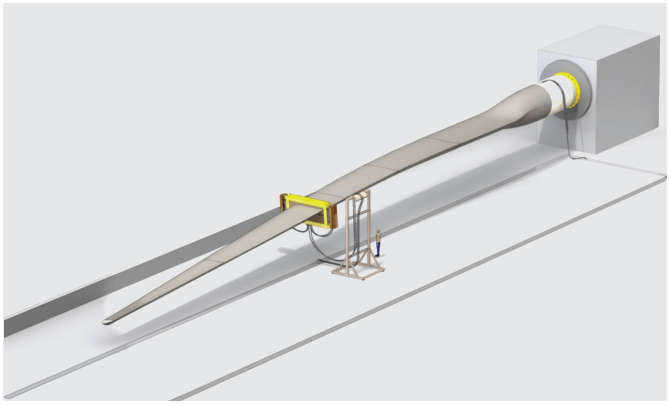
WIND TECHNOLOGY TESTING CENTER (WTCC)

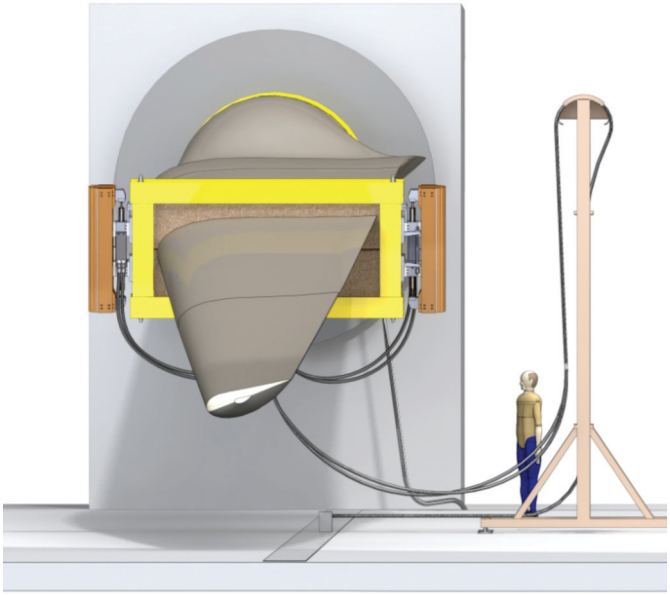
Large Blade Testing Facility

MASSACHUSETTS
CLEAN ENERGY
CENTER

BLADE TESTING RATIONALE

Wind turbine blade testing is a critical factor in maintaining high levels of reliability and evaluating the latest technological developments in airfoils and materials. Adequate testing allows wind energy to be even more competitive. In addition, blade testing is required as part of turbine certification to meet international design standards—such as IEC, GL, DNV , etc.—allowing developers to mitigate the technical and financial risk of deploying mass-produced wind turbines.



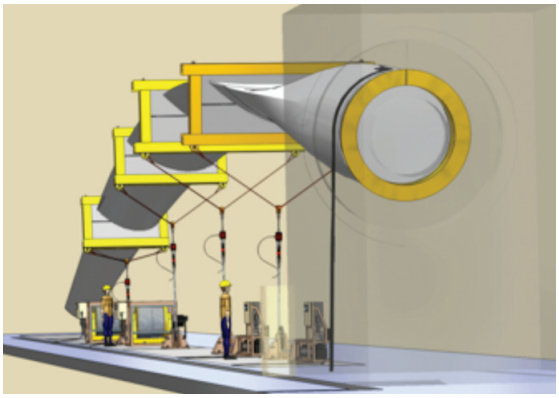


Fatigue Test

BLADE TESTING AT WTTC

The Massachusetts Clean Energy Center's (MassCEC) Wind Technology Testing Center (WTTC) offers a full suite of certification tests for turbine blades up to 90 meters in length. WTTC also offers the latest wind turbine blade testing and prototype development methodologies to help the wind industry deploy the next generation of land-based and offshore wind turbine technologies.

- Full suite of static and fatigue tests per IEC61400-23 standard
- Three test stands and 100-ton overhead bridge crane capacity
- Blade material testing
- Dual axis static or fatigue testing
- Lightning Protection Testing (future expansion)
- Prototype Development and Activity
- Research and development partnerships
- Hands-on workforce training
- Strong commitment to client intellectual property protection



Static Test

TEST SPECIFICATIONS

Static testing

A key test for wind turbine blades is the static test. In this test design the blade is pulled in the horizontal or vertical axis, flapwise and edgewise, in order to measure blade deflection and strains. Static testing will be performed with a combination of computer controlled servo-hydraulic winches and cylinders connected through cables to the blade.Static tests can be performed vertically or horizontally. The ultimate static test is pulling a blade to failure, a feature available to the WTTC's clients for blades up to 90 meters.

- 84-MNm max static root bending moment
- Test to ultimate failure
- Up to 8 hydraulic winches
- Bending moment tracking
- Strain distribution
- Stiffness calibration

Fatigue testing

Blade designs are intended to last 20 plus years in the field. Repairs to damaged blades are costly and time consuming. Fatigue testing is highly accelerated life testing to simulate what a blade goes through in its lifetime on a wind turbine. Fatigue tests will be performed with the NREL/MTS UREX excitation system where hydraulic cylinders actuate linear moving masses on the blade at one or more locations. This system generates 20 plus years of cyclic field loads in a matter of months . Our engineers continuously monitor the data and periodically inspect the blade. Our system in the long term is intended to operate bi-axially, that is, both edgewise and flapwise fatigue testing can be done concurrently, dramatically reducing testing time and cost.

