Offshore Wind Accelerator
Project Webinar Series

Maine Offshore Wind Milestones

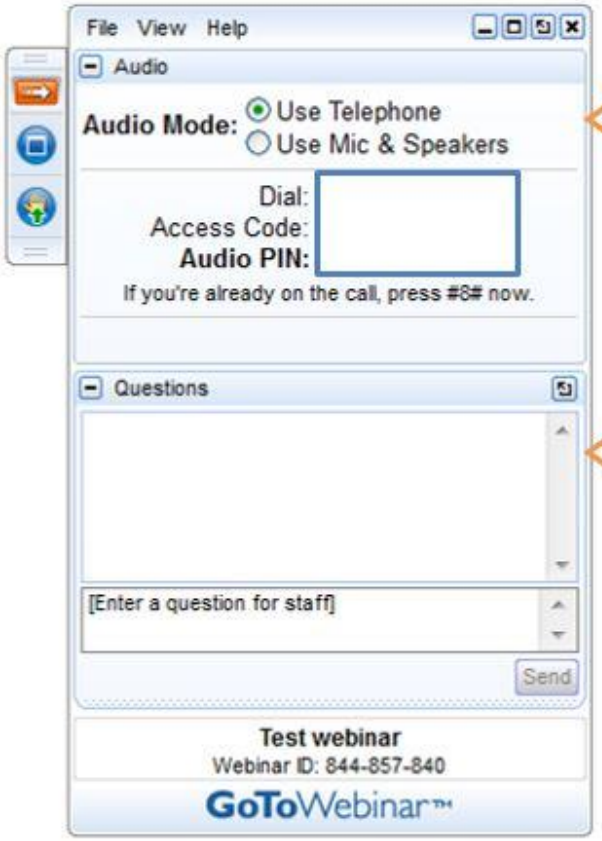
Hosted by
Val Stori, Project Director, OWAP

March 6, 2014

CleanEnergyGroup
Innovation in Finance, Technology & Policy

OffshoreWind
Accelerator Project

Housekeeping



All participants are in "Listen-Only" mode. Select "Use Mic & Speakers" to avoid toll charges and use your computer's VOIP capabilities. Or select "Use Telephone" and enter your PIN onto your phone key pad.

Submit your questions at any time by typing in the Question Box and hitting Send.

This webinar is being recorded.

You will find a recording of this webinar, as well as all previous CEG webcasts, archived online at

http://www.cleanenergystates.org/webinars/

Offshore Wind Accelerator Project

OWAP Objective: Address key challenges facing offshore wind in five focus areas

- Work with individual States to assist with the development of strategic, long-term policies to advance offshore wind and develop a serious process to get to OSW scale in the U.S.
- Work on regional strategies with multiple states to increase opportunities for joint funding, networking and information sharing, joint procurement, supply chain and siting cooperation.
- Work on developing new finance tools and mechanisms, including buyers' networks and joint aggregated purchases, to provide the needed capital to scale up the offshore wind industry.
- Continue to communicate of ideas and policy developments between states and other stakeholders through OWAP.
- Work with leading European and UK policy makers to learn about the more established experience with offshore wind in those countries, and import that knowledge to US energy policy makers.

Today's Guest Speakers

Habib Dagher, Professor of Civil/Structural Engineering, University of Maine

Jeff Thaler, Visiting Professor of Energy Policy, Law & Ethics, University of Maine

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Stay Connected to OWAP!

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Visit our website to read more about OWAP and sign up for our e-newsletter:
http://www.cleanenergystates.org/projects/accelerating-offshore-wind-owap/

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OffshoreWind Accelerator Project

The VolturnUS

Floating Wind Turbine Technology

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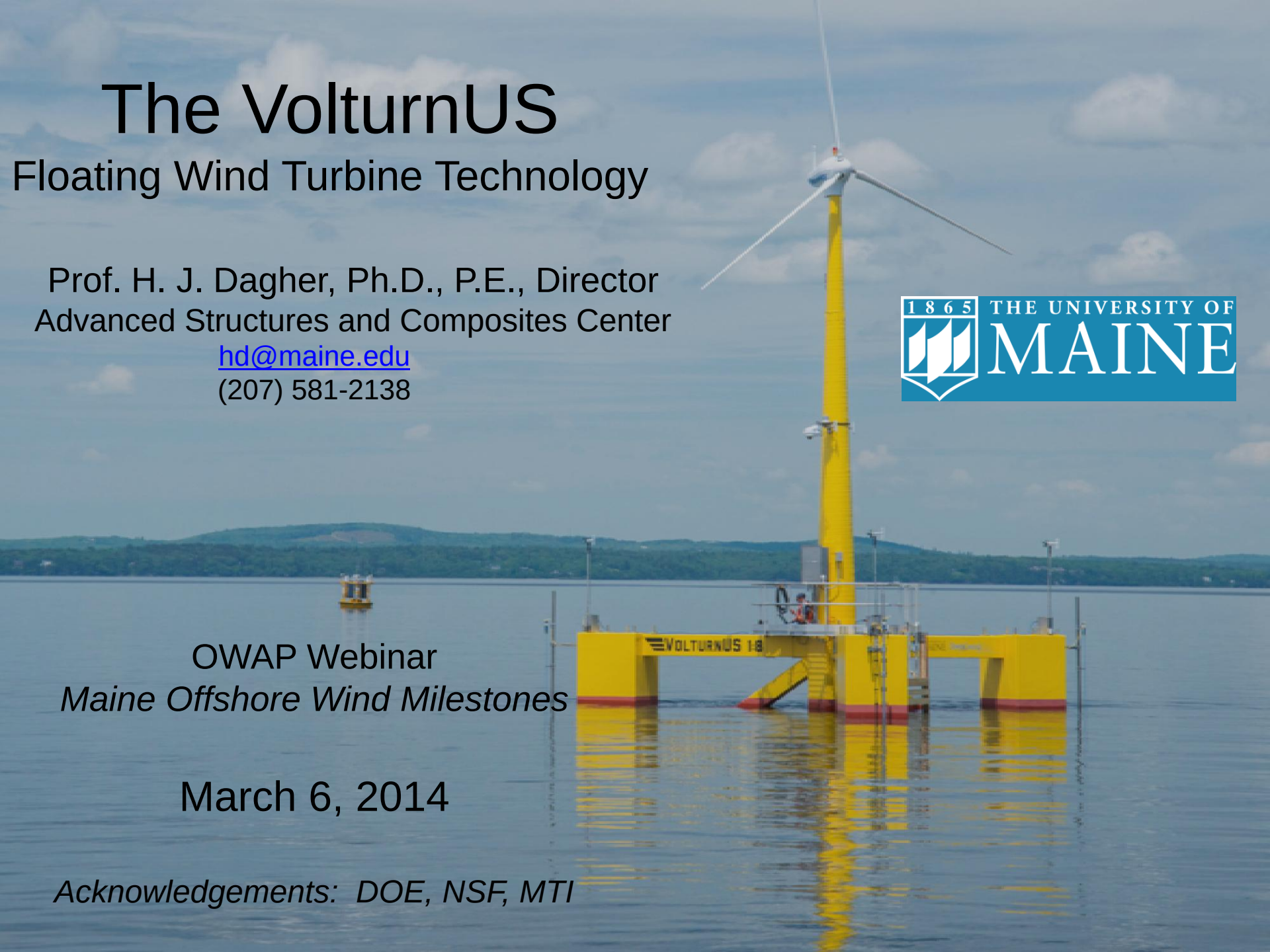

OWAP Webinar
Maine Offshore Wind Milestones

March 6, 2014

Acknowledgements: DOE, NSF, MTI

Over 30 Partners

DOE, NSF, UMaine, MTI, State of Maine

Outline

- Who are we?
- Results of the 1:8 Scale VolturnUS Testing
- The DOE Advanced Technology Demonstration Project

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Advanced Structures and Composites Center

