INFLOW AND FATIGUE RESPONSE OF THE NWTC ADVANCED RESEARCH TURBINE*†

Herbert J. Sutherland
Wind Energy Technology Department
Sandia National Laboratory
Albuquerque, NM 87185-0708
hjsuthe@sandia.gov

Neil D. Kelley
M. Maureen Hand
NREL/National Wind Technology Center
Golden, CO 80401
neil_kelley@nrel.gov, maureen_hand@nrel.gov

ABSTRACT

The Long-term Inflow and Structural Test (LIST) program is collecting long-term inflow and structural response data to characterize the spectrum of loads on wind turbines. In one of the measurement campaigns being conducted under this program, the 42-m diameter, 600-kW NWTC Advanced Research Turbine (ART) was monitored. The inflow was monitored with a planar array of five high-resolution sonic anemometers and supporting meteorological instrumentation located 1.5 diameters upwind of the turbine. The structural response of the turbine was measured using strain gauges circuits and an inertial measurement unit (IMU). The former was used to monitor root bending moments and the low-speed shaft torque, while the latter were used to monitor the motion of the tower and the nacelle. Auxiliary gauges measured blade pitch, rotor teeter, nacelle yaw and generator power. A total of 3299 10-minute records were collected for analysis. From this set, 1044 records are used to examine the influence of various inflow parameters on fatigue loads. Long-term fatigue loads and extreme loads are also examined.

*This work is supported by the U.S. Department of Energy under Contract DE-AC04-94AL85000 and DE-AC36-83CH10093. Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin company. A portion of the work was performed by the National Renewable Energy Laboratory in support of the U.S. Department of Energy under contract number DE-AC36-99GO10337.