SAND2017-5042PE

U.S. DOE MHK Composite Materials & Structures Database Webinar

FY17 Call for Samples

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Team Introductions:

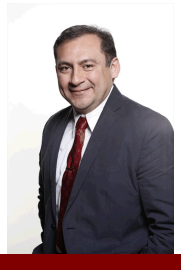
- Sandia National Laboratories
  - Bernadette A. Hernandez-Sanchez
  - Budi Gunawan

- Pacific Northwest National Laboratory
  - George Bonehyo (WSU)

- National Renewable Energy Laboratory
  - Scott Hughes

- Montana State University
  - David Miller

- Florida Atlantic University
  - Francisco Presuel-Moreno



Our Program's Goal is to address barriers and uncertainty in using composite materials for MHK.

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Material Design Tools for Marine and Hydrokinetic Composite Structures

Objective: Helping MHK industry reduce uncertainty in using composites in their designs

- Providing an *industry approved* U.S. DOE MHK Composite Materials & Structures Database (*open resource*): http://energy.sandia.gov/energy/renewable-energy/water-power/technology-development/advanced-materials/mhk-materials-database/
- Mitigating composite biofouling/environmental effects & metal-carbon fiber interconnect corrosion in saltwater
- Examining MHK load challenges on composite material & substructure performance to improve design

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Pacific Northwest NATIONAL LABORATORY

NREL NATIONAL RENEWABLE ENERGY LABORATORY

MONTANA STATE UNIVERSITY

FAU FLORIDA ATLANTIC UNIVERSITY

MHK Composites Barriers & Needs

***Top Barriers Identified to Using Composites for MHK include*:**

- Uncertainty in materials properties and selection for component **(Short-Mid Term).**
  - Industry wants to know if composites are the right materials to invest in? Why?
- Uncertainty in design with limited design tools & methodologies available **(Mid-Long Term**).
- Composites reliability and maintenance (inspection, repair) is not well understood **(Mid-Long Term).**
- Limited guidance on composites manufacture and assembly available to MHK developers (Long Term).
- Weight and transportation issues affect current designs and manufacture (Long Term).
- Materials cost will affect final design ($/lb) (Long Term).

Short 1-5 (yrs).
Mid 5-10
Long 10-20

Top Composite Research Needs include:

- Reduce uncertainty of materials selection by evaluating performance properties of coupons and subcomponents in artificial and actual saltwater environments (Short-Long Term).
- Evaluate MHK environmental effects on joints, seals, and fasteners of dissimilar materials in order to facilitate complex geometries and modularity (Mid to long term).
- Test component at full-scale structures to facilitate design optimization (Mid-Long Term).
- Identify failure mechanisms and damage tolerances (Short-Long Term).
- Determine the influence of the manufacturing process on the structural performance (Mid-Long Term).
- Determine what standards and certification process are needed for new materials to be employed in the MHK energy industry (Long Term).

What are others doing?

- Wave Energy Scotland: Structural Materials & Manufacturing Processes.
  - 10 awards on examining polymers, cements, hybrids (fiber composites), elastomers
  - Examining fundamental materials properties, loads, manufacture, and demonstration
- Other Composites Fiber Research:
  - influence of salt water on MHK materials properties and manufacturing using resin transfer moulding have been conducted primarily on tidal technologies.
  - combined cyclic loading and seawater diffusion on composites have been evaluated for tidal blades.
- However, there is still need to understand how coupling between cyclic loads and seawater.

The MHK Composite Materials & Structures Database was born from discovery in Wind Energy.

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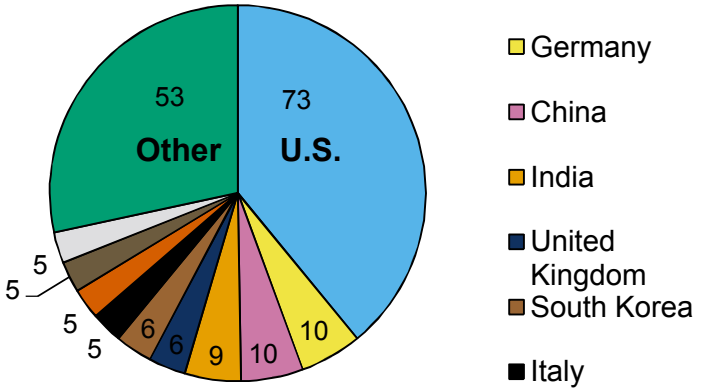
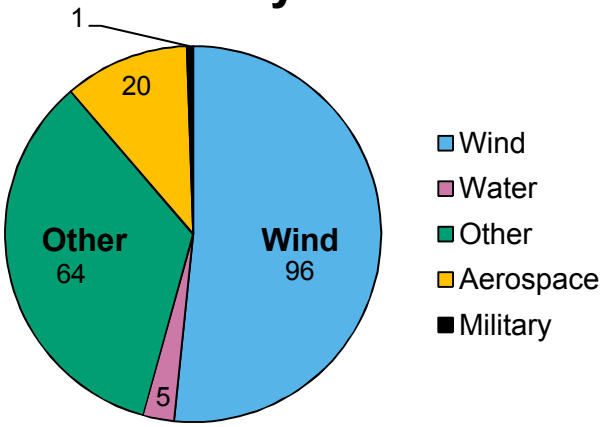
U.S. DOE MHK Composite Materials & Structures Database:

Benefits: Open Source, Industry Advised, Backed with Publications.

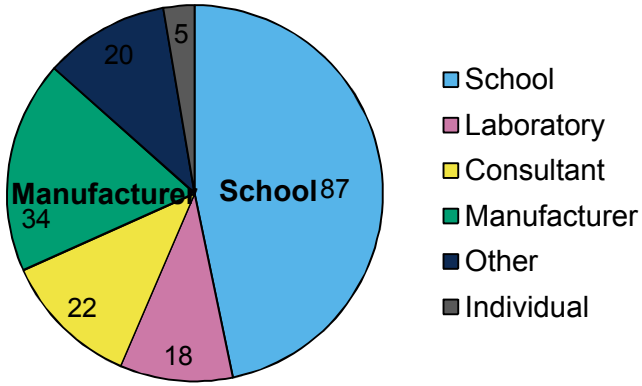
Location



Industry

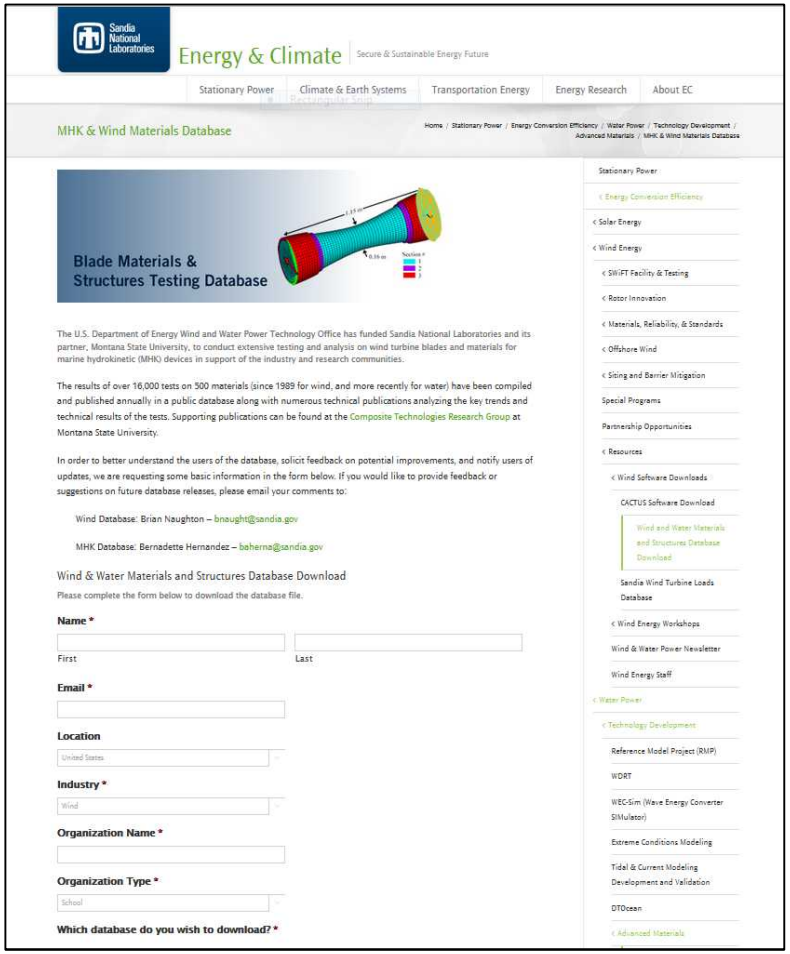


Organization Type

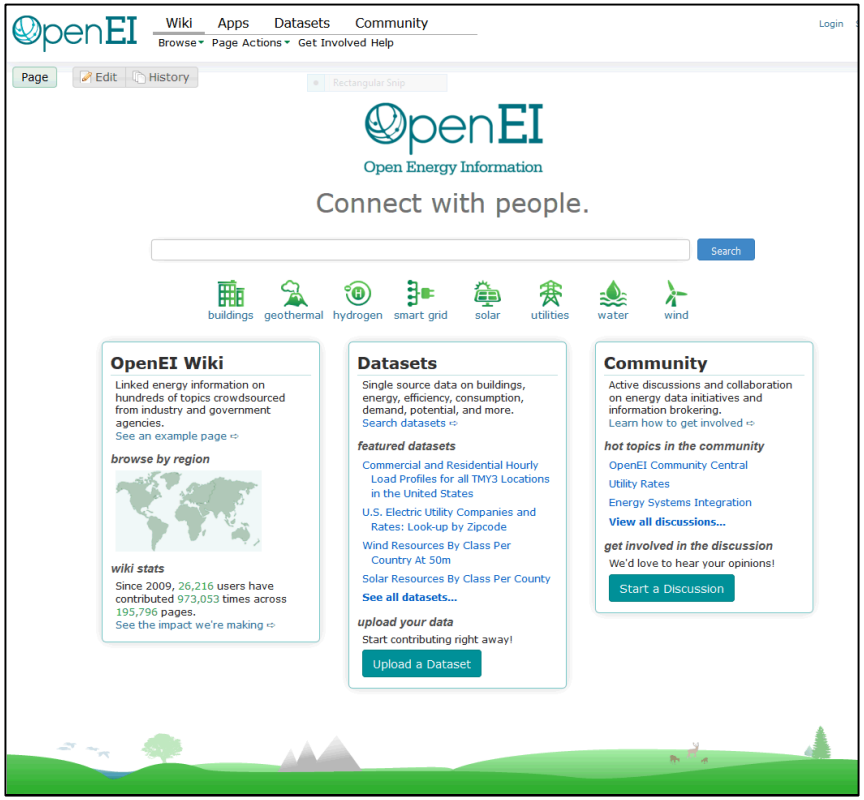


Current User Community of U.S. DOE Materials & Structures Database

Database can be found in 2 locations online and is free for users to download.



http://energy.sandia.gov/energy/renewable-energy/water-power/technology-development/advanced-materials/mhk-materials-database/



- Both the wind and water icons take you to webpages that house the link.