200 personnel

87,000 ft² Lab

18 years

1,400 students funded through lab

Composites Industry ⟷ Construction Industry

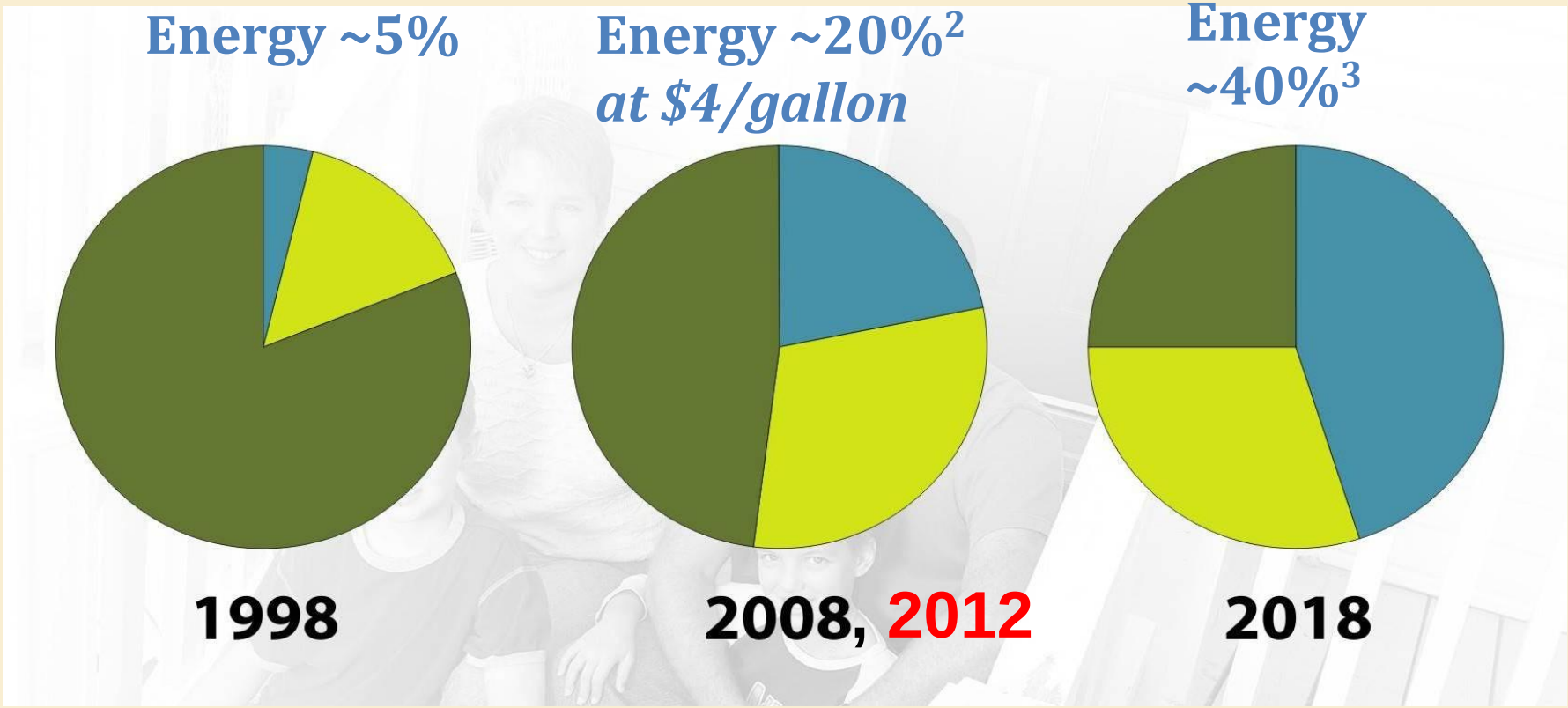
Global Industry Awards

- 2007 ACMA Best of Show
- 2007 ACMA People's Choice
- 2009 ACMA Most Creative Composites Product
- 2010 ACMA Most Creative Composites Product
- 2011 ASCE Pankow Innovation Award

Annual Heating Cost *(typical home)*

Values from http://www.efficiencymaine.com/pace/compare-heating-options on 12/7/12

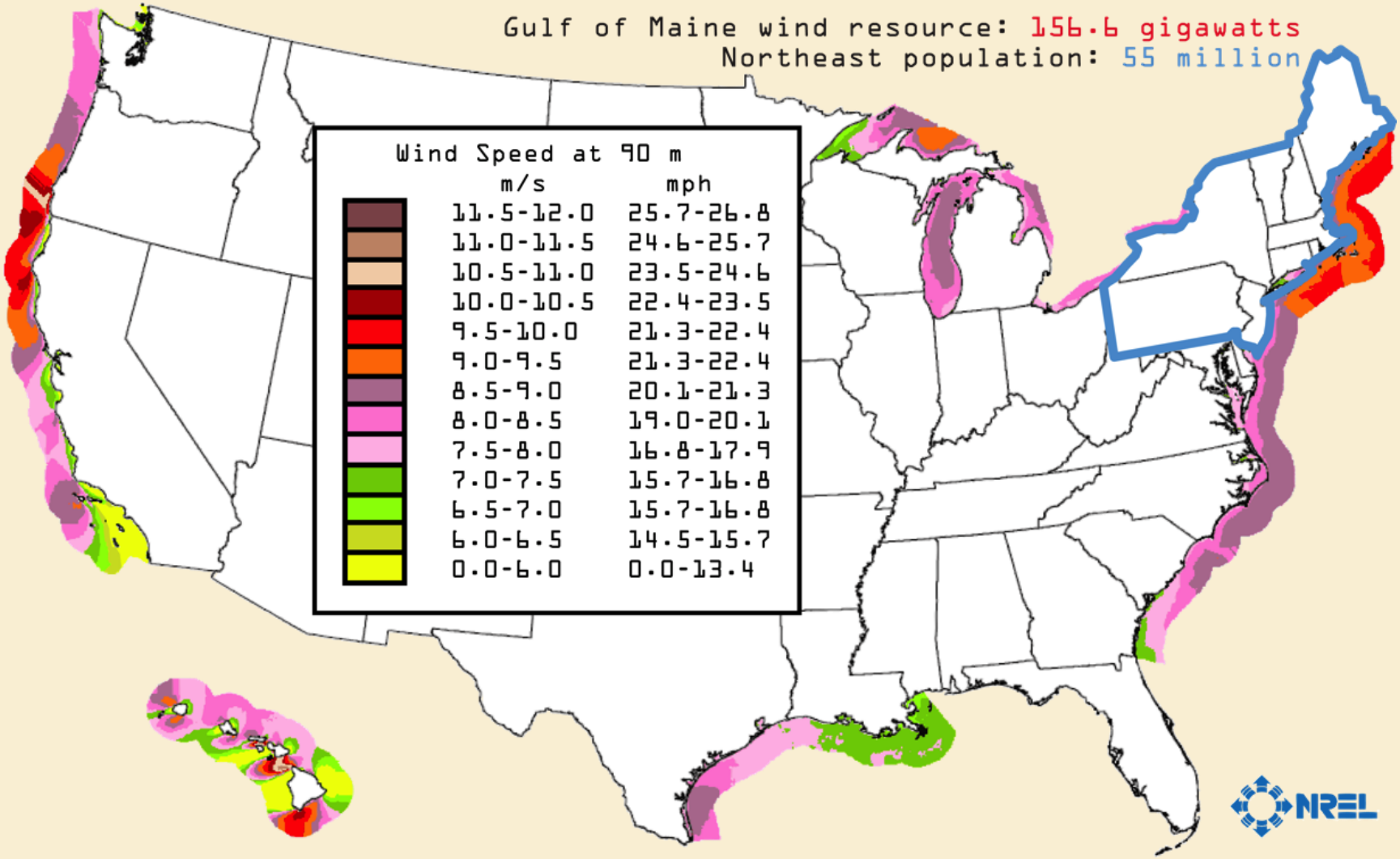
Maine Family Budget



"Family Energy"[1,2] = 50% Transportation
40% Heating
10% Electric Power

[1] Source:, Dr. George Hart, UMaine
[2] Based July '08 energy costs
[3] Assumes that health care costs do not grow past 30% of the average family budget in 2008-2018

