Green Boats and Ports for Blue Waters III

April 5 - 6, 2016

URI Graduate School of Oceanography

UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM
UNOLS

11TH HOUR RACING

NSF

THE UNIVERSITY OF RHODE ISLAND
GRADUATE SCHOOL OF OCEANOGRAPHY

DEPARTMENT OF THE NAVY
USN
ONR
Science & Technology

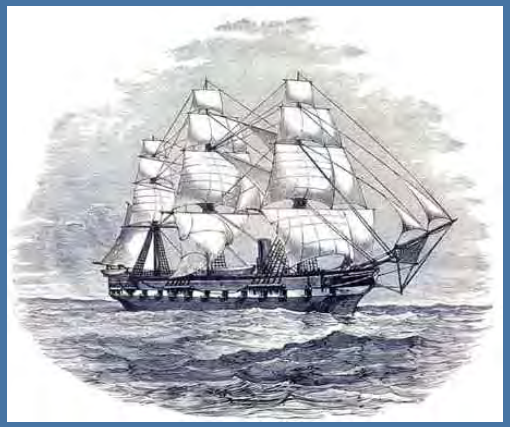
2-4% Carbon Dioxide

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 OF RHODE ISLAND
GRADUATE SCHOOL 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

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Green Boats and Ports for Blue Oceans

OBJECTIVES

1) Promoting environmental sustainability within marine vessels and ports in the New England region;

2) Development of guidelines for construction, operation and recycling of vessels and future port development;

3) Identifying business opportunities promoting green vessels and ports in New England;

4) Connect the recreational boating industry with key leaders in environmental sustainability to assist them in operating in a more environmentally sustainable way.

Ocean sustainability: Solutions to environmental problems

Featured Speakers:

The Honorable Dennis V. McGinn, Assistant Secretary of the Navy (Energy, Installations and Environment)

Mr. Dennis McGinn was appointed Assistant Secretary of the Navy (Energy, Installations & Environment) on September 3, 2013. In this position, Mr. McGinn develops Department-wide policies, procedures, advocacy and strategic plans. He also oversees all Department of the Navy functions and programs related to installations, safety, energy, and environment. This includes effective management of Navy and Marine Corps real property, housing, and other facilities; natural and cultural resource protection, planning, and compliance; safety and occupational health for military and civilian personnel; and timely completion of closures and realignments of installations under base closure laws.

Mr. McGinn is the former President of the American Council On Renewable Energy (ACORE), an organization dedicated to building a secure and prosperous America with clean, renewable energy. While at ACORE, he led efforts to communicate the significant economic, security and environmental benefits of renewable energy. Mr. McGinn is also a past co-chairman of the CNA Military Advisory Board and an international security senior fellow at the Rocky Mountain Institute.

More holistic planning for long-term coastal resilience? Port of Providence Demonstration Project

Prof. Austin Becker
Dept. of Marine Affairs -- University of Rhode Island

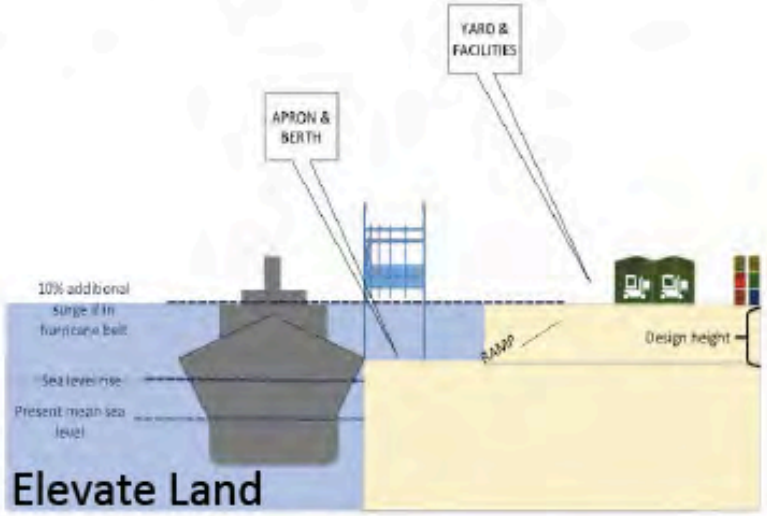
Green Boats and Ports for Blue Waters III Workshop
URI
April 4, 2016

THINK BIG WE DO

1. Accommodate –

Site-specific improvements to increase resilience

Elevate Utilities and Generator



Elevate Land

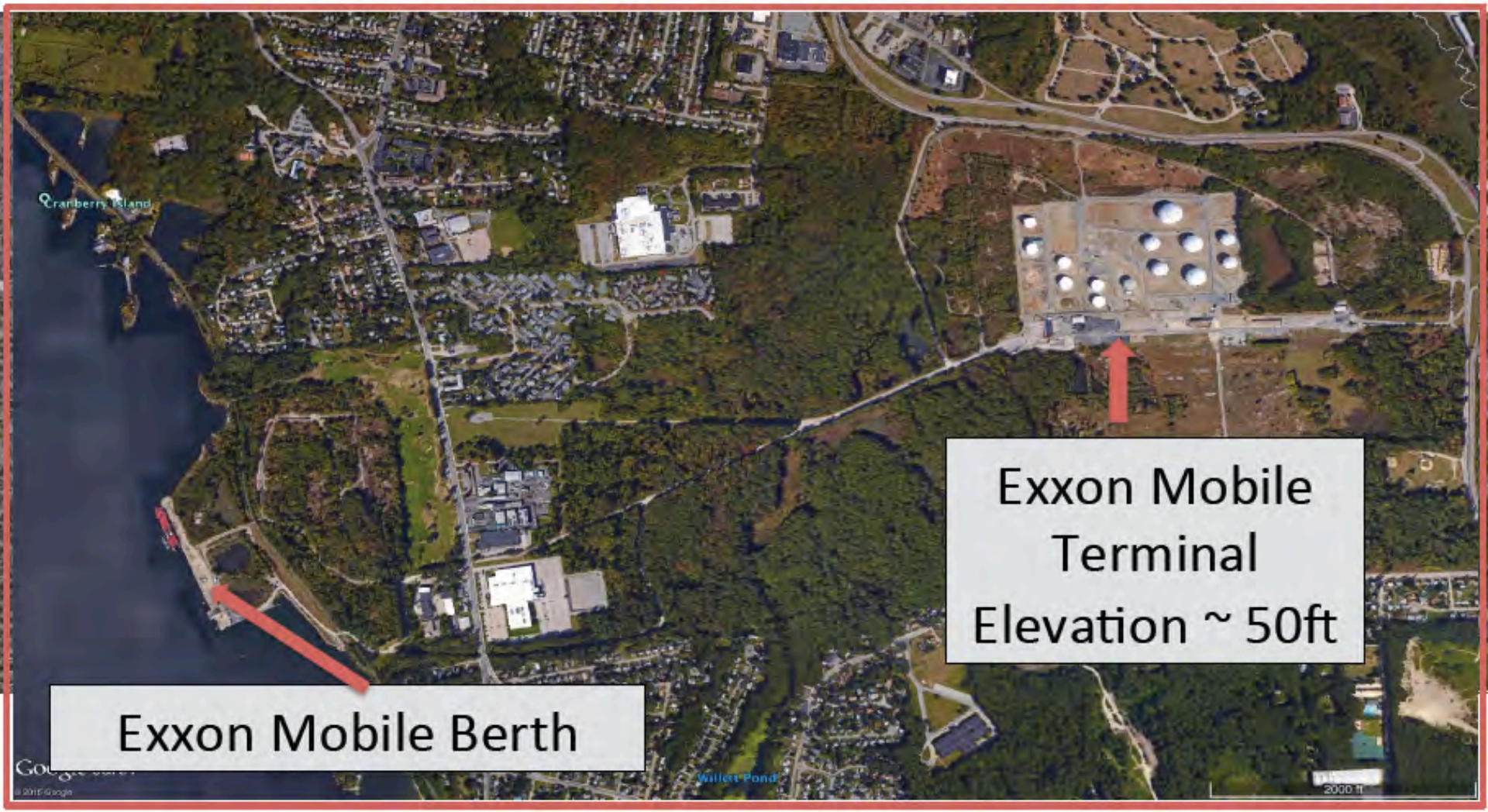
Flood berms

https://www.walthers.com/prodimage/0933/09330000003168.gif

Flood proof

2. Relocate –

Move port uses to less vulnerable location.



