Structural Testing of 9 m Carbon Fiber Wind Turbine Research Blades*

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Three 9 m carbon fiber wind turbine blades have been designed through a research program initiated by Sandia National Laboratories. The individual designs feature such innovations as carbon spar caps, material-induced twist-bend coupling, and flatback airfoils, among others. All blades were constructed with conventional dry lay-up and VARTM infusion processes. Static tests of these blades were conducted at the National Wind Technology Center. The blades were subjected to flapwise loading to simulate the extreme wind loads expected for each design in a Class 2b wind site. The blades were loaded with a three-point whiffle-tree arrangement. Upon obtaining the predetermined test load, the blades were subsequently loaded to failure. Load, deflection, strain, and acoustic emissions were monitored throughout the experiments. All blades survived the specified test loads, with two designs exceeding it significantly. In addition, carbon strains of over 0.8% in both tension and compression were recorded in one of the tests. Finally, acoustic microphones were able to detect areas where damage was occurring, and indicated the beginnings of failure. This paper outlines the results of the structural tests that were conducted.

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