Northeast US Offshore Wind Resource



Maine Timeline: 5GW Floating by 2030

Over-the-Horizon Farms

DOE Advanced Technology Demonstration

Phase 2 -
1: Prototypes
8

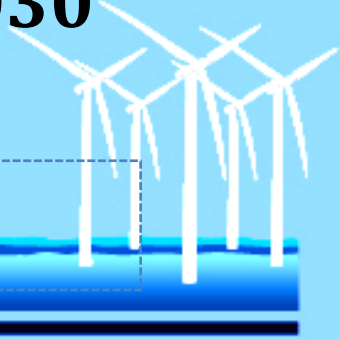
Phase 1 -
1:50 Scale

2011

2013

2017

Phase 3 -
Pilot Farm:
12 MW



2020

Phase 4 -
500 MW Farm

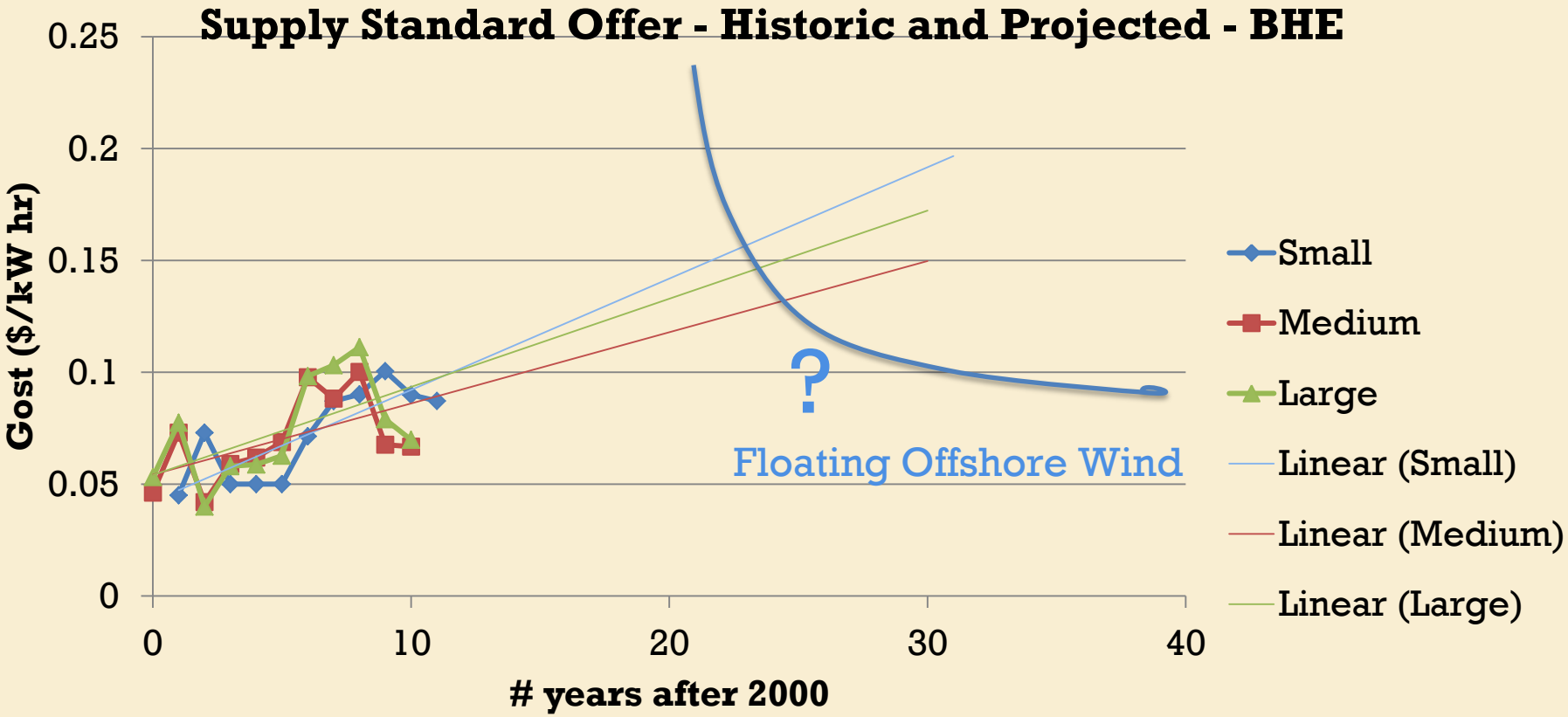
2030

Phase 5 -
5 GW by 2030s

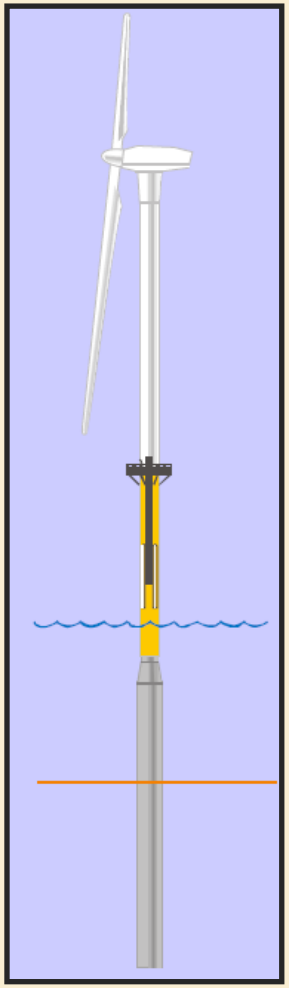
THE UNIVERSITY OF MAINE

#1 Technical Challenge:

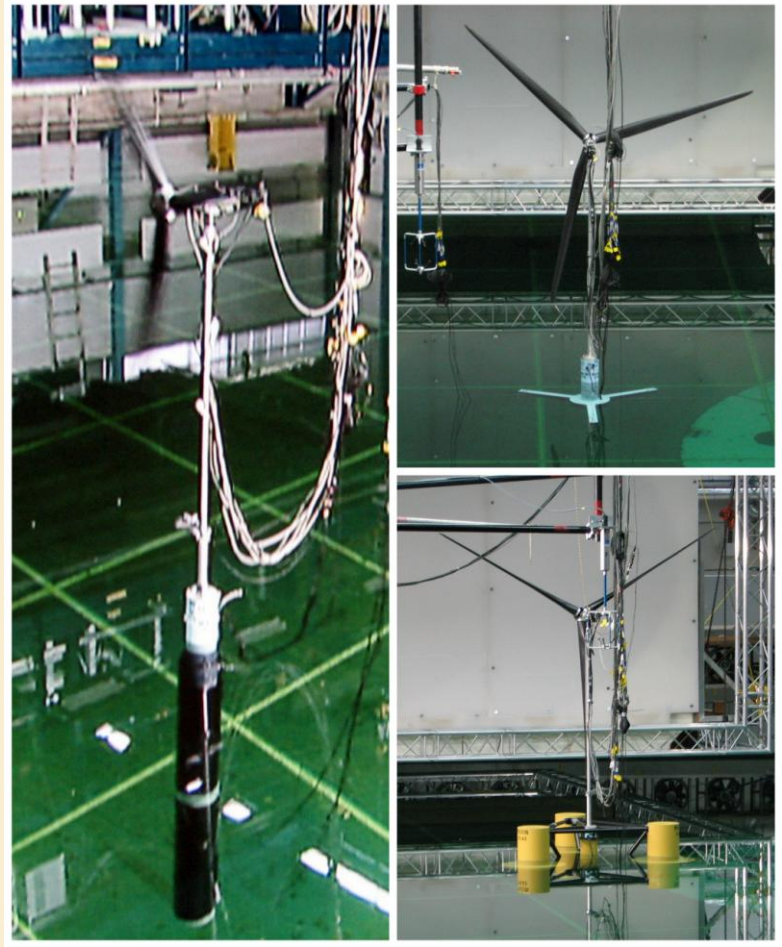
Reduce the Cost of Offshore Wind



VolturnUS Avoids Expensive Offshore Construction Assets



3 Hulls, 60 Metocean Conditions



All viable!
Choice depends on local conditions

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VolturnUS Paradigm Shift:

Use Civil Engineering versus Offshore "Oil & Gas" Assets

New England Considerations

- Limited cost-effective heavy steel fabrication capabilities.
- Limited or no access to large vessels/ floating cranes.
- Significant experience constructing concrete for heavy bridges
- Highly efficient modular construction

