every color except Flag Blue
- No power to run it
- Cost similar to conventional paint
- Application can be done in any existing paint facility
- Can easily be retrofitted into existing vessel
- Cooler to the touch on decks etc
- Same warranty as conventional paint
-And it is "Greener"



G R E G O R Y C . M A R S H A L L

N A V A L A R C H I T E C T , L T D .



ELECTROCHROMIC GLASS IN THIS APPLICATION WILL REDUCE HVAC LOADING BY 40%.
IT ALSO ELIMINATES THE NEEDS FOR BLINDS AND IS MAINTENANCE FREE



G R E G O R Y C . M A R S H A L L

N A V A L A R C H I T E C T , L T D .



MAIN SALON WINDOWS ARE ELECTROCHROMIC TO REDUCE HEAT LOADING.
AIR CONDITIONING THROUGH PHASE CHANGING MATERIALS
ALL LIGHTING IS SOLAR POWERED



G R E G O R Y C . M A R S H A L L

N A V A L A R C H I T E C T , L T D .



**Oregon State
University**

College of Earth, Ocean, and Atmospheric Sciences

Partner Links



Greening the RCRV Class

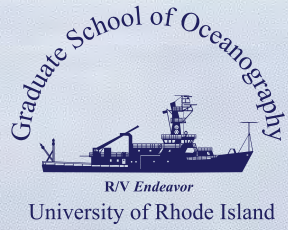


Glosten

UNOLS

UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

R/V Taani



*Design and rendering by
Glosten Associates, Inc.*

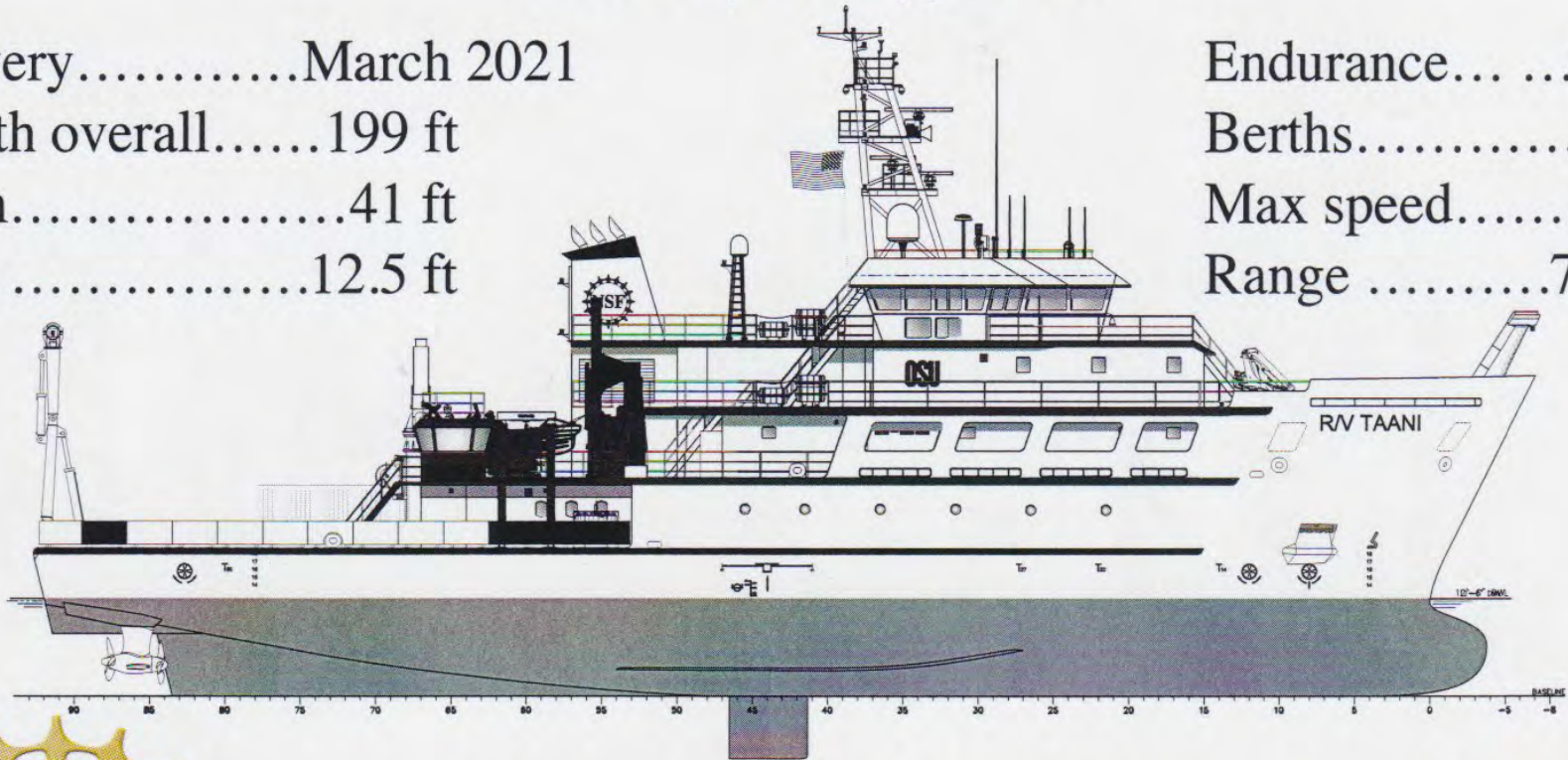
Introducing the 1st Regional Class Research Vessel

