One Source for
Wind
Asset Protection Solutions

- 24/7 On-line Monitoring
- Non-Destructive / Destructive Inspection and Maintenance
- Fleet and Site Condition Health Monitoring Software
**INTRODUCTION**

As a worldwide leader in one-source asset protection solutions, MISTRAS Group, Inc. has the technology, solutions and experience to support your wind power operations in every phase.

- Inspection and maintenance of wind turbines from our industry-leading services team, including rope access experts, help eliminate costly outages and extensive repairs. Not relying on lifts or cranes lets technicians complete work efficiently and economically.
- Industry-unique dual-function technology uses Vibration and Acoustic Emission analysis to detect turbine failures at their earliest stages.
- 24/7 wireless on-line monitoring technology provides a watchful eye on critical system components with the constant development of new monitoring concepts
- Web-based Asset Condition Monitoring systems illustrate fault warnings, alarms and diagnostics from fleet level all the way down to site level.
- World-class R&D team guiding the wind energy industry.

MISTRAS can help protect and prolong your fleet’s life with an array of asset protection solutions; all while saving costs by avoiding high-priced repairs, detecting potential issues in their infancy and prescribing preventive maintenance. Our one-of-a-kind combination of services, technology solutions and monitoring expands on a platform as a leader in traditional energy fields like refineries, offshore oil rigs, nuclear and fossil power plants and industries like aerospace and civil infrastructure. As wind power usage and the overall size and importance of wind turbines continue to grow and wind power farms continue to make their way offshore, MISTRAS’ can offer the highest standard in one-source wind power solutions thanks to more than 40 years of leadership in the non-destructive testing (NDT) and energy fields.

**NON-DESTRUCTIVE TESTING APPLICATIONS**

As traditional and advanced NDT pioneers, we’re on the cutting edge of products, services and monitoring. And we support you in the development of maintenance concepts according to regulatory and insurance requirements.

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**8-12%**

The amount of global electricity supply expected by wind power in 2020
CRACK DETECTION ON TOWERS AND FOUNDATION STRUCTURES

Acoustic Emission (AE) solutions can “listen” to the sounds of cracks forming well before other discernible signals are produced. Since only active defects produce AE signals, no time is wasted. And since online AE monitoring is supported, there are no costly outages. Also, using multiple sensors can locate defects both 2- and 3-dimensionally depending on the tested area. AE testing can even inspect weld integrity.

AUTOMATED WELD INSPECTION WITH ULTRASONICS

MISTRAS’ Automated Ultrasonic Testing (AUT) techniques have two advanced NDT solutions able to effectively and efficiently examine welds while assets remain online.

P-Scan – The highly-sensitive P-Scan systems allow for accurate identification, location and sizing of defects in weld material and online inspection of various assets. Damage mechanism results provide a highly effective planning tool for repair/replace decision-making.

Phased array – Ultrasonic phased array testing can examine weld integrity in addition to turbine blades. Its versatility allows for simultaneous views like sectoral views, A-Scan, B-Scan and C-Scan representations. This increases detection probability by giving inspectors multiple views of each weld.

AE AND UT FOR ROTOR BLADES

A mix of AE systems and Ultrasonics enables early detection of most structural rotor blade faults: girder; bonding of shear web, trailing edge or leading edge; shear web/girder position; quality and width of bond laminates; and adhesive thickness. It can also test prototypes, production parts and parts subject to maintenance to detect deviations.

LST FOR TURBINE BLADES

Line Scanning Thermography (LST) inspects bond quality during manufacturing, so a defective bond can be repaired and re-inspected before installation. Using LST allows for large area inspection in a short time thanks to proprietary novel scanning protocols and image processing methods.
WHY NOT PREVENT A PROBLEM BEFORE IT STARTS?
That’s exactly the goal with MISTRAS’ multilateral destructive testing (DT) process. Our DT solutions support and advise you in the stages of development, process verification, production and at a potential damage analysis. Our CFRP/GFRP testing centers help you find the best possible materials (i.e. resin, fibers) for nacelles and blades. Keeping with our goal to form partnerships, not just transactions, we offer you the opportunity to supervise your materials development in our laboratories.

SAMPLE PREPARATION
We prepare and produce the samples in line with your expectations by using infusion, autoclave or RTM processes.

ANALYTICAL MATERIALS TESTING
Analytical testing of materials can be used in the development stage, in process verification, in production and in potential damage analysis through a variety of tests: high-performance liquid chromatography (HPLC), differential scanning calorimeter (DSC), fourier transform infrared spectroscopy (FTIR Spectroscopy), and fiber volume content. (DSC), fourier transform infrared spectroscopy (FTIR-Spectroscopy), fiber volume content.

MECHANICAL MATERIALS TESTING
Compression, tensile, bending and shear tests help define strain measurement and the physical properties of the material. Therefore, we are able to measure the important strength that you need to know.

METALLOGRAPHIC MATERIALS TESTING
With measurement microscopy, damage in components can be visualized and subsequent conclusions can be drawn about failure mechanisms. With that key information, supporting developments about components are made. And, through the dimensioning of microsections, layer construction, fiber content and fiber type can be determined with production monitoring and optimization to follow. This course of testing also improves welding processes and provides damage analysis results.
MISTRAS’ Ropeworks Center of Excellence (COE) specializes in inspection and maintenance of utility-scale wind turbine blades and towers using industry-leading rope access capabilities. Our technicians have experience with almost every major utility-scale wind turbine manufacturer in the world. Ropeworks technicians have been working on wind energy services since 2003 and each undergoes world-class technical training in rope access and specialized disciplines such as inspection and composite technology. Both traditional and advanced NDT technology is utilized to evaluate the integrity of assets and materials.

