

# Aerodynamic and Aeroacoustic Properties of Flatback Airfoils

Dale E. Berg<sup>\*</sup> and Jose R. Zayas<sup>†</sup>  
Sandia National Laboratories<sup>‡</sup>  
Albuquerque, NM 87185-1124 USA

**In 2002, Sandia National Laboratories (SNL) initiated a research program to demonstrate the use of carbon fiber in wind turbine blades and to investigate advanced structural concepts through the Blade Systems Design Study, known as the BSDS. One of the blade designs resulting from this program, commonly referred to as the BSDS blade, resulted from a systems approach in which manufacturing, structural and aerodynamic performance considerations were all simultaneously included in the design optimization. The BSDS blade design utilizes “flatback” airfoils for the inboard section of the blade to achieve a lighter, stronger blade. Flatback airfoils are generated by opening up the trailing edge of an airfoil uniformly along the camber line, thus preserving the camber of the original airfoil. This process is in distinct contrast to the generation of truncated airfoils, where the trailing edge the airfoil is simply cut off, changing the camber and subsequently degrading the aerodynamic performance. Compared to a thick conventional, sharp trailing-edge airfoil, a flatback airfoil with the same thickness exhibits increased lift and reduced sensitivity to soiling. Although several commercial turbine manufacturers have expressed interest in utilizing flatback airfoils for their wind turbine blades, they are concerned with the potential extra noise that such a blade will generate from the blunt trailing edge of the flatback section. In order to quantify the noise generation characteristics of flatback airfoils, Sandia National Laboratories has conducted a wind tunnel test to measure the noise generation and aerodynamic performance characteristics of a regular DU97-300-W airfoil, a 10% trailing edge thickness flatback version of that airfoil, and the flatback fitted with a trailing edge treatment. The paper describes the test facility, the models, and the test methodology, and provides some preliminary results from the test.**

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<sup>\*</sup> Principal Member of Technical Staff, Wind Energy Technology Department, MS 1124, Associate Fellow AIAA

<sup>†</sup> Manager, Wind Energy Technology Department, MS 1124

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