R/V TAANÍ

Siletz for "Offshore"

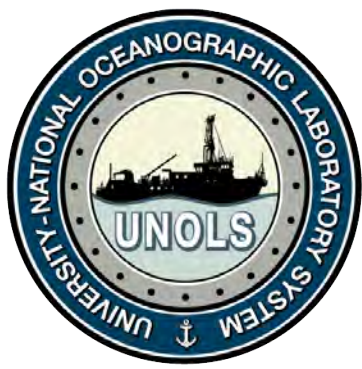
Delivery.....March 2021
Length overall.....199 ft
Beam.....41 ft
Draft12.5 ft

Endurance... ..21 days
Berths..... 29
Max speed.....13 kt
Range7064 nm



Operated by OSU for the
National Science Foundation &
the University National Oceanographic
Laboratory System (UNOLS)

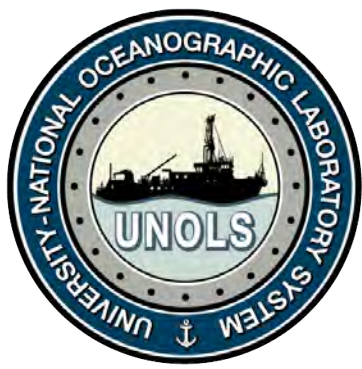




Regional Class Research Vessel Green Ship Initiatives

• (<http://ceoas.oregonstate.edu/ships/rcrv/>)

- Hull form optimization 15% reduction in resistance
- Hull coating-hard coating No biocide toxin release
- Variable speed generators 5-15% reduction in fuel
- Efficient motors 3-10% electrical savings
- LED lighting Lower energy use
- Waste Heat Recovery HVAC, water makers, hot water
- Biological MSD Clean effluent
- Environmentally acceptable lubricants Minimize oil discharge
- Minimize underwater radiated noise Minimize noise pollution
- EPA tier 4 engines Reduce air emissions
- Solid waste storage No incinerator air emissions



GREENING THE FLEET: FUTURE CONSIDERATIONS

- * Additional costs will be incurred to address or incorporate “green” solutions
- * Many of these expenses will be front-loaded: construction phase, but
- * Green technology may reduce operational costs during the lifetime of the vessel
- * Green solutions need to be customized for individual ships or missions



Green Workshops

Developing collaborations between UNOLS, ship operators, and the private sector has been and will be beneficial to the UNOLS fleet.

Acknowledgments

NSF: Bob Houtman

NSF: Tim Schnoor

UNOLS: Jon Alberts, Annette DeSilva, Alice Doyle, Karen Besson, Caitlin Mandel, Dennis Nixon

<https://www.unols.org/ships-facilities/unols-vessels/greening-fleet-initiative>

The Future of Ocean Research

REGIONAL CLASS RESEARCH VESSEL ATLANTIC OCEAN

Homeport: URI Graduate School of Oceanography
Narragansett, R.I.



East Coast
Oceanographic
Consortium
Founding Members

THE
UNIVERSITY
OF RHODE ISLAND
GRADUATE SCHOOL
OF OCEANOGRAPHY



University of
New Hampshire

Woods Hole
Oceanographic
INSTITUTION

KON TIKI