**BLADE SERVICES**
Our blade specialists have one goal – keep the blades spinning. They offer comprehensive solutions through a combination of inspection, preventive maintenance and repair. Preventive maintenance and inspection are essential to maximize asset lifespan, asset integrity and return on investment. Our team can also be deployed quickly to respond to acute problems like lightning damage.

- **Inspection** — performed using visual or advanced NDT methods with findings delivered in electronic format. Inspection includes thorough assessment of blade condition, tower weld integrity, composite materials and lightning protection systems; identification of potential issues; root-cause analysis; and repair recommendations.

- **Repair and Maintenance** — With 10 years of experience, our specialists can make repairs that prolong the lifespan and overall effectiveness of the asset and can fix damage caused by: leading edge erosion; bond-line failure; moisture intrusion; freeze/thaw cycling; and installation and lightning damage.

**TOWER SERVICES**
MISTRAS’ Ropeworks technicians can also offer cost-effective maintenance and repair services for wind turbine towers, such as: internal/external cleaning and inspection; tower flange sealing; dent removal and coating repair; torque testing of landing bolts; and bus bar service.
**DETECT AND IDENTIFY ONSET OF COMPONENT FAILURES**

ACMwt (Asset Condition Monitoring for Wind Turbines) is an online, real-time condition monitoring system that includes the best breed of features and functions, exclusively developed for wind turbine components. It represents an economic breakthrough with the integration of two sensor technologies—Acoustic Emission (AE) detection and conventional vibration monitoring—in one sensor body.

**SOLUTION: DUAL FUNCTION SENSOR (DFS)**

DFS is based on the strengths of two industry accepted monitoring techniques—Vibration and Acoustic Emission (AE). On their own, neither proved reliable enough, but working together, AE detection and vibration monitoring can help identify early wear, fault detection and fault isolation all while reducing costs and increasing reliability. Vibration monitoring is a well-developed industry standard in the rotating world of machinery diagnostics, but there are areas where it also falls short. It’s for that reason the supplemental Acoustic Emission monitoring proves so vital.

- **Vibration** – Able to detect advanced mechanical and some electrical conditions as well as balance issues that will ultimately cause failure in rotating machinery. Ideal for high-speed rotating machines.
- **Acoustic Emission (AE)** – Able to diagnose failure modes before they cause collateral or secondary damage. Other functions include expanded fault detection and helping define operating envelope for extended life. Ideal for slower speed rotating machines.

**DRIVE TRAIN SOLUTION**

ACMwt System Monitoring Module is a complete data acquisition and analysis system for drive train condition monitoring. The computer-based system is housed within the nacelle and collects info from Dual Function Sensors (DFS), extracts data from the turbine controller, performs the fault detection alarming and runs the analysis software.

**NETWORK SOLUTION**

ACMwt Network Configuration combines intelligent data analysis with data integrity assurance that would not be affected in the event of any potential network outage.
Globally, wind power generation has tripled since 2004 and increased by more than 20 percent between 2008 and 2009 alone. But as a global leader in one source asset protection solutions, MISTRAS doesn’t just respond to the market – it helps drive it. Well before the wind power industry revolution of the mid-2000s, MISTRAS companies were already active in research and development in the field of wind turbine inspection. Since 1997, French, German and Greek MISTRAS subsidiaries have engaged in pioneering, European-Union-funded research in the challenging field of wind turbine blade global inspection with the development of proven quality and testing procedures.

**SOLUTION: ACOUSTIC EMISSION PROOF TESTING AND DAMAGE ASSESSMENT OF WIND TURBINE BLADES (AEGIS)**

AEGIS increases the reliability of wind turbine blades through the development of proof-testing techniques, which has two main advantages:
- Identify developing problems before critical stage
- Improve the understanding of damage processes

Extensive lab and on-site trials utilizing Acoustic Emission (AE) monitoring during static and fatigue failure tests produced methodologies for 100 percent inspection of fiber reinforced plastic (FRP) blades for application during blade certification. Advanced analysis of AE data enabled the establishment of specific criteria for assessing the structural integrity a blade’s critical zones through AEGIS.

Building on a results-oriented history, MISTRAS’ advanced wind energy R&D is ongoing and consistent. A current EU-funded R&D project targets the development of integrated, long-term condition monitoring systems of operating wind turbines including offshore installations. Focus is given on the in-service damage assessment of gearboxes and blades using mainly AE techniques.
- Using our wireless AE nodes, MISTRAS monitors wind blade turbines remotely. Sensors positioned at critical areas inside the blade detect signals produced by potential damage formation and transmit them to a computer in the nacelle for automated analysis and correlation with the operational parameters of the wind turbine.

Modern wind turbines are designed to work for 100,000 hours. Yet factors like local climate conditions and wear and tear on critical system components like rotor blades and gearboxes threaten product lifespan. The price of a new set of rotor blades, a gearbox or a generator is often 15-20 percent of the entire turbine.

Before making costly decisions, non-destructive testing and an Asset Condition Monitoring system can provide a full assessment of vital component damage. State-of-the-art online monitoring techniques like Acoustic Emission, Vibration or Guided Waves along with semi-online/offline techniques such as Ultrasonic or Acousto-Ultrasonic can provide a clear assessment.