3. Protect –
New storm barrier for Providence Harbor.

Mission Excellence Through Sustainability

Green Boats & Ports III Workshop | 05 April 2016

U.S. Coast Guard | Rear Admiral Bruce D. Baffer

Resiliency | Massport

A pathway to a more resilient future

URI 4.5.16

Port of Boston

- Oldest continually active port in Western Hemisphere (400 years)
- New England's maritime hub
- Supports 34,000 jobs
- $2 billion to local, regional,
- and national economies

Context for our resiliency work

Possible Impacts

- **Airports**
  - Logan Airport prolonged closure – regional/national, international transportation/ economic impacts
  - Passenger, business, critical goods, and commerce disruption
  - Lack of ability to serve area-wide storm recovery efforts
- **Maritime**
  - Major facility and equipment loss leading to long term closure
  - Loss of cruise & container business
- **Real Estate**
  - Financial risks associated with tenant disruptions/recovery
  - Disruptions to local/regional transportation system
- **Agency-wide**
  - Loss of human resources
  - Greater recovery cost

Disaster Infrastructure Resiliency Planning (DIRP)

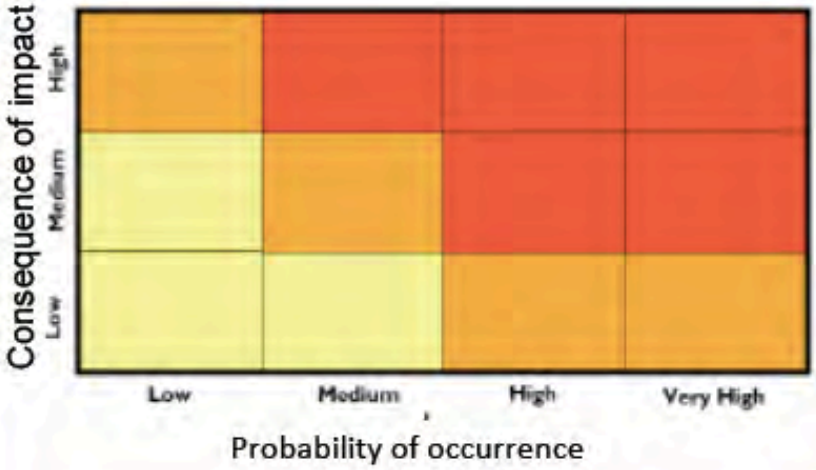
Goals of the project:

- Understand Massport's vulnerability to climate impacts
- Develop short-term and long-term resiliency strategies

Project approach:

- Climate projections

- Vulnerability and risk assessment



- Adaptation planning & design

North American Marine Environment Protection Association®

NAMEPA

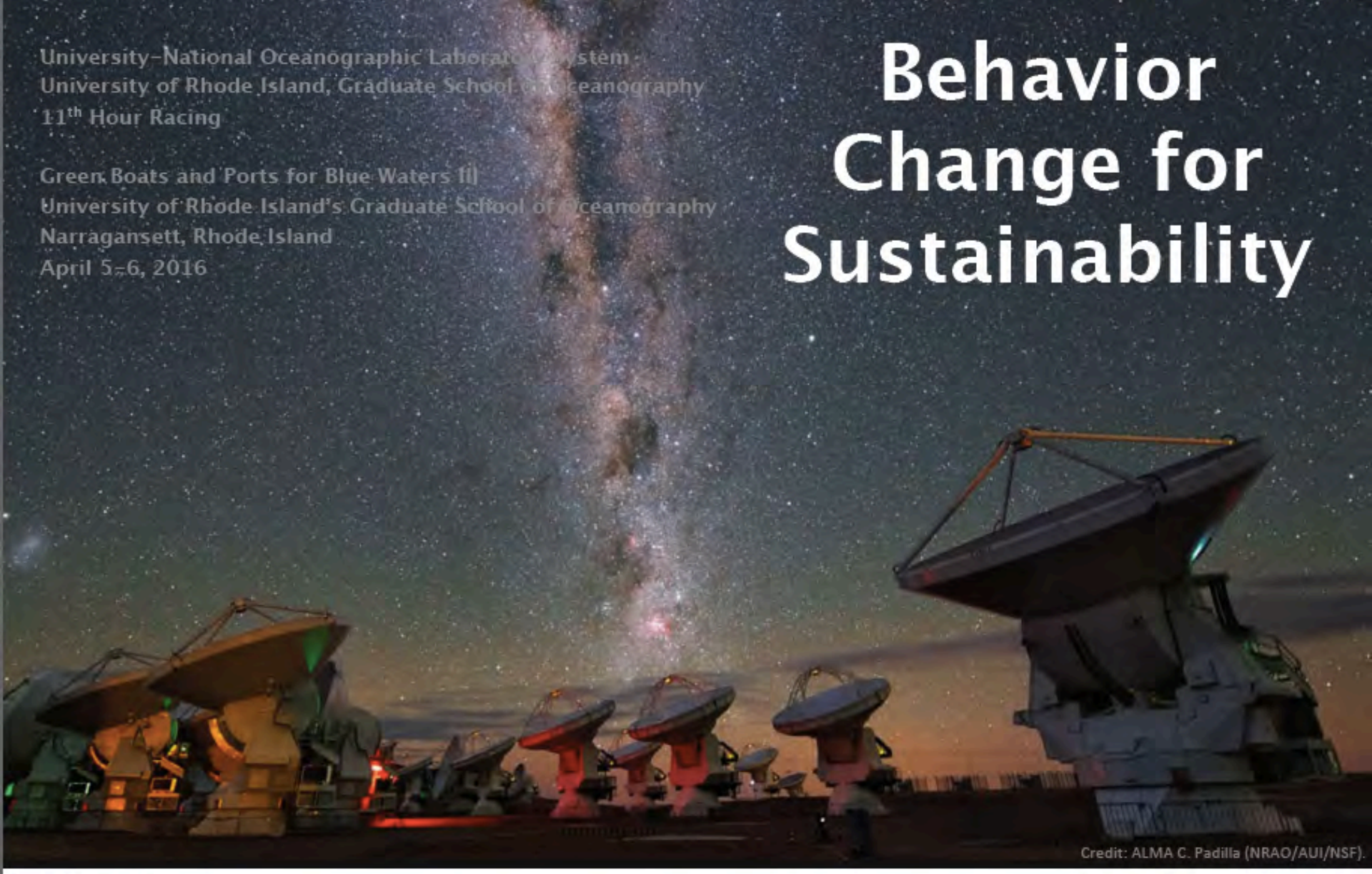
2014 Lloyd's List Awards ENVIRONMENT AWARD WINNER

Regulatory Opportunities and Challenges for Shipping and Ports

University-National Oceanographic Laboratory System
University of Rhode Island, Graduate School of Oceanography
11th Hour Racing

Green Boats and Ports for Blue Waters III
University of Rhode Island's Graduate School of Oceanography
Narragansett, Rhode Island
April 5-6, 2016