- Under Water Power Database and Tools

Call for samples to be performance tested when exposed to biofouling and saltwater.

- Coupon samples are needed for testing.
- FY17 Testing will take place at PNNL and MSU
- Developing substructure plan for FY18

Criteria for Biofouling Testing at PNNL

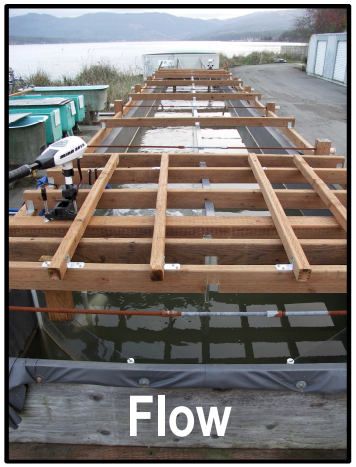
PNNL Marine Sciences Laboratory in Sequim , WA

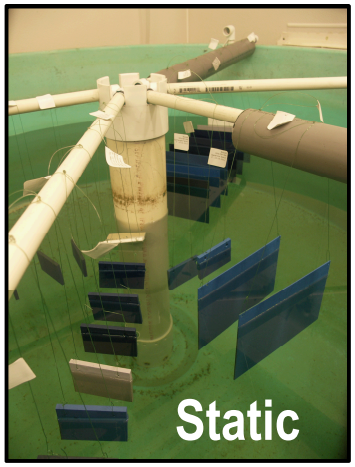
Evaluate under static & flow conditions with unfiltered natural seawater.

Two Tanks will be used:

1. Flow
2. Static

Short Term Testing at 3 months

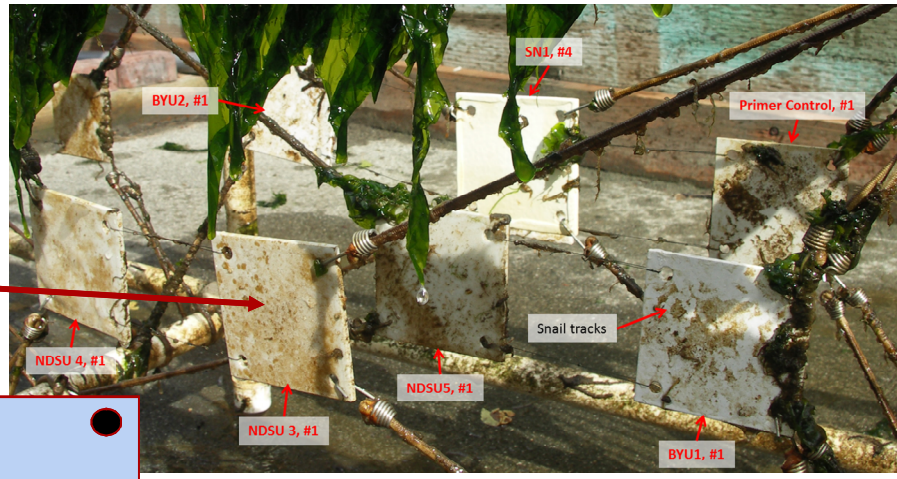




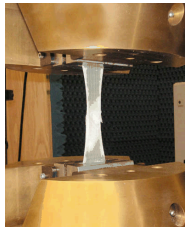
Example types and Numbers of Coupons Needed

For 1 data point:
(3) 8x8 in panels
(3) 3x3 in
(3) 4x4 in
(3) 1x1 in

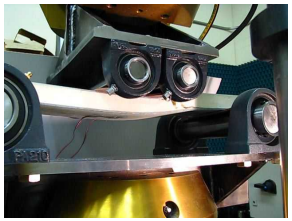
Sample geometry:
Need hole or clips for edges



Criteria for Composite Performance Testing at MSU

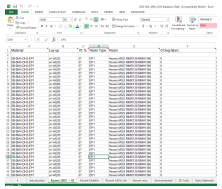


Coupons to Structural elements



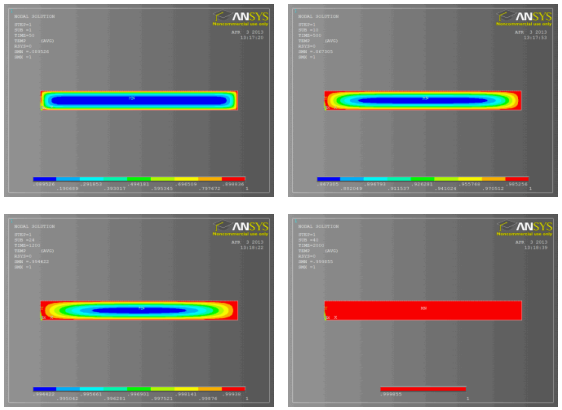
Elements to Substructure

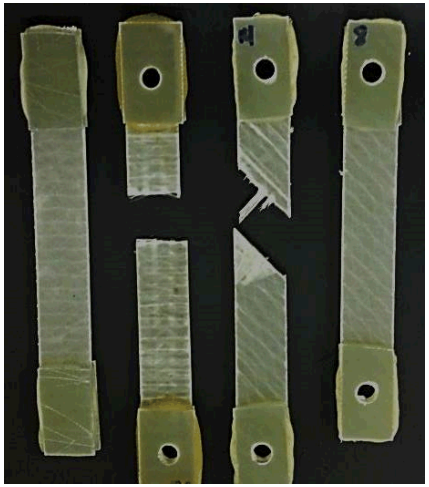
Testing to Dissemination



Three different conditions are of interest:

1. Dry State
2. Artificial Sea Water (partial to full saturation)
3. Actual Sea Water (partial to full saturation)





Example types and Numbers of Coupons Needed

Static and Fatigue Testing
For 1 data point at 1 condition
(5) 8x1 in dog bone
(5) 10x1 in

Developing Substructure Testing at NREL & MSU for FY18-19

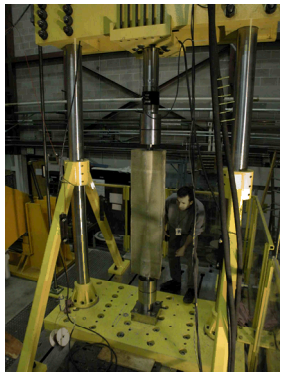
Developing test plan to examine joints, plys, …..and other elements of design

Three different conditions are also of interest:

1. Dry State
2. Artificial Sea Water (partial to full saturation)
3. Actual Sea Water (partial to full saturation)

- Full-scale and component testing
- Characterization, strength, and fatigue test capabilities
- 500 kN actuators, reaction stands to 17 MNm
- Extensive structural measurement equipment and condition monitoring systems

Test Frame at MSU



Important Dates and Contact Information

- Please email letter of intent by May 30th, 2017 to baherna@sandia.gov
- June 15, 2017 Collection Date for both MSU and PNNL sites.
- Samples will not be returned
- By submitting samples you agree to have data uploaded and publically disseminated in database.

Biofouling Characterization
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