1-14-2015

2015 AQ Summit: Research Update by Steve Von Vogt

Steve Von Vogt

Opportunities to Innovate in Aquaculture with Composite Materials

Presentation at
1st Annual Maine Aquaculture R&D Forum
January 14, 2015

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Maine Composites Alliance
Maine Wind and Ocean Energy Initiative

The Maine **Composites** Alliance

is...

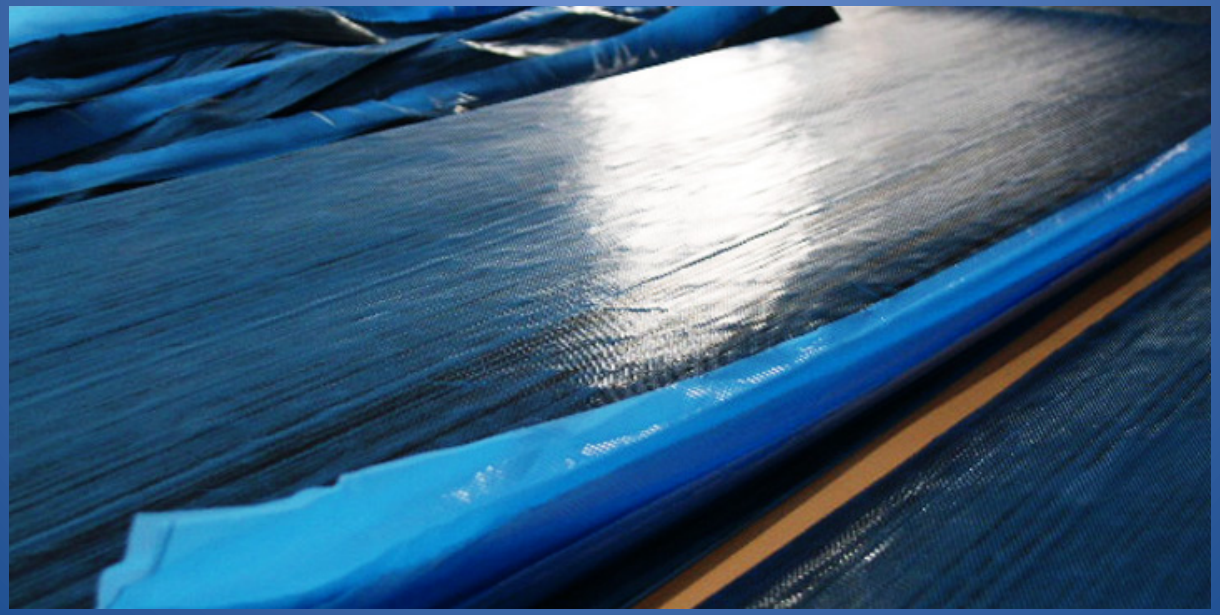
A Composites Industry Development Network

- Supports Education and Workforce Development
- Supports Research and Development
- Connect out of state companies with Maine partners
- Connect Maine industry solutions to world market needs

Composite Material:
Definition:

A combination of two or more constituent materials with significantly different physical or chemical properties, that when combined, produce a material with characteristics different from the individual components.

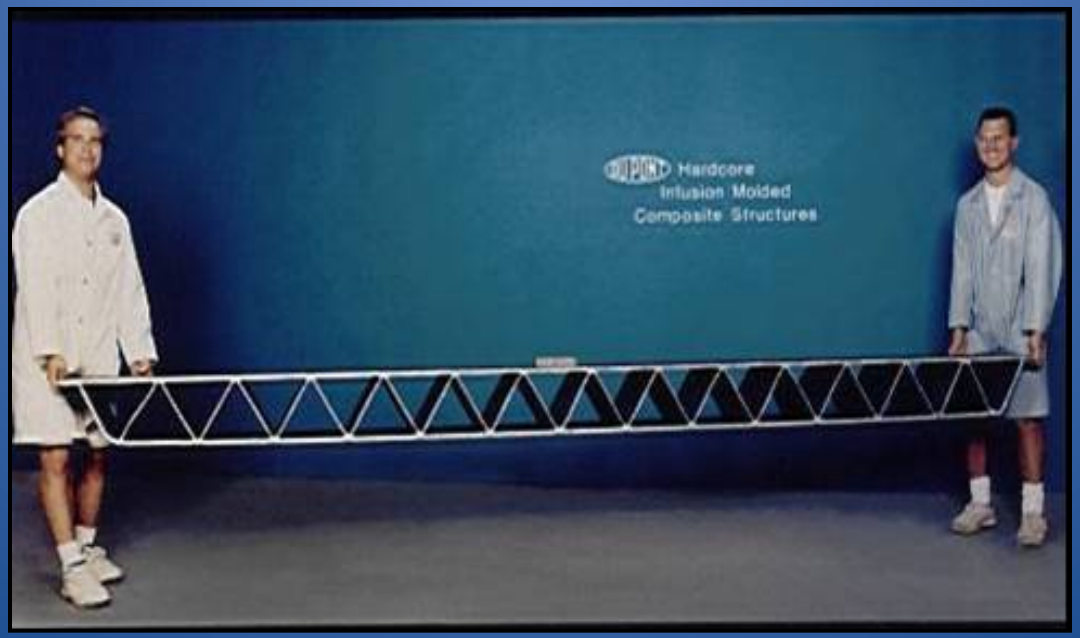
FRP= Fiber reinforced Plastics



Composites vs. Traditional Materials

Stronger and stiffer than metals on a density basis

- For the same strength, lighter than steel by 80% and aluminum by 60%
- Superior stiffness-to-weight ratios