Behavior Change for Sustainability

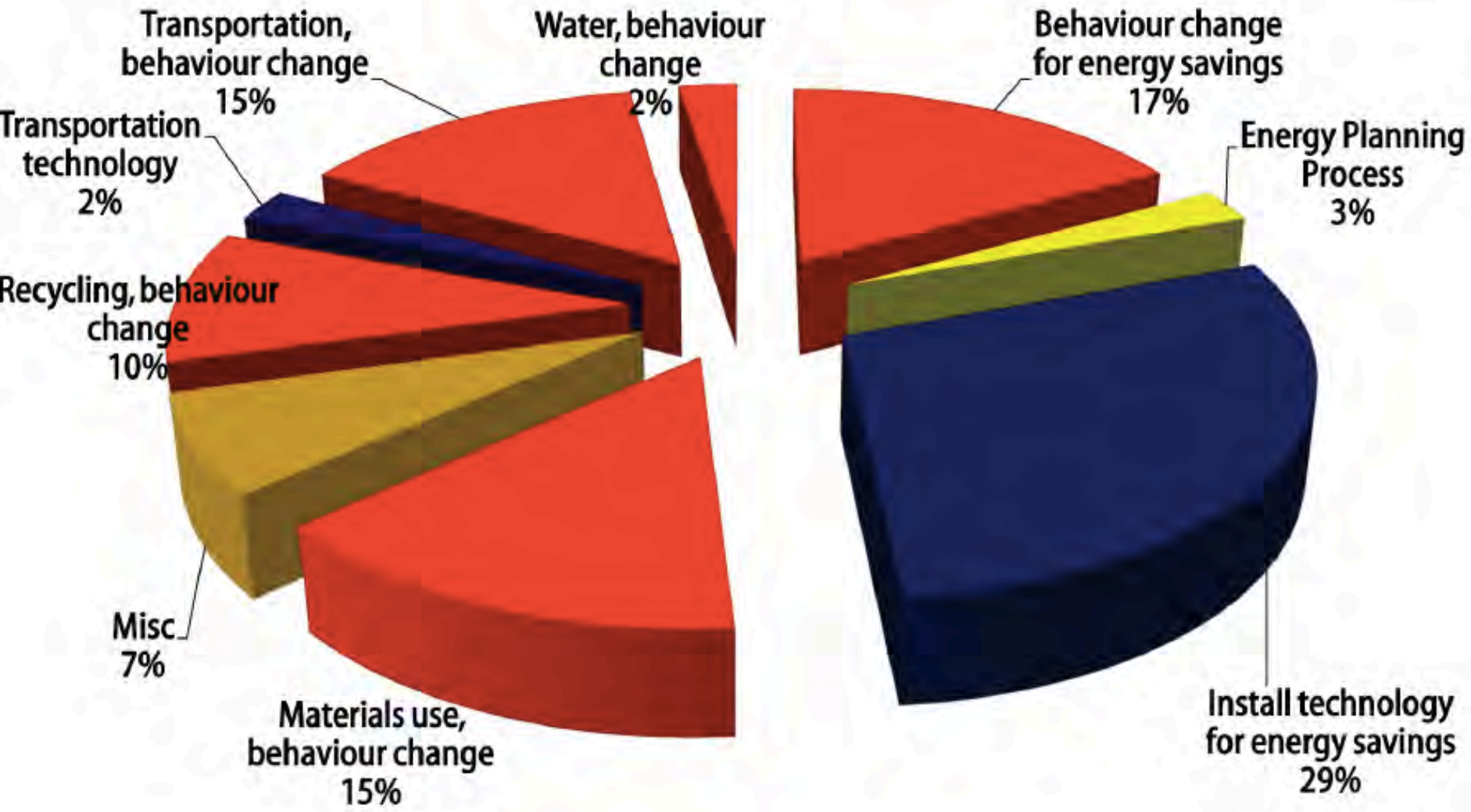


Credit: ALMA C. Padilla (NRAO/AUI/NSF).

Pete McEvoy
Vice President Administration
Associated Universities, Inc (AUI)

Associated Universities, Inc.

What type of change?

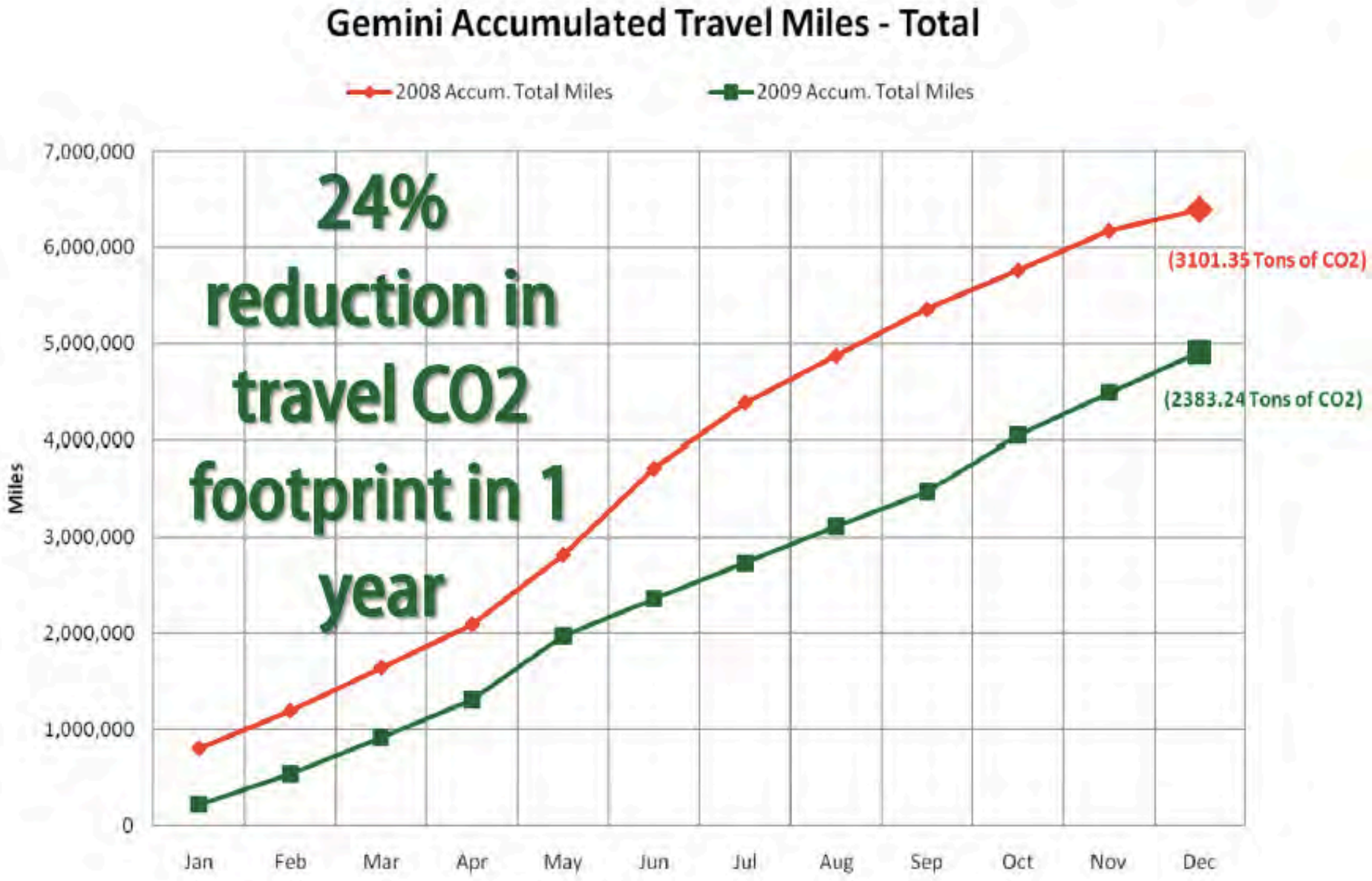


What type of change?

31% of comments promoted technology

59% promoted **behavior change**

Travel


Gemini Accumulated Travel Miles - Total
2008 Accum. Total Miles
2009 Accum. Total Miles
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
Miles
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
24% reduction in travel CO2 footprint in 1 year
(3101.35 Tons of CO2)
(2383.24 Tons of CO2)

Mr. Gregory Marshall, CEO Gregory C. Marshall Naval Architect Ltd.

Gregory C. Marshall is a Victoria, B.C. Canada based Naval Architect specializing in the design of Large custom yachts built worldwide. Greg has been in the Yacht design business for more than 35 years and has had the current firm in Victoria for 21 years. Greg and his business partner Gordon Galbraith and their team of 16 designers, engineers and stylists have penned some of the world's most spectacular yachts including "VvS1" (111 Feet), Winner of 11 global awards in 2007 including, Best Power yacht, Best Interior, Most innovative Yacht; "Calixas" (105 Feet)winner of 9 global awards in 2009 including the Best Power yacht, winner of the most innovative yacht; "BigFish (147 Feet), Winner of 14 global awards including Best Motoryacht, Best Interior, Best Naval Architecture, Best Styling and Most Innovative yacht. "Attessa IV" (330 Feet) winner of the Best the best refit.

Current projects include a 280 foot custom yacht for a private customer; a 220 foot yacht for an American Owner; A 200 foot yacht for a Middle Eastern Owner as well as an array of smaller projects.

