Material Property Testing

Accredited through International Accreditation Services, Inc., the UMaine Composites Center offers a wide range of standard material property tests, including:

Plastic Materials	ASTM D256	Determining the Izod Pendulum Impact Resistance of Plastics
	ASTM D635	Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
	ASTM D638	Tensile Properties of Plastics
	ASTM D695	Compressive Properties of Rigid Plastics
	ASTM D696	Coefficient of Linear Thermal Expansion of Plastics Between -30 °C and 30 °C with a Vitreous Silica Dilatometer
	ASTM D790	Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
	ASTM D792	Density and Specific Gravity (Relative Density) of Plastics by Displacement
	ASTM D953	Bearing Strength of Plastics
	ASTM D2765	Standard Test Methods for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics (Methods A and C)
	ASTM D3846	In-plane Shear Strength of Reinforced Plastics
	ASTM D4065	Standard Practice for Plastics: Dynamic Mechanical Properties: Determination and Report of Procedures
	ASTM D4812	Unnotched Cantilever Beam Impact Strength of Plastics
	ASTM D6109	Flexural Properties of Unreinforced and Reinforced Plastic Lumber
	ASTM D6110	Determining the Charpy Impact Resistance of Notched Specimens of Plastics
Composite Materials	ASTM C393	Flexural Properties of Sandwich Constructions
	ASTM D2344	Short-beam Strength of Polymer Matrix Composite Materials and Their Laminates
	ASTM D2584	Ignition Loss of Cured Reinforced Resins
	ASTM D3039	Tensile Properties of Polymer Matrix Composite Materials
	ASTM D3410	Compressive Properties of Polymer Matrix Composite Materials with Unsupported Gage Section by Shear Loading
	ASTM D3479	Tension-Tension Fatigue of Polymer Matrix Composite Materials
	ASTM D3518	In-plane Shear Response of Polymer Matrix Composite Materials by Tensile Test of a ± 45o Laminate
	ASTM D4255	Standard Guide for Testing In-plane Shear Properties of Composite Laminates
	ASTM D5379	Shear Properties of Composite Materials by the V-Notched Beam Method
	ASTM D5528	Mode I Interlaminar Fracture Toughness of Unidirectional Fiber-Reinforced Polymer Matrix Composites
	ASTM D5766	Open Hole Tensile Strength of Polymer Matrix Composite Laminates
	ASTM D6115	Mode I Fatigue Delamination Growth Onset of Unidirectional Fiber-Reinforced Polymer Matrix Composites
	ASTM D6641	Compressive Properties of Composite Laminates Using a Combined Loading Compression (CLC) Fixture
	ASTM F1679	Using a Variable Incidence Tribometer (VIT)
Adhesives	ASTM D905	Strength Properties of Adhesive Bonds in Shear by Compression Loading
	ASTM D1101	Integrity of Adhesive Joints in Structural Laminated Wood Products for Exterior Use
	ASTM D2339	Strength Properties of Adhesives in Two-Ply Wood Construction in Shear by Tension Loading
	ASTM D2559	Standard Specification for Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions
	ASTM D3165	Strength Properties of Adhesives in Shear by Tension Loading of Single-Lap-Joint Laminated Assemblies

In addition, ISO and IEC standards within our accreditation scope are:

IEC 61400-23 Full-scale Structural Testing of Rotor Blades
ISO 62 Determination of Water Absorption
ISO 178 Determination of Flexural Properties
ISO 527 Determination of Tensile Properties, 1 - 5
ISO 604 Determination of Compression Properties
ISO 844 Determination of Compression Properties
ISO 845 Determination of Apparent Density
ISO 1887 Determination of Combustible Matter Content
ISO 1889 Determination of Linear Density
ISO 2896 Determination of Water Absorption
ISO 3344 Determination of Moisture Content
ISO 3374 Determination of Mass per Unit Area
ISO 14130 Determination of Apparent Interlaminar ShearStrength by Short Beam Shear Method

Rev. 02/2019

Wind Blade Testing

Design, Fabricate and Test Under One Roof

The University of Maine Advanced Structures and Composites Center's award winning research staff help clients take innovations from concept through design validation. The 8100 m², $160 million laboratory employs more than 150 people with expertise in large-scale and coupon-level instrumentation and testing, composites manufacturing and analysis, finite element analysis and other modeling techniques. UMaine Composites Center faculty and staff may be engaged to jointly develop products, or may be contracted to fabricate and test composite or concrete products.

