SAND 99-1324
Unlimited Distribution
Printed June 1999

# Design, Manufacture and Testing of A Bend-Twist D-spar

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Sandia Contract: BB-6066

## Abstract

Studies have indicated that an adaptive wind turbine blade design can significantly enhance the performance of the wind turbine blade on energy capture and load mitigation. In order to realize the potential benefits of aeroelastic tailoring, a bend-twist D-spar, which is the backbone of a blade, was designed and fabricated to achieve the objectives of having maximum bend-twist coupling and fulfilling desirable structural properties (EI & GJ). Two bend-twist D-spars, a hybrid of glass and carbon fibers and an all-carbon D-spar, were fabricated using a bladder process. One of the D-spars, the hybrid D-spar, was subjected to a cantilever static test and modal testing.

Various parameters such as materials, laminate schedule, thickness and internal rib were examined in designing a bend-twist D-spar. The fabrication tooling, the lay-up process and the joint design for two symmetric clamshells are described in this report. Finally, comparisons between the experimental test results and numerical results are presented. The comparisons indicate that the numerical analysis (static and modal analysis) agrees well with test results.