Access to better wind resource

>50% gross Capacity Factors farther offshore

> 9 m/s wind

Construction of VolturnUS 1:8 at UMaine Offshore Wind Lab


VOLTURNUS 1:8

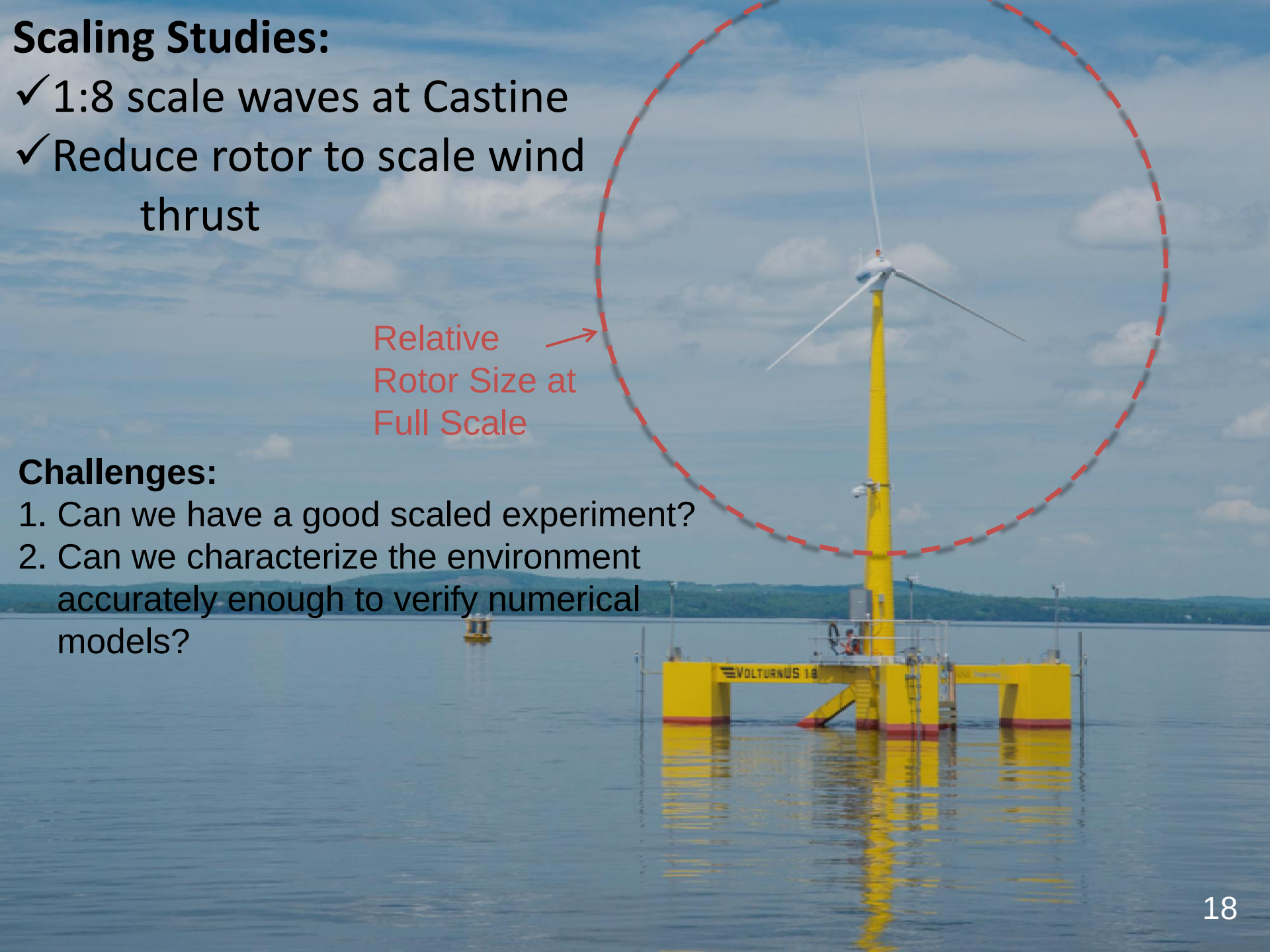
VolturnUS 1:8 Tow-out Validated


VOLTURNUS
MAINE

Scaling Studies:

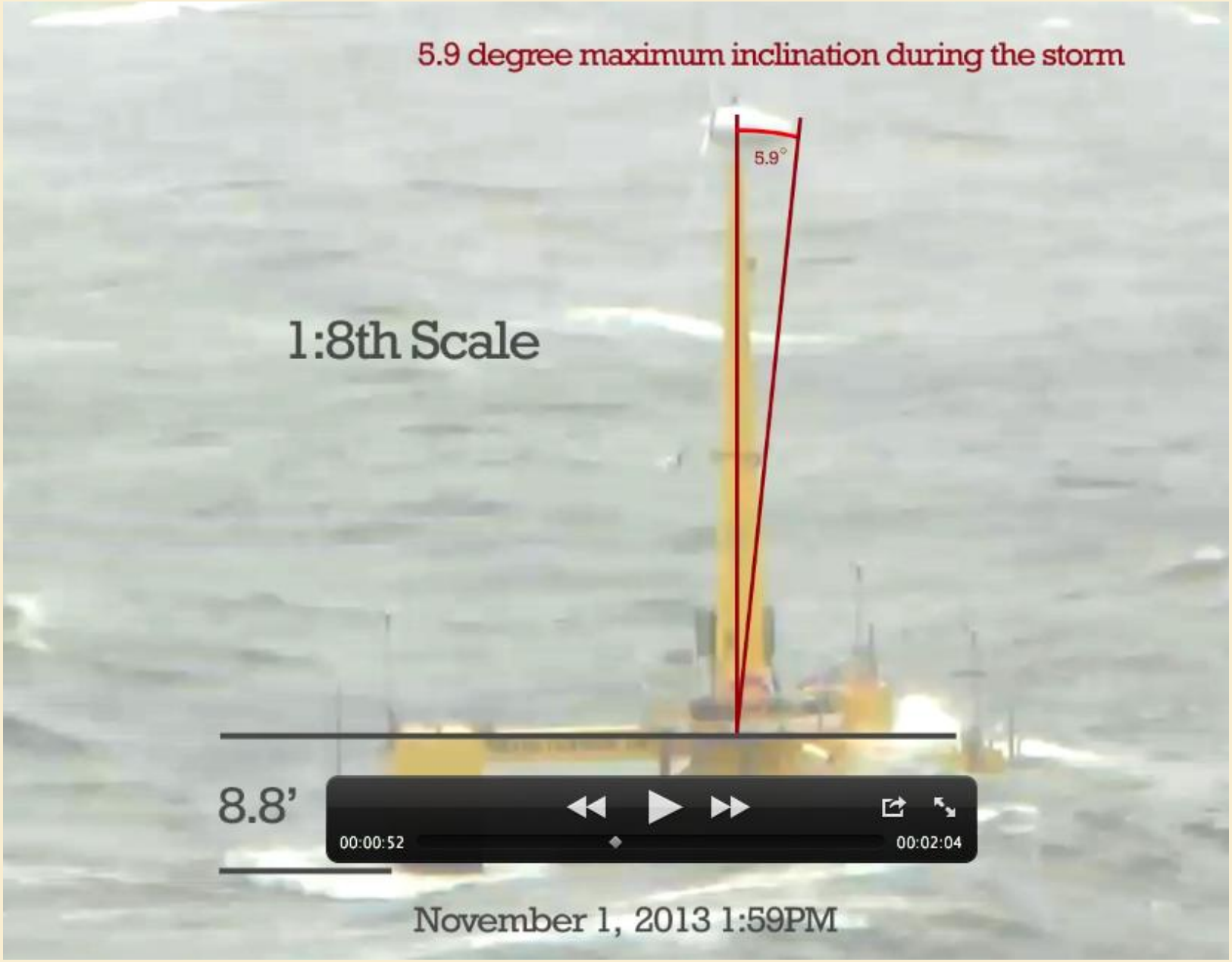
✓1:8 scale waves at Castine

✓Reduce rotor to scale wind thrust



Challenges:

1. Can we have a good scaled experiment?
2. Can we characterize the environment accurately enough to verify numerical models?