Can travel Thousands of Miles

Completely Sustainable

Requires very little Maintenance

Construction from one tree

Biodegradable when done

Efficient Hull Form

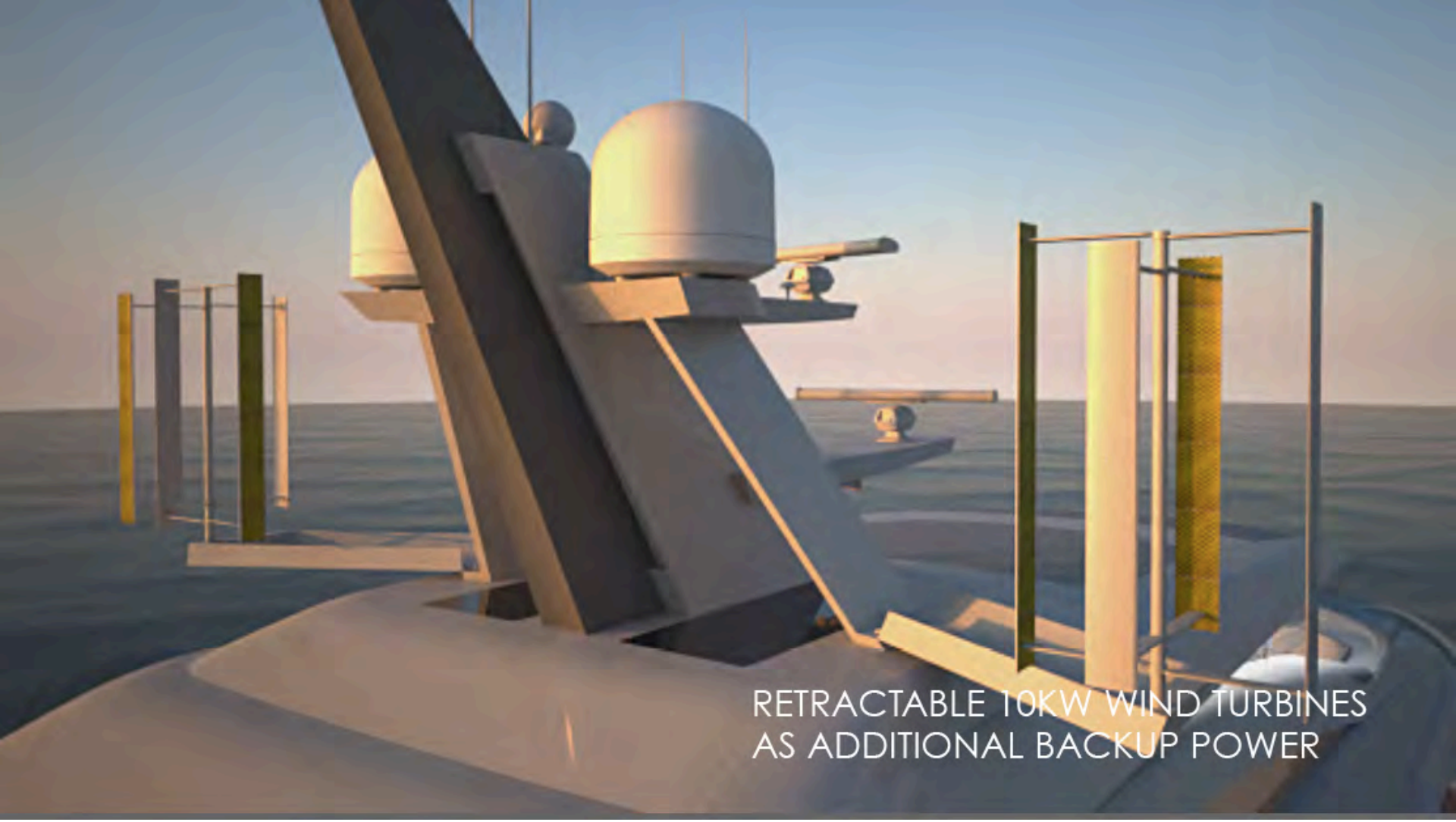
Oceangoing


THE CHALLENGE IS THAT NONE OF OUR CUSTOMERS WANT TO GIVE UP ANYTHING
"YES, THIS TOY GARAGE IS TRULY GOING ON ONE OF OUR PROJECTS"