- The National Renewable Energy Lab's (NREL) patented resonant test system technology
- 24-hour fully monitored fatigue testing
- 21-meter tip-to-tip fatigue test tip displacement

FACILITY SPECIFICATIONS

Load Capacity:

- Maximum static bending moment 84-mega Newton meter (MNm)

Blade Length:

- Up to 90-meter blades depending on test details and specifications

Blade Displacement:

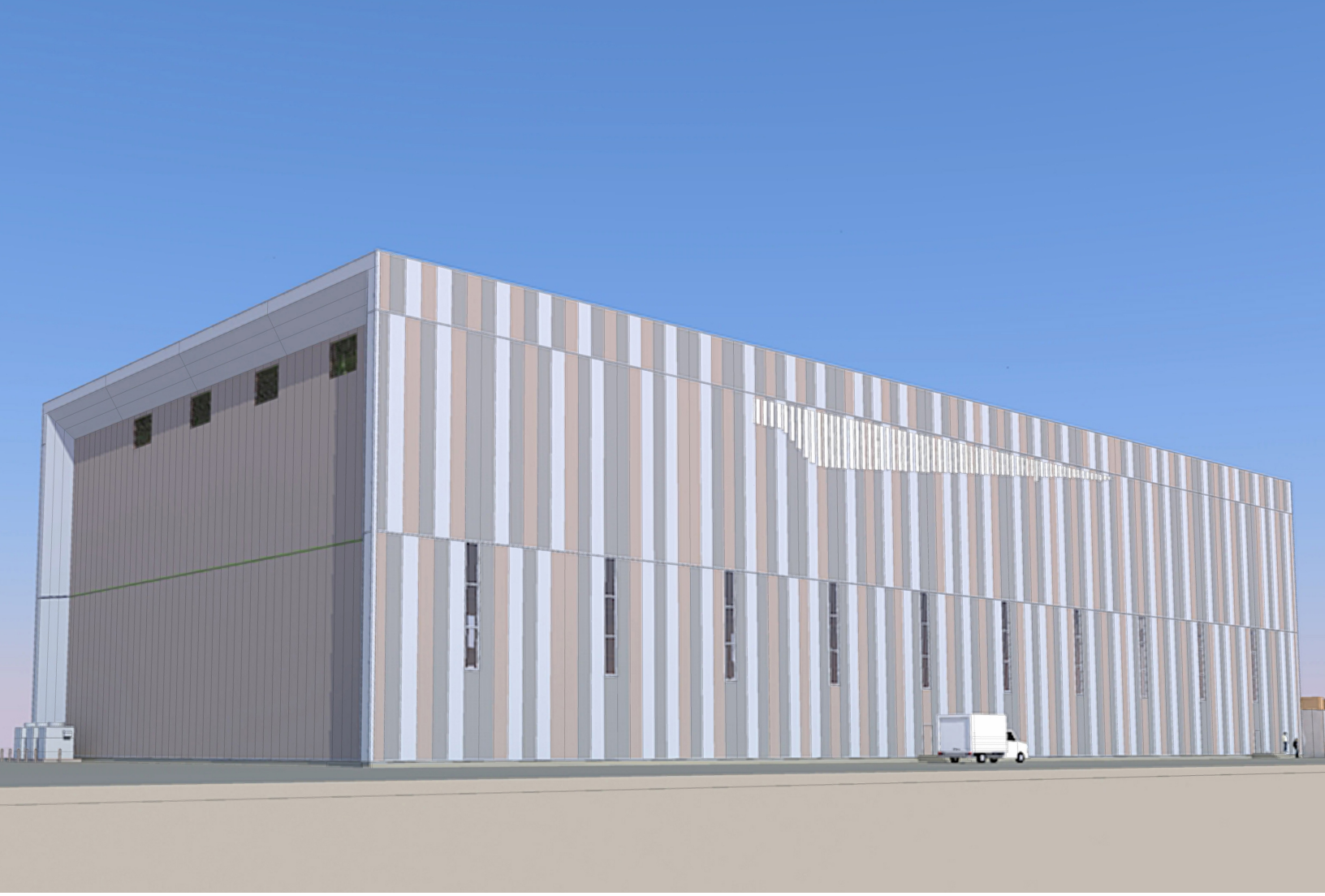
- 32-meter maximum horizontal tip displacement
- 21-meter maximum vertical tip displacement

Overhead Cranes:

- One 50-ton and two 25-ton hoists

Blade Mounting Heights:

- 6.5 meters from floor to blade route center for test Stands 1 and 2 with an angle of six degrees above horizontal. Wedge plates can be used to modify the mounting angle between zero and 12 degrees.
- 5 meters for test Stand 3 with an angle of eight degrees above horizontal. Wedge plates can be used to modify the mounting angle between zero and 16 degrees.



TECHNOLOGY PARTNERS

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Rahul Yarala, WTTC Executive Director
ryarala@masscec.com
WTTC Site Address:
100 Terminal Street
Boston MA 02129

Massachusetts Clean Energy Center
55 Summer Street, 9th Floor
Boston, MA 02110
P (617) 315-9355 • F (617) 315-9356
info@masscec.com • www.masscec.com

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