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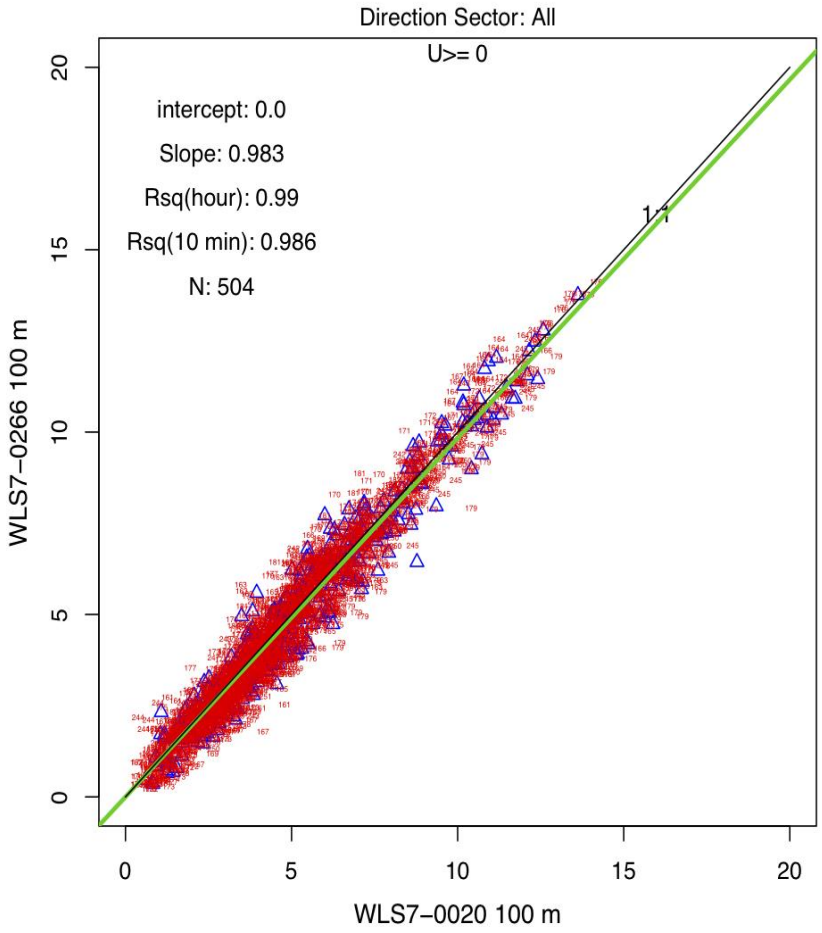
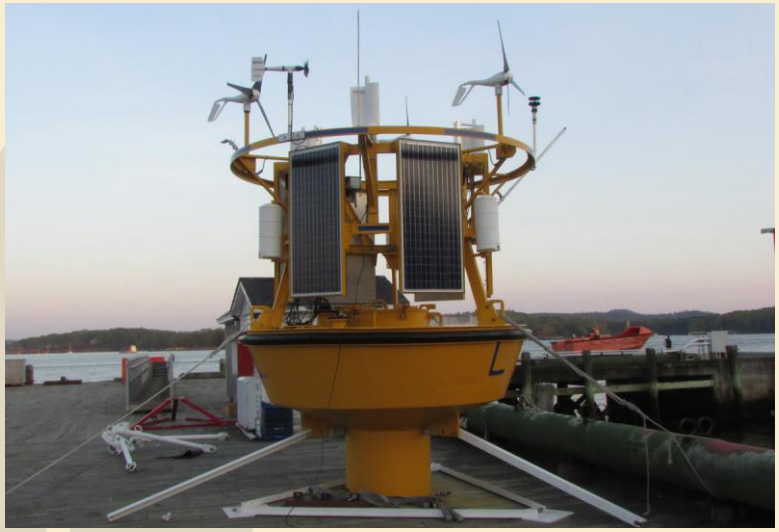
VOLTURNUS 1:8
Operational Footage From The Winter Storm "Electra"
December 15, 2013
Castine, ME
Contact:
00:00:08
00:01:02

DeepC*LIDAR* Built, Deployed, Validated





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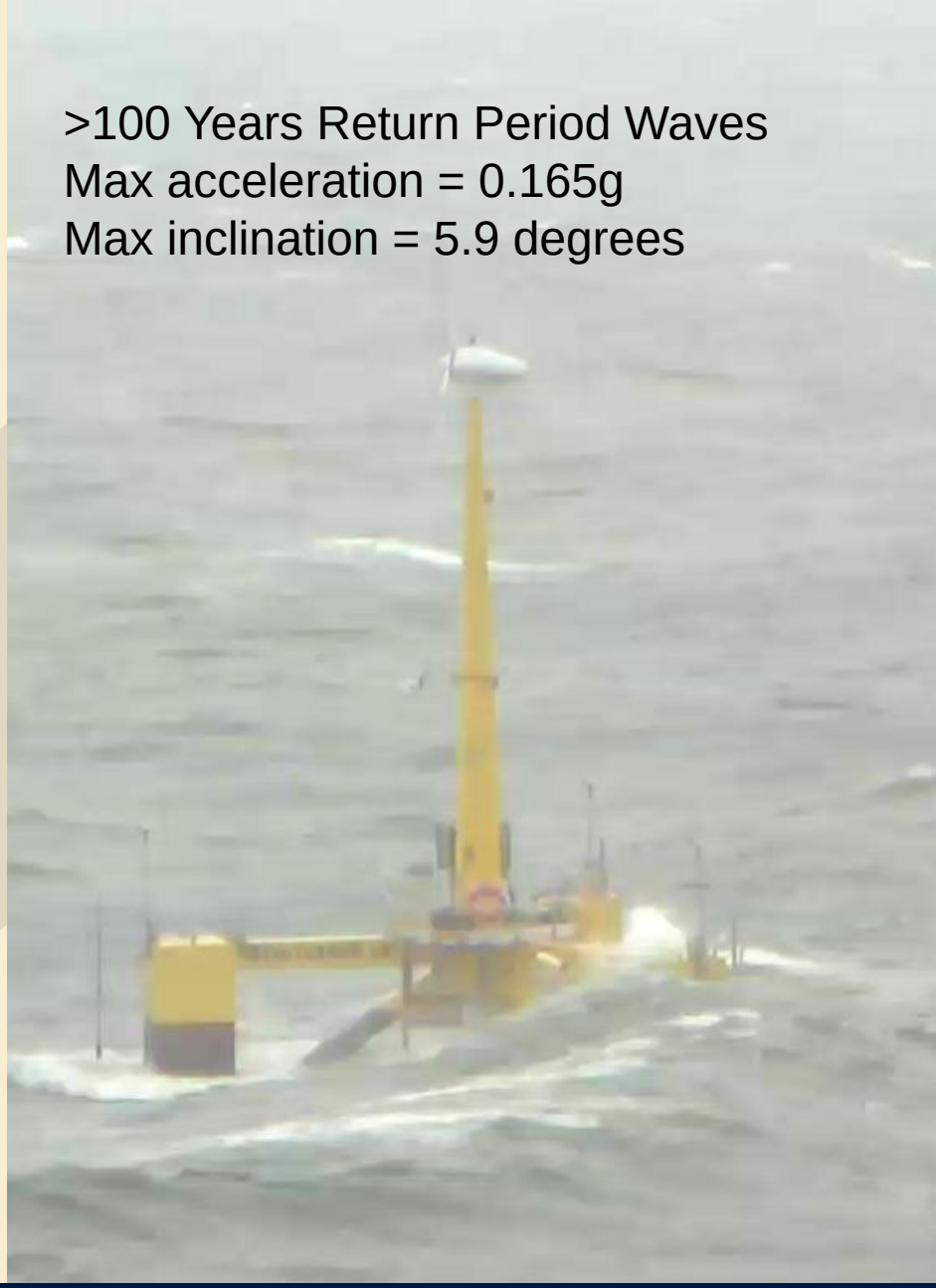
VolturnUS 1:8

Extreme Event: Nov. 1, 2013

Wave (m)	Return Period (years)
19.0	50
19.5	100
21.5	**Measured - scaled**
22.3	500

>100 Years Return Period Waves
Max acceleration = 0.165g
Max inclination = 5.9 degrees