Industry Application of Composites

- Boats and vessels for:
  - Luxury
  - Military
  - Commercial

Industry Application of Composites

- Industrial Application
  - Piping Systems
  - Bridges
  - Marine Infrastructure

Industry Application of Composites

- Off Shore Buoys and floatation
- Aerospace

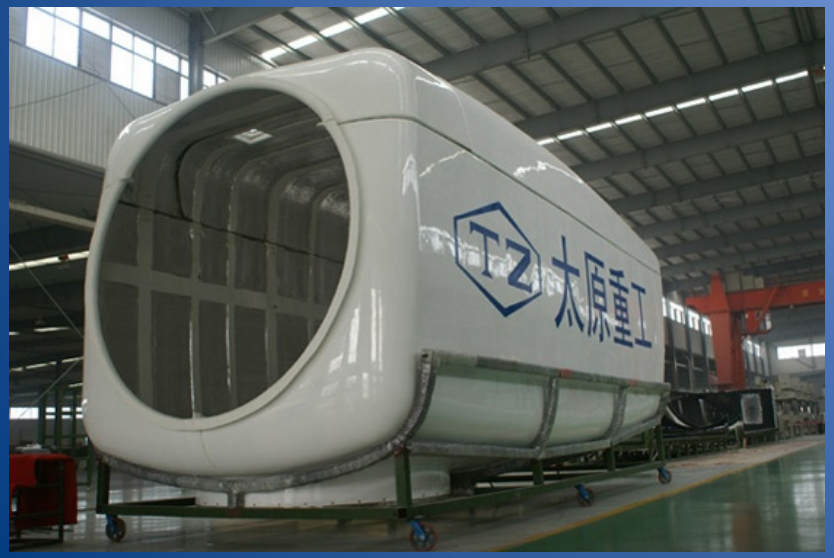
Comparative Application: Offshore oil composite uses

Reduce Weights and Corrosion Maintenance Costs:

1. Composite Grids/ Gratings
2. Hand rails & Ladder Components
3. Aqueous Piping System
4. Water & fuel storage tanks, Vessels
5. Low pressure composite valves
6. Spoolable type thermosetting tubes
7. Sump Caissons and pull tubes
8. Cable support systems
9. Modular paneling for partition walls
10. High pressure accumulator bottles
11. Flexible & Floating Risers, Drill pipe
12. Sub – sea structural components
13. Boxes, housings and shelters
14. Fire water pump casing & sea water lift pump casing
15. Tendons
16. Offshore bride connecting between platforms
17. Blast & Fire protection

Current application in Wind Industry:

Blades and
Nacelle Housing



Some experimentation with towers and shafts

Maine Composite Products

Maine Partners for Composite Opportunities

Companies with expertise in Deep Water Solutions:

- Floating Oil Exploration Platforms
- Composite Buoy and Float Platforms
- Composite Marine Infrastructure
- North Atlantic Environment Expertise

Opportunities in Maine

R&D:

- Composite Material Testing
- Manufacturing processes
  - Automated Construction
- Blade design an
- Deepwater prototyping

Advanced Structures & Composites Center

Why Use Composites for Marine Systems?

- Composite materials are not subject to corrosion degradation.
- Complex shapes are easily formed with composites.
- Lightweight composite structures are easy to handle and require smaller control machinery.
- Sandwich laminates are ideal for resisting hydrostatic loads.
- Composite laminates have excellent fatigue characteristics.

Ocean Environment

Corrosion

Recent studies estimate the direct cost of corrosion in the United States to be nearly$300 billion dollars per year.

Extreme Waves

On the open sea, waves can commonly reach seven meters in height or even up to fifteen in extreme weather. In contrast, some reported rogue waves have exceeded thirty meters in height.

Examples of Large Composite Marine Structures

VolturnUS Wind
Platform - Umaine

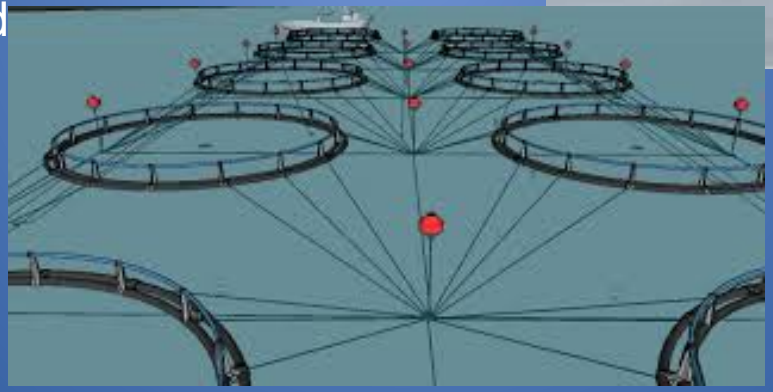
Ocean Farms Technology
Fish Farm Cage

Composite Drilling
Riser Developed by
Aker Kvaerner Subsea

Opportunities to Innovate

Engineering and Automation

Advanced Materials



Mooring Systems

Summary

• Composite materials are well suited for marine aquaculture applications because they are non-corrosive and have good fatigue life.

• Directional properties of composites permit design optimization but loads, material properties and failure modes need to be defined.

• The physical properties of composite structures are defined during fabrication, so quality assurance procedures are paramount.

• Composites are especially attractive to build complex shapes, when weight is critical, and when manufacturing