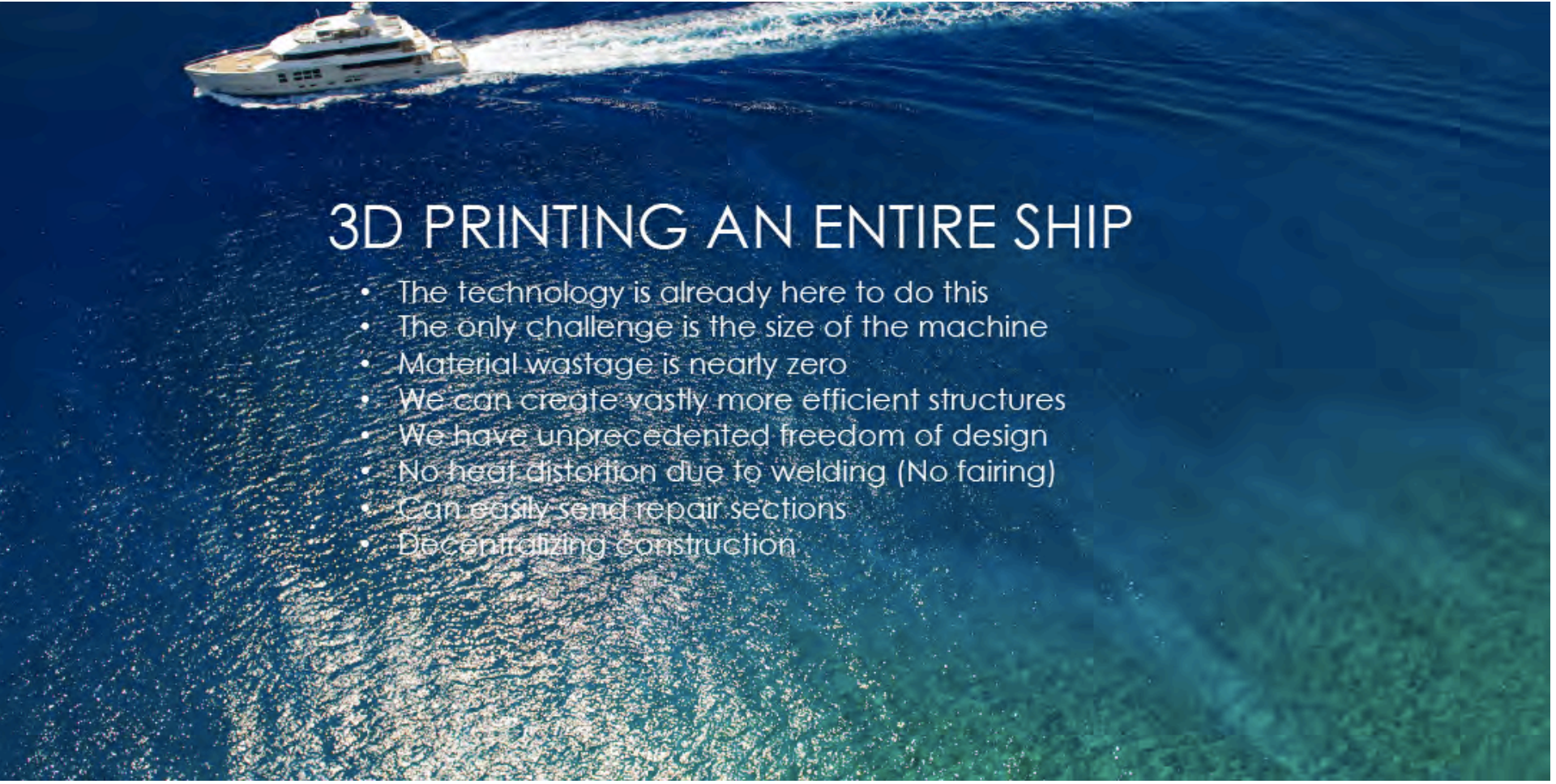

IF YOUR FEELING TOO LAZY TO WALK TO THE
BOW YOU CAN ALWAYS TAKE A HELICOPTER
ATTESSA IV

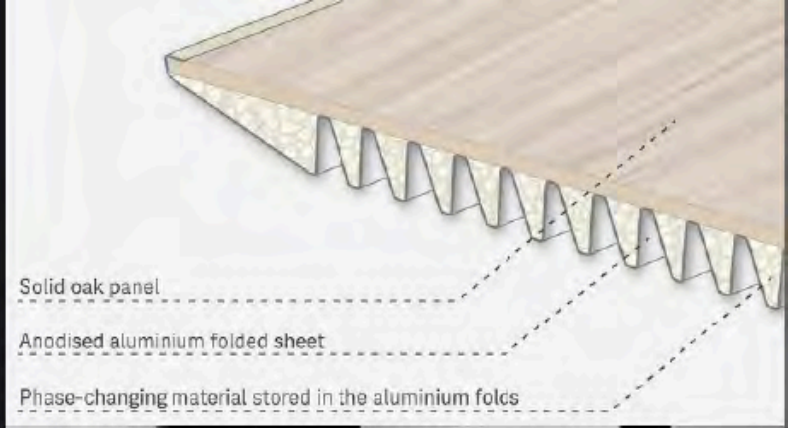

SOLAR PANELS ON THE HELICOPTER PAD

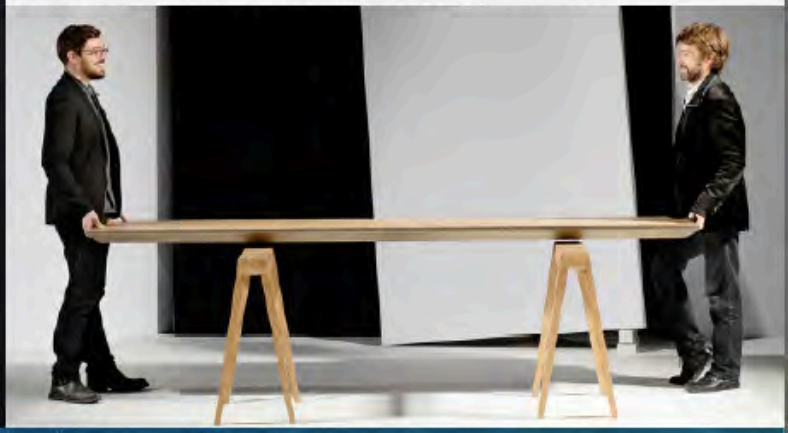

GREGORY C. MARSHALL
NAVAL ARCHITECT LTD.


RETRACTABLE 10KW WIND TURBINES
AS ADDITIONAL BACKUP POWER

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

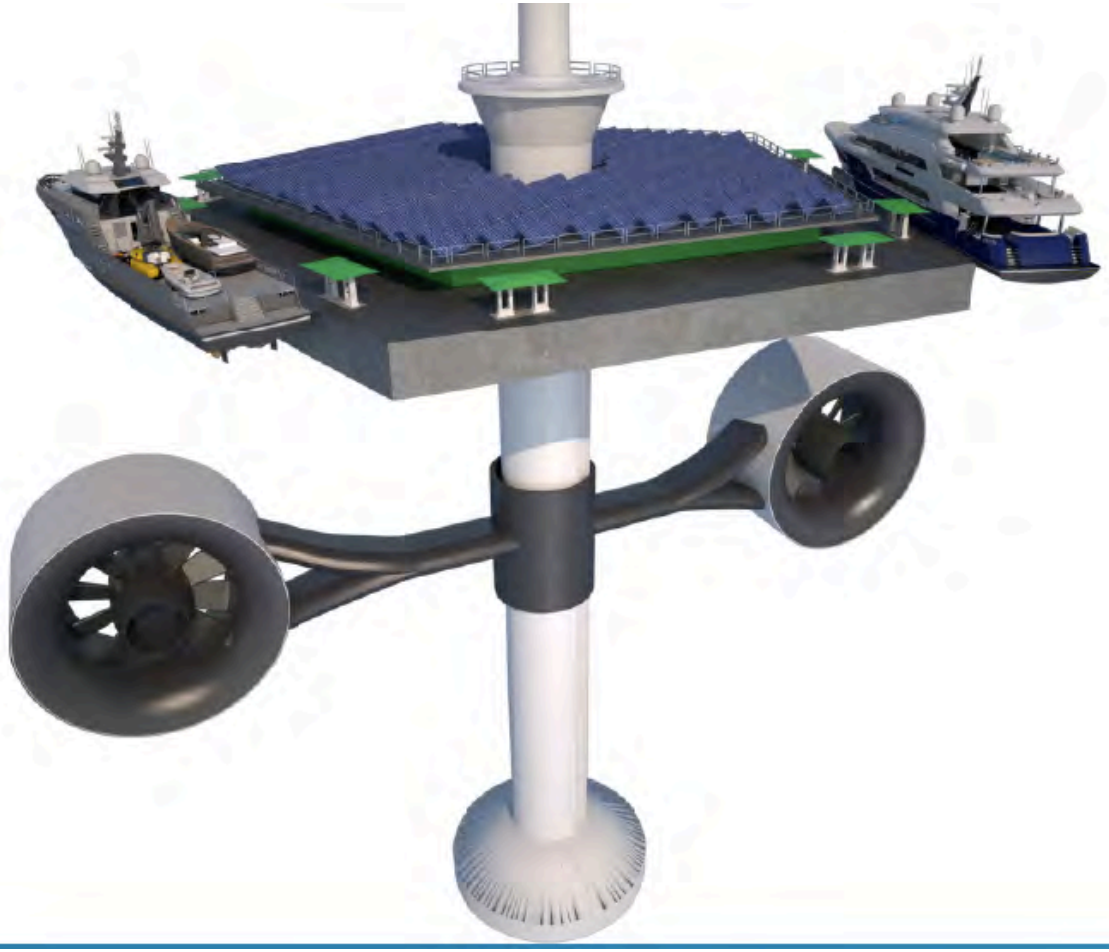

3D PRINTING AN ENTIRE SHIP
• The technology is already here to do this
• The only challenge is the size of the machine
• Material wastage is nearly zero
• We can create vastly more efficient structures
• We have unprecedented freedom of design
• No heat distortion due to welding (No fairing)
• Can easily send repair sections
• Decentralizing construction