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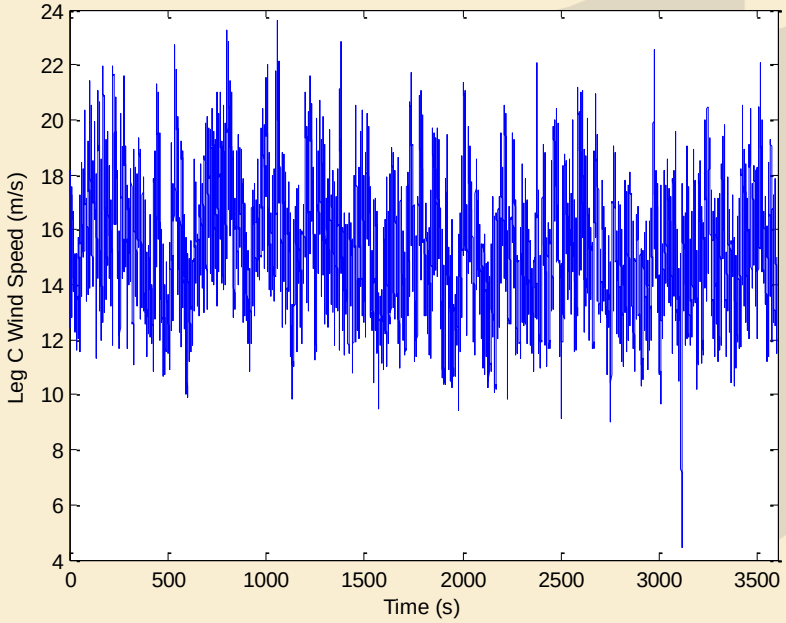
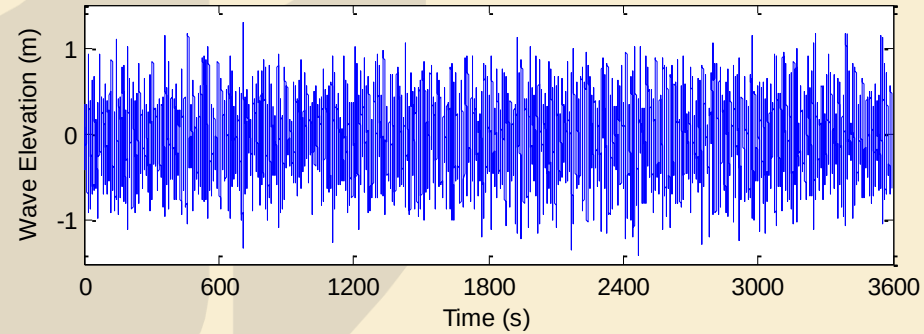
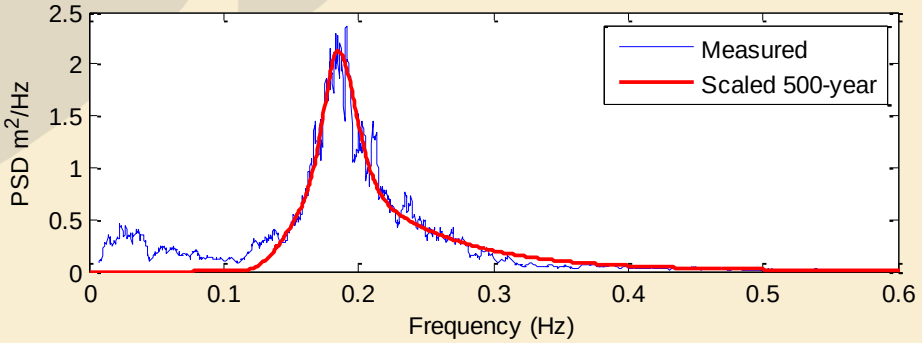
Environment for Model Correlation Study

Nov. 27, 2013, 12:51:54 PM to 1:51:58 PM

- U_{avg} = 15.4 m/s, U_{max} = 23.6 m/s **Produces rated thrust**
- H_s = 1.6 m, T_p = 5.2 s, H_{max} = 2.6 m **Between 100-500 years RP**







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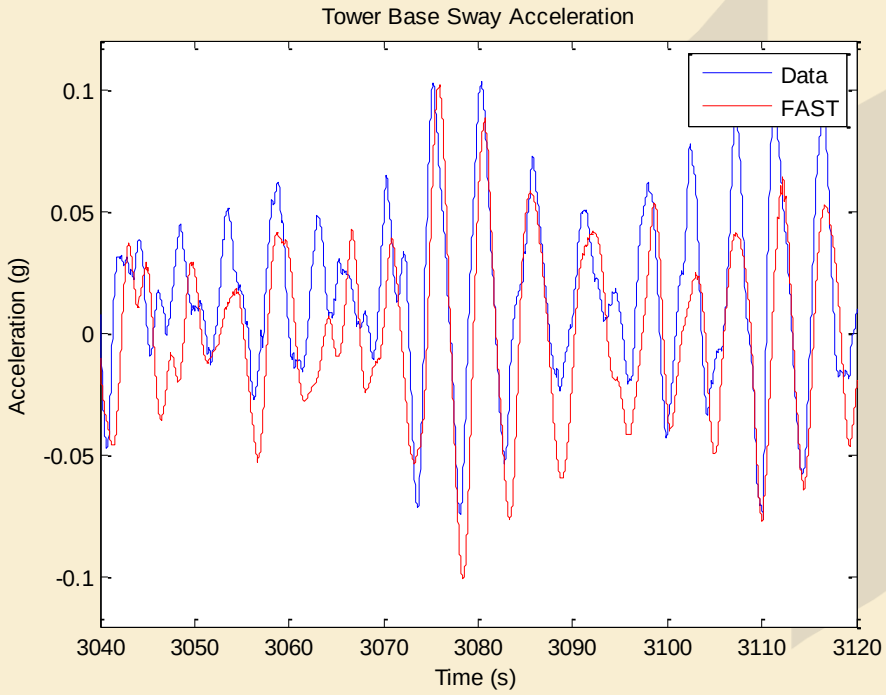
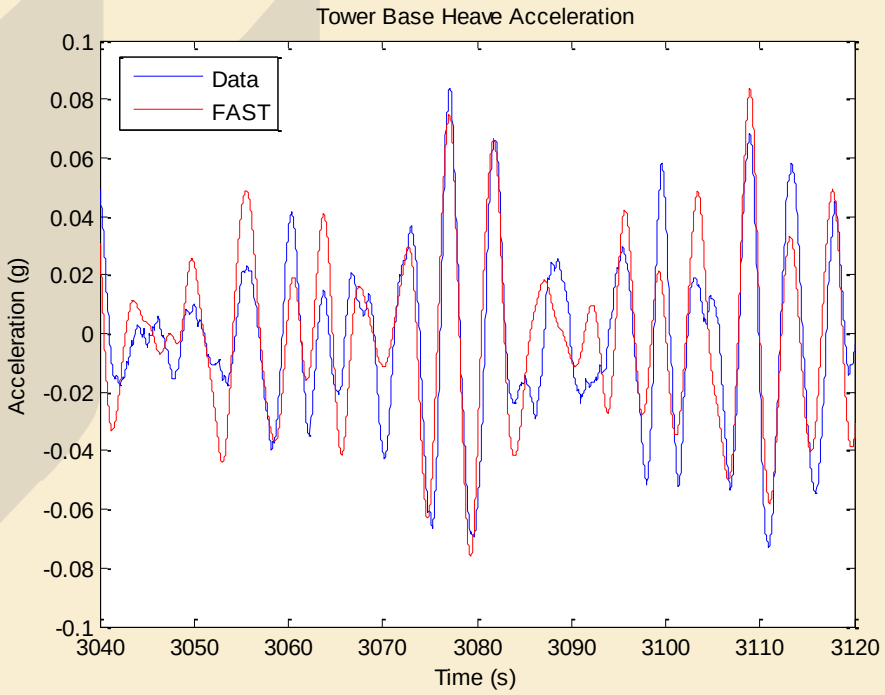
Removed Technology Risk:
Close Agreement Measured vs Simulation

