Improving Reliability through Mechanical Testing & Simulation

Improving wind turbine reliability is critical to realizing the promise of a clean, sustainable and economically viable global wind power infrastructure. Manufacturers and suppliers who successfully optimize their wind turbine and component designs to minimize costs and maximize uptime will emerge as industry leaders.

As the world’s premier test and simulation solution provider, MTS stands uniquely qualified to deliver the technology and expertise required to improve wind turbine reliability and durability. MTS solutions are deployed worldwide, subjecting wind turbine materials, components and structures to a full spectrum of mechanical testing, including:

- Characterization
- Strength Testing
- Durability Testing
- Systems Testing

Contact your local MTS office or representative today and explore all the ways we are meeting the wind turbine industry’s critical mechanical testing needs.

MTS TEST & SIMULATION LEADERSHIP

Test engineers and researchers worldwide rely on MTS for the innovative testing technologies and expertise required to accelerate and improve research, design, development and manufacturing processes. High performance MTS solutions have long been deployed to meet demanding material, component and structural testing needs across a broad spectrum of industries. MTS has extended this broad array of mechanical testing capabilities into the rapidly developing field of wind power generation:

- MTS supports the world’s leading wind turbine manufacturers, suppliers and research facilities with state-of-the-art technology and testing solutions, facilities planning, test consulting, and complex systems integration
- Advanced MTS testing technologies are simulating the complex and extreme loading environments of wind turbine drivetrains, blades, bearing systems, towers and more
- Robust MTS materials test systems are conducting static and dynamic testing of advanced, lightweight composite materials
- MTS testing expertise is proving crucial to the development of the next generation test and simulation technologies required to test the extremely large wind turbine structures planned for the near future

Hall 27 Stand E30
Hannover Messe 2011 – Wind Energy

MTS Wind Power Solutions

MTS offers Best Total Value solutions for testing:
A. Blades
B. Blade Pitch Bearings/Drive Systems
C. Complete Nacelle Assemblies
D. Complete Drivetrain Systems & Components
E. Gearboxes
F. Main Bearings
G. Yaw Bearings/Drive Systems
H. Towers

• Metals & Composites

4-11 April, 2011
Hannover, Germany

be certain.
Addressing a Full Spectrum of Wind Turbine Mechanical Testing Needs

Drivetrain Test Solutions

High-performance MTS Drivetrain Test Solutions apply real-world rotational and off-axis loading for optimizing the reliability of complete nacelle assemblies, complete drivetrain systems, and drivetrain components such as gear boxes and bearing systems.

» Applications include:
  – System simulation and verification
  – Performance and durability testing
» Employs innovative MTS Non-Torque Loading (NTL) System to apply extreme loads in six degrees of freedom
  – Highly robust and efficient design results in low cost of operation, high uptime and long life
  – Rotation/moment input via prime mover
  – Off-axis, or non-torque, loads (3 forces, 2 moments) via MTS NTL System
  – Integral, low-friction hydrostatic bearing technology delivers superior dynamic performance
» State-of-the-art FlexTest® digital controls ensure high-fidelity simulation and optimum test accuracy

Multi-Purpose Bearing Test Solutions

The highly flexible MTS Multi-Purpose Bearing Test Solution accurately replicates rotor hub and blade loading for performing mechanical tests on a wide array of wind turbine bearings, including pitch, yaw and main bearing systems.

» Applications include:
  – Performance under load
  – Static deflection and stiffness measurements
  – Durability/fatigue
» Employs state-of-the-art MTS Non-Torque Loading (NTL) System to apply extreme loads in five degrees of freedom
  – Highly robust and efficient design results in low cost of operation, high uptime and long life

Blade Pitch Bearing Test Solutions

Available in multiple configurations, MTS Blade Pitch Bearing Test Solutions accurately replicate blade loading (Fx, Fy, Fz and Mz) for performing mechanical tests on blade pitch bearings and blade pitch drive systems.

» Applications include:
  – Performance under load
  – Static deflection and stiffness measurement
  – Durability/fatigue
» Features changeable specimen adapters for accurately replicating a range hub and blade stiffness characteristics
» Precision control achieved with state-of-the-art FlexTest digital controls and Multipurpose TestWare software
» May utilize loading fixtures or actual wind turbine components
Addressing a Full Spectrum of Wind Turbine Mechanical Testing Needs

Blade Static Test Solution

The MTS Blade Static Test Solution applies tightly controlled static loading to blades for performing stiffness and strength tests required for FEM model validation and/or certification to International Electrotechnical Commission (IEC) Technical Specification 61400-23.

Blade Fatigue Test Solution

The highly accurate MTS Blade Fatigue Test Solution applies automated cyclic loading to blades at resonant frequency for meeting the fatigue testing demands of International Electrotechnical Commission (IEC) Technical Specification 61400-23.