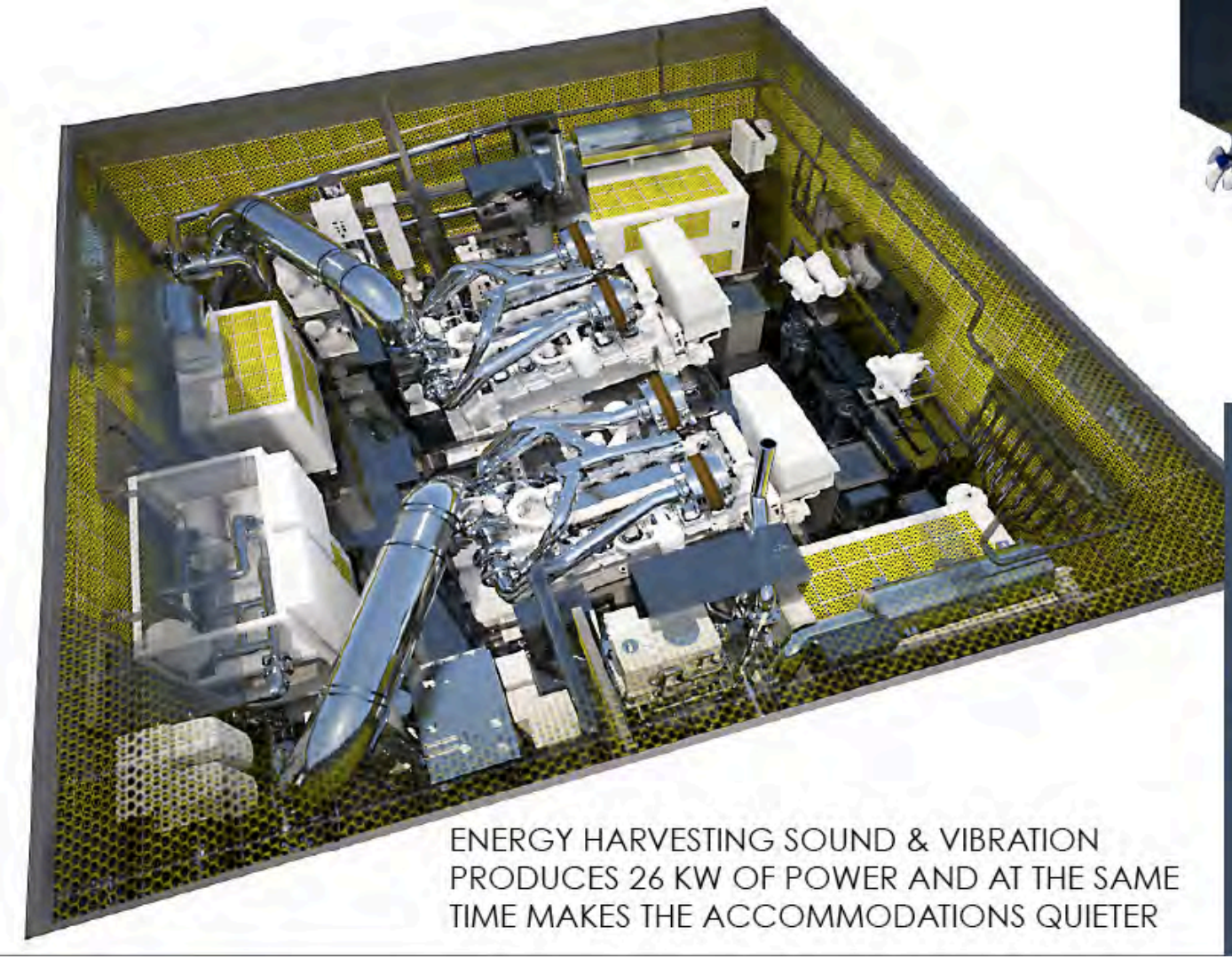


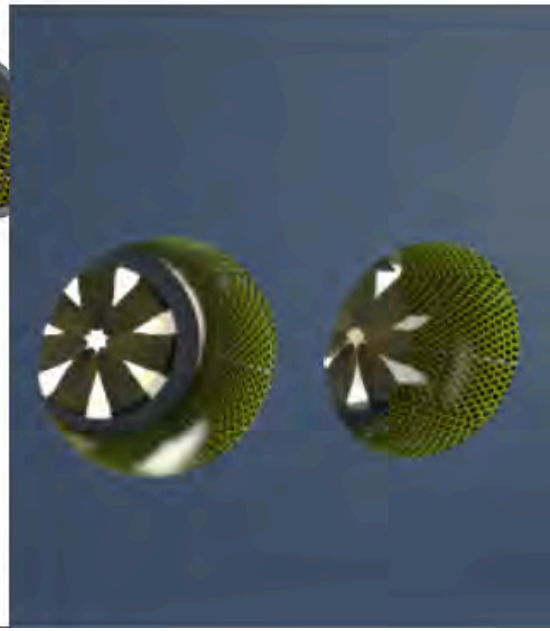


PHASE CHANGING FURNITURE

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







ENERGY HARVESTING SOUND & VIBRATION
PRODUCES 26 KW OF POWER AND AT THE SAME
TIME MAKES THE ACCOMMODATIONS QUIETER

U.S. DEPARTMENT OF TRANSPORTATION – MARITIME ADMINISTRATION

MARITIME ADMINISTRATION

Office Of Environment

Green Boats & Ports Workshop
April 5-6, 2016

Michael Carter
Director
202.366.9431
michael.carter@dot.gov

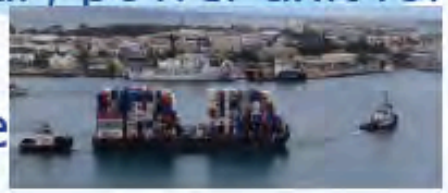
Maritime Industry Environmental Drivers

- **Challenges = Opportunities for Innovation**
  - We are seriously lagging landside transportation in environmental innovation
  - Need for technologies that work in the marine environment – ballast water treatment, exhaust gas treatment
  - Need for demonstration of and innovation in alternative fuels and energy
  - Need for advanced systems and technologies for energy efficiency and conservation

Marine Application of Fuel cell

MOU with DOE established on June 2013

- **On-going project on marine fuel cell project**
  - Prototype demonstration of fuel cell auxiliary power unit for shore/shipboard power
  - Collaboration with multiple industry partne

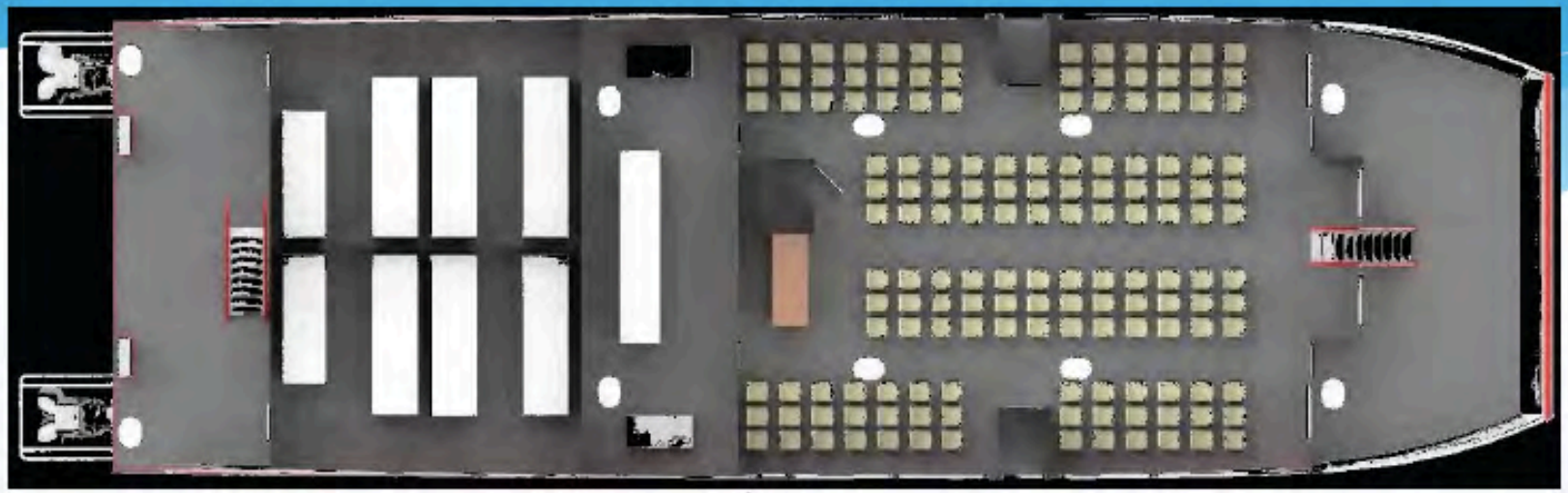


    - ✓ Hybrid hydrogen PEM fuel stack in a 20' container
    - ✓ 100kW 230V AC 3 phase
    - ✓ Power for 10 refer containers
      - ABS and USCG approval

- **Current marine fuel cell project (FY 2014 currently under planning)**
  - Shipboard technology demonstration of fuel cell for auxiliary power
    - ✓ 10kW s120-240 V AC solid oxide fuel cell
    - ✓ JP-8, ULSD, No. 2 diesel

Zero Emission Ferry

* **OPERATION**
  * 23 nm one-way
  * Each round trip uses about 500 kg LH2
  * Daily logistics: Two morning round trips
  * Refuel in less than 1 hr.
  * Two afternoon round trips
  * Designing the ferry to meet the long distance
* **PERFORMANCE**
  * 35 knots
  * Zero emissions
  * 130' x 39' preferred size envelope, 150' long is maximum
  * <100 Gross Registered Tons (GRT)
  * 90% MCR (i.e., power margin)
  * Prefer one refueling per day.




S.F. - BREEZE

The Maritime Aquarium
AT NORWALK

R/V Spirit of the Sound®

The practical application of a hybrid system in a 19 meter research vessel

The Maritime Aquarium
AT NORWALK

The Technology:

- Incat Crowther Hull
- Northern Lights Generation
- BAE Systems HybriDrive Propulsion System
- Corvus Energy Storage Systems

Photo Courtesy of Brian Gauvin

GREEN BOATS AND PORTS FOR BLUE WATERS

UNIVERSITY OF RHODE ISLAND
GRADUATE SCHOOL OF OCEANOGRAPHY

Mike Gaffney, C.E.M., C.E.A., C.P.Q.