Base Sway acceleration



Base Heave acceleration



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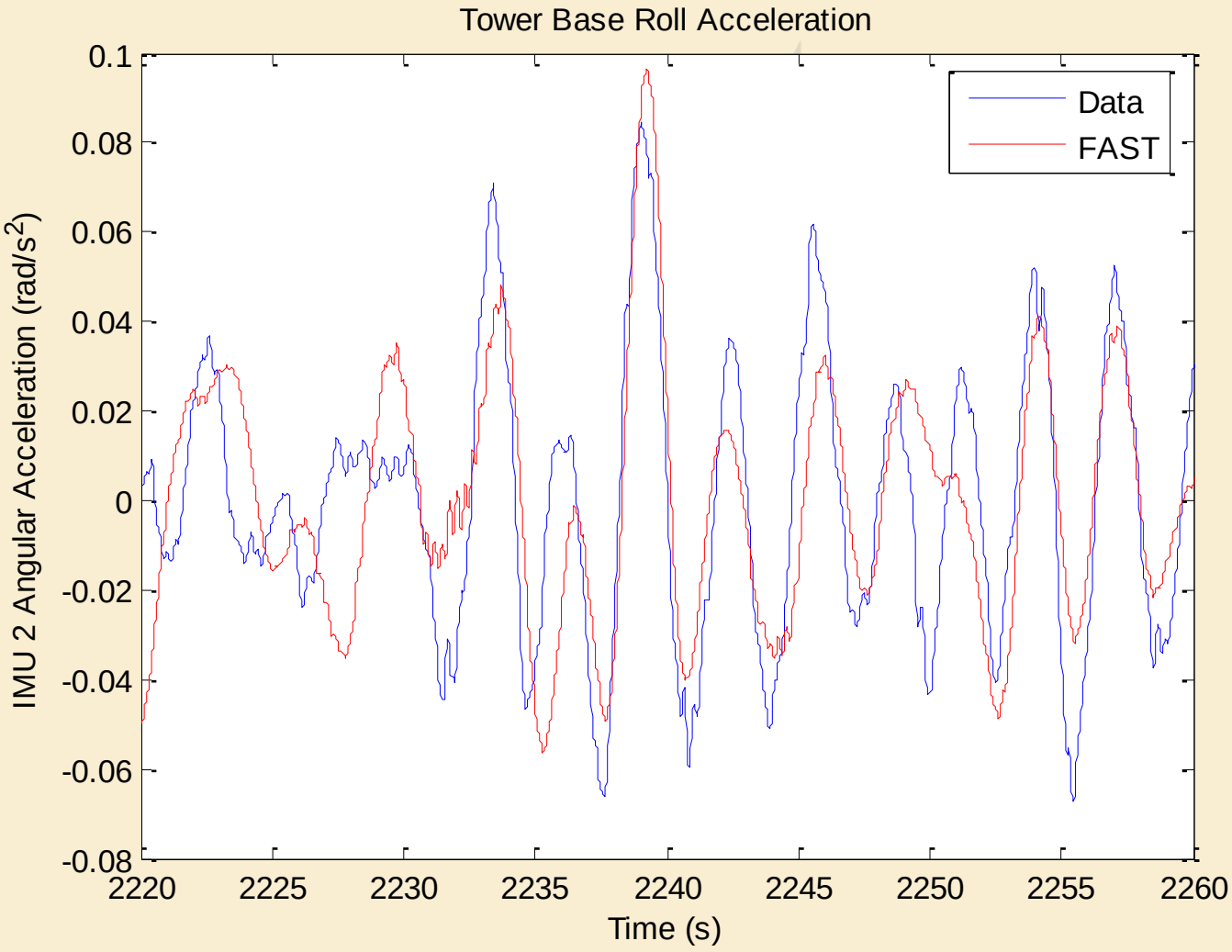
Platform Angular Acceleration

Measured vs Simulation



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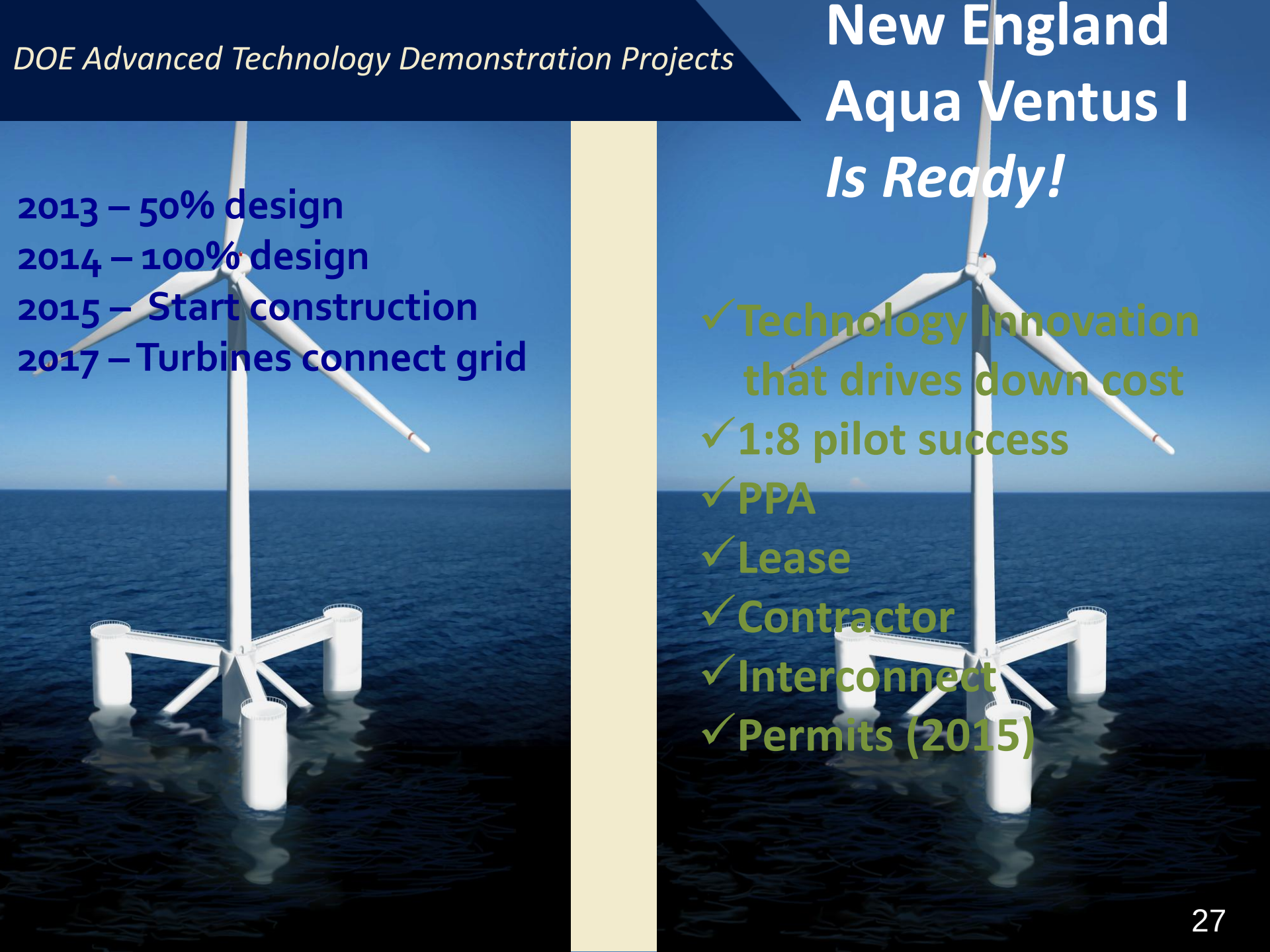
New England Aqua Ventus I *Is Ready!*