» Employs compact, energy-efficient uREX (Universal Resonant Excitation) System, developed through a Cooperative Research and Development Agreement (CRADA) between the U.S. DOE’s National Renewable Energy Laboratory (NREL) and MTS Systems Corporation

» Features automated control of test end-levels and test frequency

Seismic Simulators (Shake Tables)

MTS Seismic Simulators subject full wind turbine structures, towers and substructures to forces and motions in up to six degrees of freedom to simulate real-world earthquake conditions and perform modal testing.

» Available in custom six-degree-of-freedom configurations for subjecting full structures to real earthquake conditions; special-purpose configurations for evaluating extremely large specimens that require fewer degrees of freedom; and affordable standard uniaxial and bi-axial seismic simulators for testing substructures and components in more compact laboratory environments

» Combines state-of-the-art FlexTest digital controls modified for seismic simulation and MTS Seismic Test Execution System (STEX) software

Materials Test Systems

MTS materials test systems combine high-performance MTS servohydraulic load frames, FlexTest digital controls, MTS TestSuite™ software and a full complement of grips, fixtures, extensometers and environmental simulation systems. Available in uniaxial and multi-axial configurations, these systems are engineered to accurately apply monotonic and/or cyclic loading to determine the mechanical properties of a wide variety of advanced materials, including:

» Glass fiber reinforced polymer matrix composites

» Composite materials that will be used in self-feathering blades (anisotropic properties)

» Carbon fiber composites under consideration for longer (100+ meter) turbine blades

» Advanced alloys and ceramics
MTS wind turbine testing solutions integrate the very latest in precision MTS testing technology, including versatile digital controls, advanced test application software, reliable hydromechanical power systems and a host of high-performance servohydraulic force and motion application mechanisms.

**UREX Systems (Blade Fatigue)**

UREX (Universal Resonant Excitation) systems integrate MTS 244 Actuators, linear bearings and adjustable masses to apply cyclic loads to blades at resonant frequency for flap-wise (typically 0.5 to 2 Hz) or edge-wise (typically 2 to 5 Hz) fatigue testing. UREX systems are capable of performing dual-axis resonant blade testing, which combines edge- and flap-wise testing to dramatically accelerate fatigue testing. Compact and energy-efficient, the UREX system is the result of a cooperative research & development agreement (CRADA) between the U.S. DOE’s National Renewable Energy Laboratory (NREL) and MTS Systems Corporation.

**Hydraulic Winch Assemblies (Blade Static)**

MTS hydraulic winch assemblies integrate test quality winches and articulating pulley assemblies to apply static loading near blade tips where force requirements are relatively low (below 200 kN) and displacement needs are greater than two meters. The assembly’s control manifold features manual mode for setup and automatic mode for testing.

**Linear Actuator Assemblies (Blade Static)**

MTS linear actuator assemblies feature durable, single-ended actuators for applying static loading near blade roots where force requirements are relatively high (above 200 kN) and displacement needs are less than two meters. The assembly’s control manifold features manual mode for setup and automatic mode for testing.

**FlexTest Controllers**

State-of-the-art FlexTest digital controllers deliver higher speeds and channel densities to keep pace with evolving test demands, and share common hardware boards and user interface tools, simplifying test standardization and optimization. Features that are particularly useful for wind turbine testing applications include: limit detectors, which provide the ability to initiate a controlled shutdown when user-defined limits are reached; and dual mode control, which allows the system to run in displacement control for stability while performing tests based on the specimen acceleration or strain conditions being achieved.

**Multipurpose TestWare (MPT) Software**

MPT software features an easy-to-use “drag and drop” environment for quickly and easily building, running and reporting on complex material, component and structural tests. The MPT package includes 793.86 Blade Resonance Search & Tracking software.

**AeroPro Software**

Advanced AeroPro software features a tightly integrated control and data acquisition user interface, advanced control loop optimization tools, and a host of test setup utilities to streamline and accelerate complex, multi-axial structural testing.

**MTS TestSuite Software**

The MTS TestSuite software platform serves as the foundation for a growing set of easy-to-use material test modules for a full range of fatigue and fracture mechanics test applications.

**Unrivaled MTS Support**

MTS fields the most experienced worldwide service, support and consulting staff of any mechanical testing solution provider. This global team can provide the facilities planning expertise required to ensure that your test laboratory is properly configured at the outset to readily accommodate all your foreseeable wind turbine testing activities. This consulting spans a wide range of considerations, including:

- Hydraulic power supply and distribution
- Foundation and strong floor design
- Floor plan efficiency

Upon facility completion, MTS will coordinate the installation and integration of test systems and train your laboratory personnel to operate them safely and efficiently. Once your laboratory is fully operational, MTS lifecycle management programs can serve to maximize system uptime and productivity and help you complete test programs as quickly as possible.