Laboratories

Offshore Wind Lab
with 605 m² strongfloor
Structural Testing Lab
with 240 m² strongfloor
Kenway Composite Materials Lab
125 m², environmentally controlled
Mechanical Testing Lab
110 m², environmentally controlled
Polymer Characterization Lab
230 m²

Blade Testing in Offshore Wind Lab

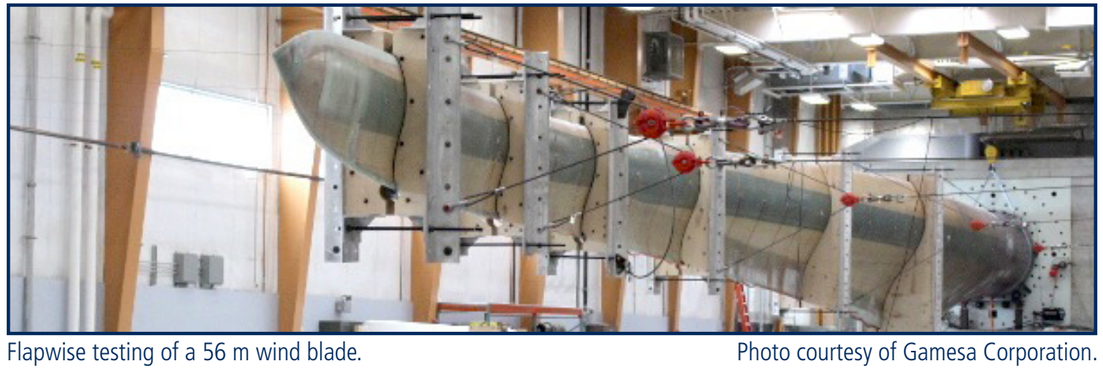
- 605 m² strongfloor
- Blade lengths up to 70 m
- Reaction wall static capacity > 30,000 kN·m
- Reaction wall fatigue capacity > 20,000 kN·m
- MTS FlexDAC and AeroPro testing systems
- Six winch frames with 130 kN static capacity
- Servohydraulic actuators to 2000 kN capacity
- MTS inertial resonance excitation systems
- Complete fixturing and instrumentation services

Manufacturing Technology

- Prepreg, tape and fiber lay-up
- Vacuum assisted resin transfer molding
- SCRIMP
- Extrusion and filament winding
- Injection and compression molding
- Property enhancement using nanomaterials
- Low-logistics concrete formwork
- Hybrid concrete / composite structures

Design Capabilities

- Computer aided design in SolidWorks or AutoCAD
- Finite element analysis in ANSYS or ABAQUS
- Nonlinear material modeling including impact and fatigue
- Multiphysics simulation in LS-DYNA
- Aeroelastic wind turbine analysis in FAST
- Hydrostatic design and damage stability analysis in GHS
- Hydrodynamic analysis in Multisurf, WAMIT and Aqwa
- Coupled analyses, floating offshore wind focus



Flapwise testing of a 56 m wind blade. Photo courtesy of Gamesa Corporation.

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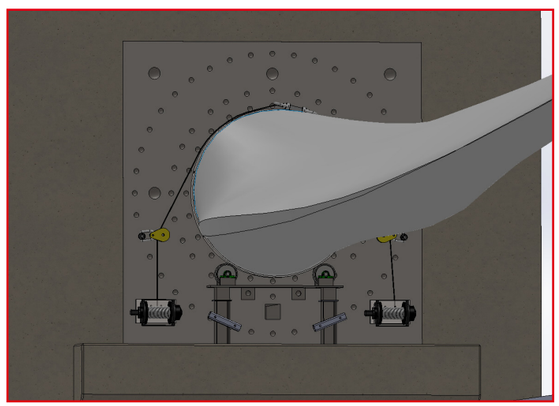
TESTING CAPABILITIES

The UMaine Composites Center is an ISO 17025 accredited laboratory with more than 20 years of testing experience meeting industry standards from coupon-scale to full-scale, including wind blade testing to IEC 61400-23. Our competnance and responsiveness have led to more than 500 product development and testing projects. The Offshore Wind Laboratory includes fully equipped, integrated laboratories to develop and test durable, lightweight, corrosion-resistant material solutions for the emerging offshore wind industry.