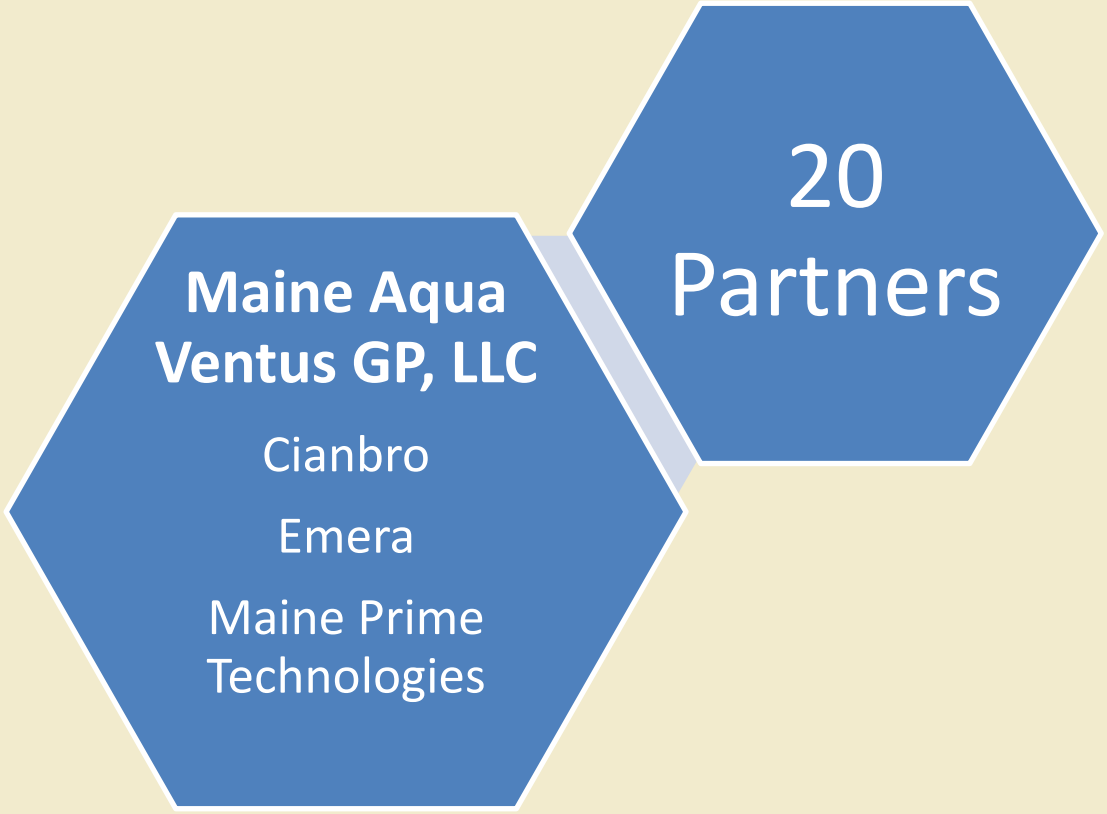


2013 – 50% design
2014 – 100% design
2015 – Start construction
2017 – Turbines connect grid

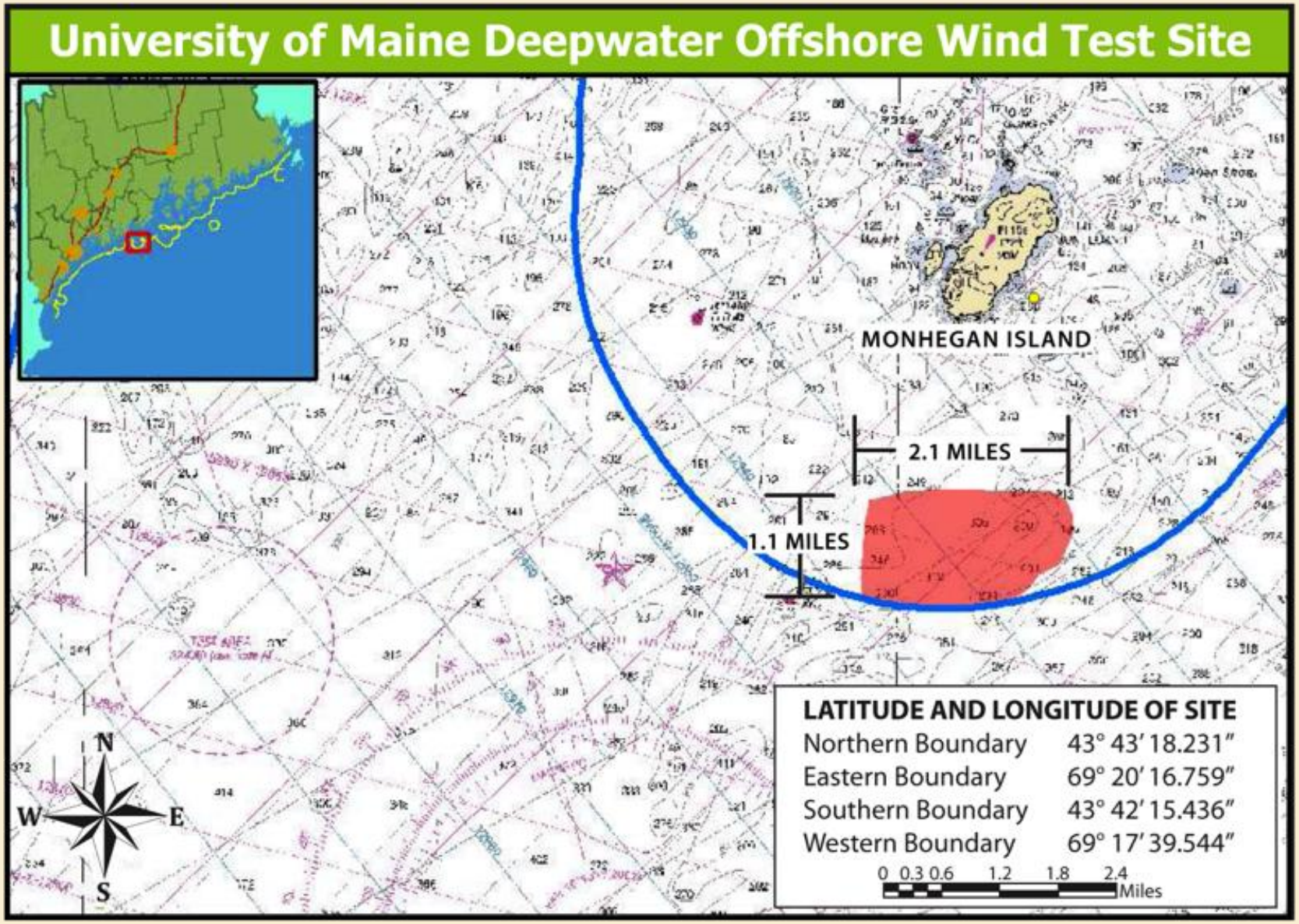
- ✓ Technology Innovation that drives down cost
- ✓ 1:8 pilot success
- ✓ PPA
- ✓ Lease
- ✓ Contractor
- ✓ Interconnect
- ✓ Permits (2015)

20-year Power Purchase Agreement: Maine Aqua Ventus, LP formed

Maine PUC Proposal Submitted August 2013
23 cents/kWh Term Sheet Decision January 2014



University of Maine Deepwater Offshore Wind Test Site



Visual and Sound Models at Site

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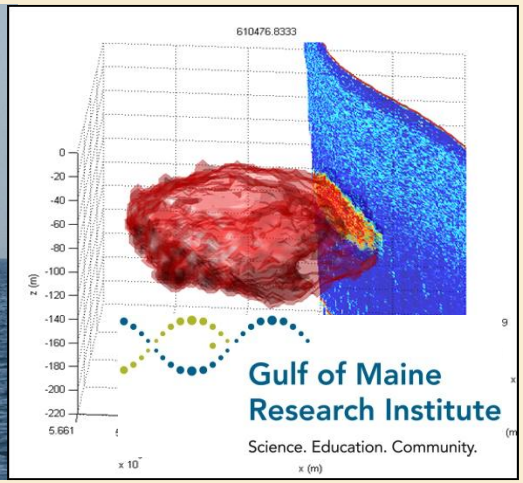
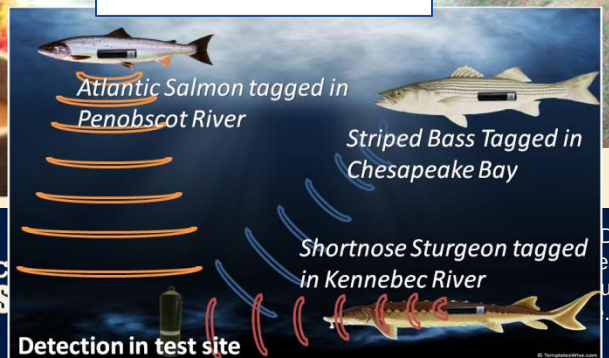
Environmental Baselining at Test Site



Community and Stakeholder Outreach 2010-2014



In Castine, Maine, on June 13, 2013, at noontime, the first offshore wind electrons started to flow into the US electricity grid.

2017- Pilot Project
2020's – Commercial Floating Farms

Thank you!

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