Certified Energy Manager and Auditor

Certified Power Quality Professional

USCG Licensed Chief Engineer

Senior Engineer, Navis Energy Solutions

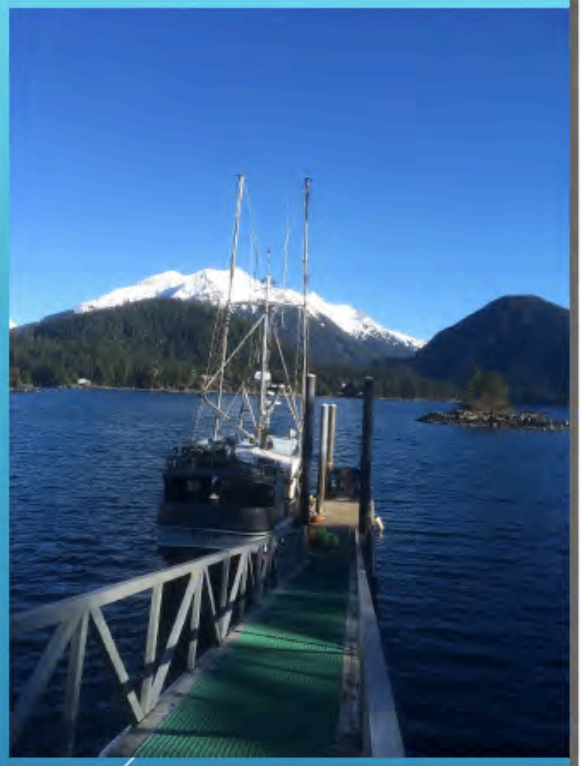
Norfolk, VA

April 5, 2016

NAVIS
ENERGY MANAGEMENT SOLUTIONS LLC

PRESENTATION TOPICS

- Energy Efficiency (Cultural and Technical)
- Fishing Vessel Energy Efficiency Project
  - Alaska Fisheries Development Foundation (AFDF)
  - Alaska Longline Fishermen's Association (ALFA)
  - Energy Analysis Tool (EAT): Baseline Energy Consumption and Cost
- ECMs
  - Refrigeration and HVAC
  - Hydraulics



BIODIESEL FOR MARINE APPLICATIONS

A "CHICKEN OR THE EGG" SITUATION

Dr. Robert Morton
Newport Biodiesel, Inc.
312 Connell Highway
Newport, RI 02840
www.newportbiodiesel.com

WHY BIODIESEL?

"BIODIESEL IS THE BEST FUEL ON THE PLANET"

- BIODIESEL REDUCES GHG EMISSIONS BY 89%
- EVERY UNIT OF ENERGY PUT INTO PRODUCING BIODIESEL YIELDS 7 UNITS OF USEABLE ENERGY
- BLENDS DIRECTLY WITH PETROLEUM DIESEL
- 20% BIODIESEL BLENDED WITH ULTRA LOW SULFUR PETROLEUM DIESEL HAS LOWER EMISSIONS THAN NATURAL GAS
- READY TO USE TODAY – NO NEED TO MODIFY ENGINES

KLÜBER LUBRICATION

your global specialist

The Case for Environmentally Acceptable Lubricants: Reducing Operational Discharges of Lubricants into Oceans and other Water Bodies

Green Boats and Ports for Blue Waters III Workshop

Benjamin Bryant – North American Marine Market Manager

Environmentally Acceptable Lubricants

United States Environmental Protection Agency
Office of Wastewater Management
Washington, DC 20460

Environmentally Acceptable Lubricants

- 'Environmentally Acceptable Lubricants' means lubricants that are '**biodegradable**' and '**minimally-toxic**' and are '**not bio accumulative**'
- Environmentally Acceptable Lubricants include those labeled by the following **labeling programs**:
  - Blue Angel
  - European Ecolabel
  - Nordic Swan
  - the Swedish Standards SS 155434 and 155470
  - Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) requirements
  - EPA's Design for the Environment (DfE)

CORPORATE SOCIAL RESPONSIBILITY

Green Boats and Ports for Blue Waters III Workshop
April 5-6 2016

Carnival Corporation
Aubrie Brake
Manager, Environmental Policy

Carnival FUN FOR ALL. ALL FOR FUN.

Carbon Credits : A Marine Industry First

John Mangano
Regional Marketing Manager

AkzoNobel

Hybrid Hype
&
The Realities of Building Green

Joe Hudspeth
Vice President of Business Development
All American Marine, Inc.

Against the Wind:

Finding Green Solutions for the Disposal of Fiberglass Boats

Dennis Nixon

GSO

UNOLS
UNIVERSITY-NATIONAL OCEANOGRAPHIC LABORATORY SYSTEM

Rhode Island Sea Grant

The New Frontier: Vessel Recycling

Technological Recycling Processes

-Pure Materials Recovery (Physical Processing, Grinding, Separation of "recyclate")

-Microwave Pyrolysis (Chemical Recovery, Melting and Separating of Materials in the Absence of Oxygen)

Valuable Components

-Polyester Fibers
-Liquid Resin
-Oil/Wax Additives

Much Different from Traditional Boatyard "Recycling"

GSO

UNOLS

Rhode Island Sea Grant

The Greening of R/V Sikuliaq

Shrinking a Ship's Environmental Footprint

Bottom Coating

- The standard ablative bottom coating system for anti-fouling is **not** used on Sikuliaq
  - Non-ablative bottom coating that is highly ice resistant
  - Reduced frictional resistance over conventional bottom coating and low VOC during application
  - Reduced friction resistance results in reduced hull resistance for improved fuel economy
  - The non-ablative nature of the coating, combined with low VOC, results in reduced solvent emissions and no release of biocides into the water.

Integrated Power Plant Concept

- Designed with an integrated power plant
  - Combines generation of both ship's service electrical power and ship's propulsion into a common electrical plant with a load management system
  - Improves overall energy efficiency of the Sikuliaq
    - Allows the operator to adjust electrical generation capacity to more closely match the electrical demand
    - Uses anywhere from one to four diesel generators depending on demand
    - Results in minimizing the running of the electrical plant in an "over capacity" condition which improves energy efficiency and reduces emissions

Bio-degradable Hydraulic oil

- Uses bio-degradable hydraulic oil
  - Minimizes risk from any accidental hydraulic oil discharges
  - Recent hose burst with a favorable response from USCG once reported and cleaned up

Ballast Water

- Sikuliaq uses the Hyde Guardian System

HG 100 Model, Treats ballast water at 100 m3 / hour
Relatively trouble free and operates as designed
Uses no chemicals

One Ocean at a Time: Green Initiatives in the Regional Class Research Vessels

Don B. Hilliard
Fleet Engineer, Oregon State University

UNOLS "Green Boats & Ports for Blue Waters" III
5 – 6 April 2016

Hull Form

UNOLS "Green Boats & Ports for Blue Waters" III
5 – 6 April 2016

Areas of Initiative

- Hull Form
- Propulsors
- Power Plant
- Auxiliaries
- Coatings and Lubricants
- Certification

Auxiliary Systems

- Waste Heat Recovery as heating source for
  - Distillation
  - Potable water heating
  - HVAC heating

Power Plant

- Variable speed/frequency power generation
  - Integrated DC bus
  - Reduced conversion loss
  - Reduced generation loss
- Real-time fuel monitoring
  - Engine-specific efficiency
  - Vessel efficiency

Auxiliary Systems

- Variable Speed fan and pump motors
- LED lighting throughout, dimmable where appropriate (labs and accommodation areas)
- Oil/water separation to <5ppm
- Biologic, non-chlorinating MSD
- Shore power sized for all expected loads