IEC 61400-23 WIND BLADE TESTING

- Static proof loads to > 30,000 kN·m
- Fatigue loads to > 20,000 kN·m
- Natural frequency and damping measurements
- Blade rotation system with >150 kN·m brake system
- Digital image correlation to characterize surface buckling
- Rolling ultrasonic probe to inspect adhesive joints

Offshore Wind Laboratory reaction wall



Offshore Wind Laboratory blade rotation system

STRUCTURAL TESTING EQUIPMENT

Servohydraulic static and dynamic tests
- MTS AeroPro control system
- MTS FlexDAC data acquisition system

Structural test frames (vertical reaction)
- 3 x 1300 kN capacity
- 1 x 450 kN capacity
- 1 x 220 kN capacity

Structural test walls
- 6 x 3200 kN·m capacity
- 1 x >30,000 kN·m capacity

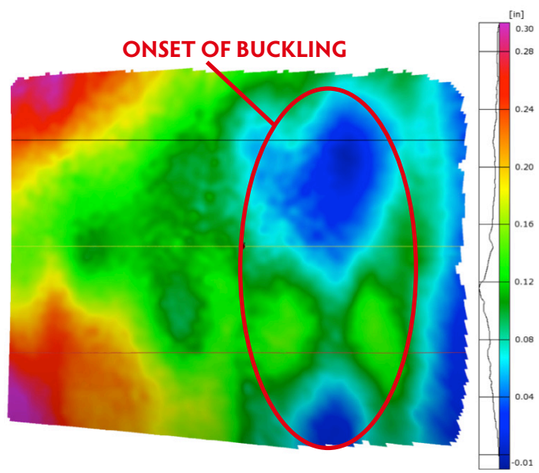
Winch frames
- 6 x 130 kN capacity

Servohydraulic actuators, including:
- 2 x 1300 kN (2000 kN in compression)
- 3 x 450 kN
- 3 x 250 kN
- 3 x 100 kN, 1 high-speed (1.2 m/s)

Hydraulic power supplies:
- 280 kW in Offshore Wind Laboratory
- 170 kW in Structural Testing Laboratory

NONCONTACT DISPLACEMENTS AND STRAINS

- GOM ARAMIS optical 3D deformation analysis
- Displacement resolution 0.1 mm over large surfaces
- Strain distributions around joints
- up to 50 MegaPixel camera resolution



Surface displacement by 3D digital image correlation

MATERIAL COUPON TESTING EQUIPMENT

Servohydraulic tension-compression test frames
- 1 x 500 kN capacity
- 3 x 100 kN capacity
- 1 x 25 kN capacity

Servohydraulic axial / torsional test frames
- 1 x 100 kN / 1100 N·m capacity
- 1 x 25 kN / 100 N·m capacity

Drop weight impact testing machine, 1.5-1250 J

NON-DESTRUCTIVE TESTING

- Phased-array ultrasonic inspection
- Acoustic emission testing
- Embedded fiber optic strain sensing

MICROSCOPY

- Optical microscopy
- Scanning electron microscopy (SEM)
- Environmental SEM
- Transmission electron microscopy
- Atomic force microscopy (AFM)
- Microtomography
- Laser scanning confocal microscopy

ENVIRONMENTAL TEST CHAMBER

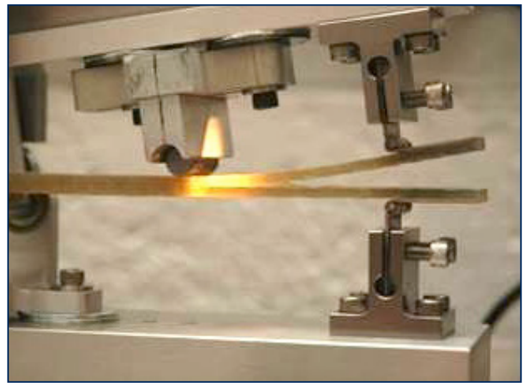
300 m^3 chamber (6.8 m x 6.8 m x 6.1 m high)
Door opening 4.3 m x 4.25 m high
Temperature range -40 to +50°C
- Uniformity ±3.0°C, constancy ±0.2°C

Relative humidity range 20 to 95%
- Uniformity ±5%, constancy ±2.5%

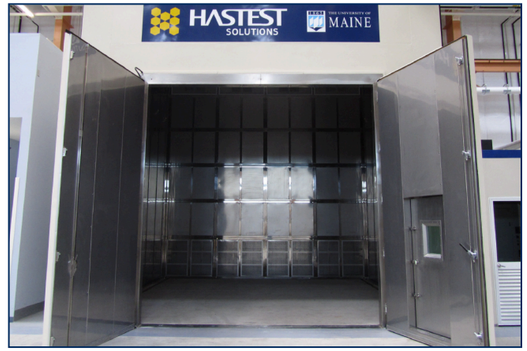
Ramp rate in thermal cycling ±10°C per hour
Capability to conduct fatigue tests within chamber

SUBSTRUCTURE TESTING

- Plastic, adhesive and composite property testing
- Multiaxial strength and stiffness of substructures
- Application-specific fatigue, creep and impact testing
- Multi-scale tests from constituents to structures



Fracture mechanics testing



Offshore Wind Laboratory environmental test chamber

Wind blade fatigue testing with inertial resonance excitation