Coatings and Lubricants

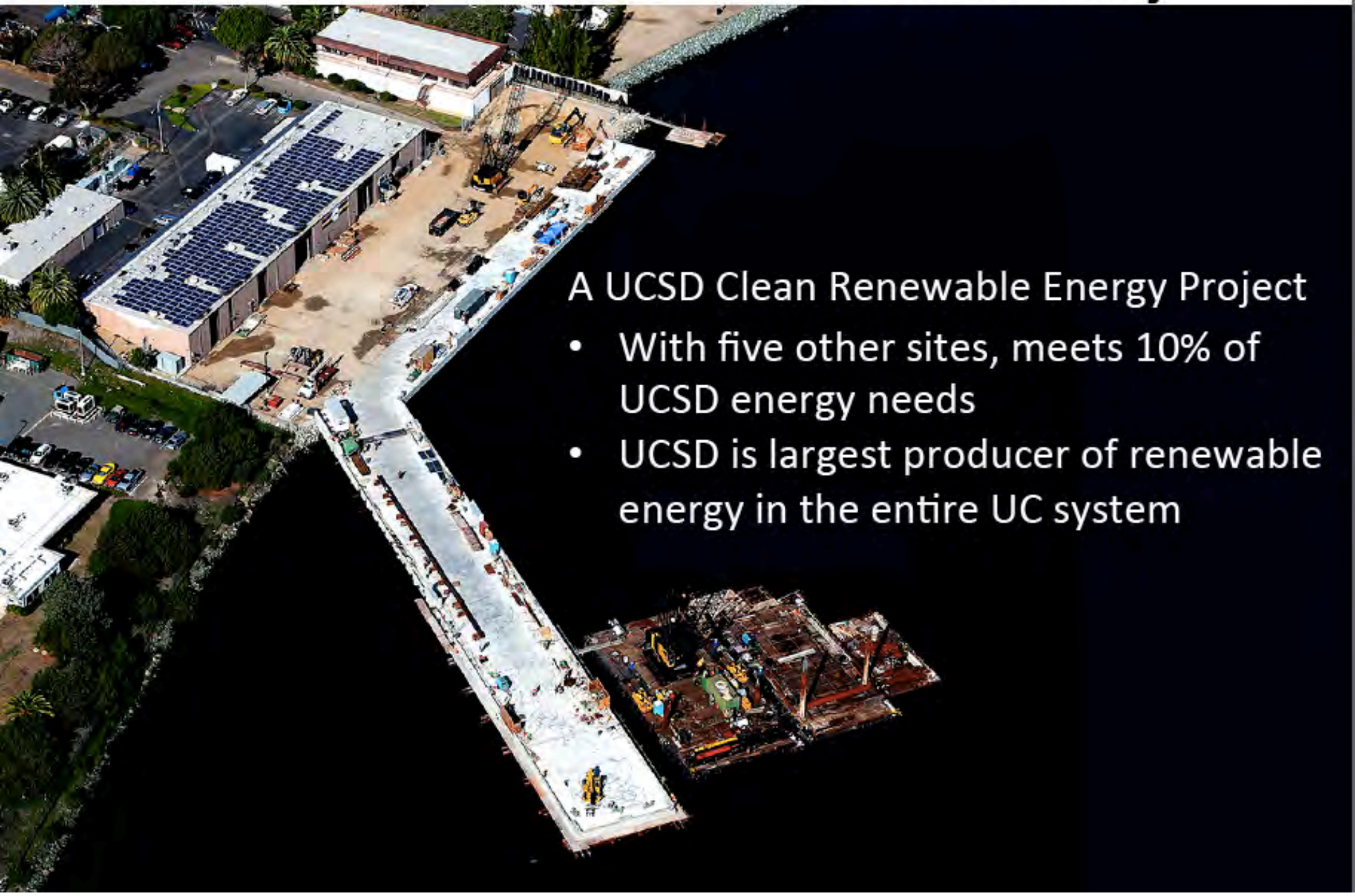
- Advanced fluoropolymer foul-release for underwater hull
  - Non-biocidal
  - Non-ablative
  - Low friction adds 1-3% efficiency
  - Growth sloughs at <4 knots

Green Light for Sustainability

Zoltan Kelety
Scripps Institution of Oceanography
University of California San Diego

UC San Diego

Solar: 95 KW Photovoltaic Array



A UCSD Clean Renewable Energy Project

- With five other sites, meets 10% of UCSD energy needs
- UCSD is largest producer of renewable energy in the entire UC system

Increased Shore Power

- Scripps Nimitz Marine Facility has provided cold-iron berthing since 1967
- Minimizes diesel emissions and noise from berthed vessels

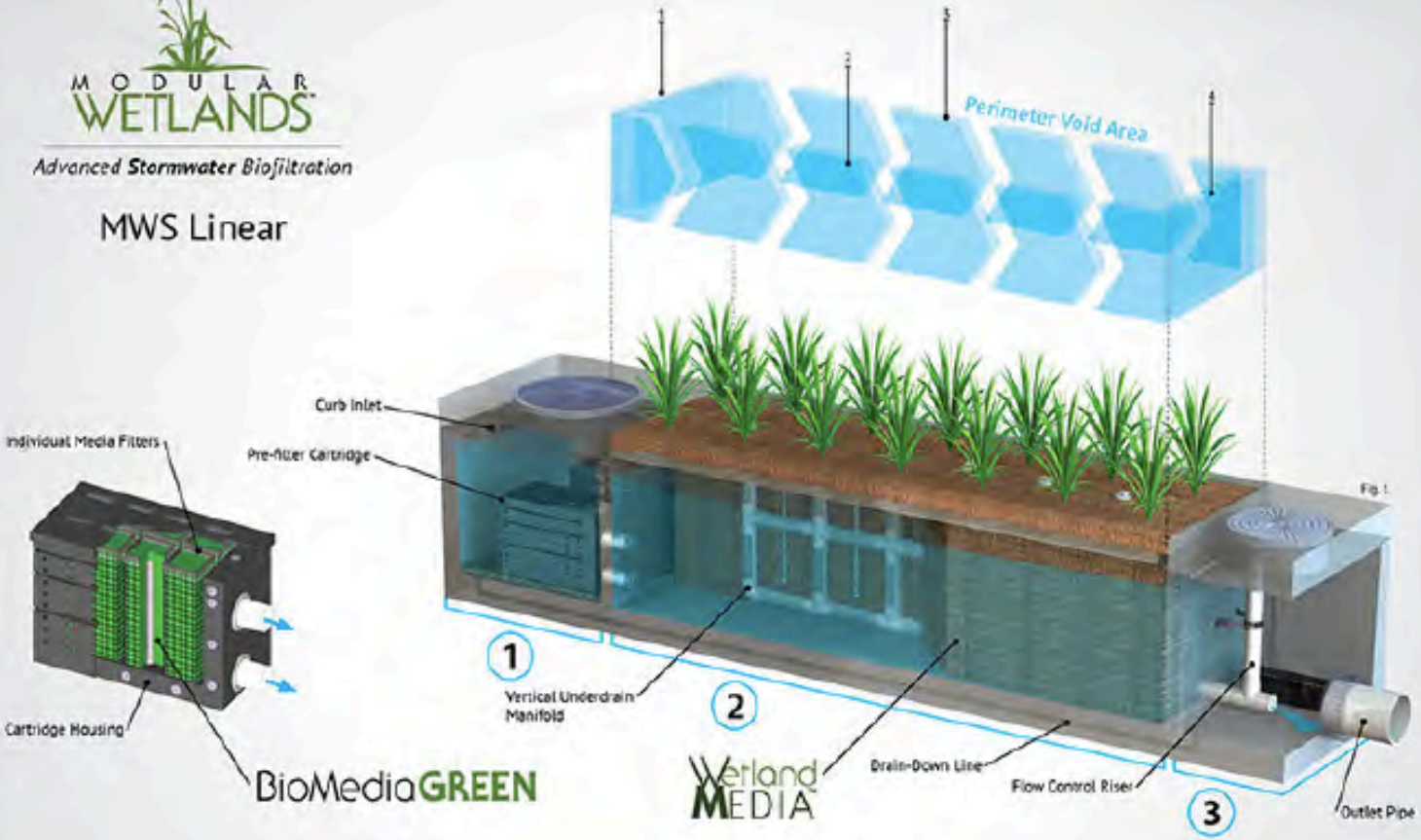
All ship's loads including crane and winch starting current can be picked up on shore power

Zero Runoff Stormwater Collection

MODULAR WETLANDS

*Advanced **Stormwater** Biofiltration*

MWS Linear



1 Pre-Treatment → 2 Biofiltration → 3 Discharge

Biofuel

R/V *Robert Gordon Sproul* operated using 100% renewable diesel fuel, sourced from vegetable and waste oil, during 2014-2015