Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

On the skin friction drag reduction in large wind turbines using sharp V-grooved riblets. Application to a 2.5 MW Clipper wind turbine section ROGER ARNDT, LEONARDO CHAMORRO, FOTIS SOTIROPOULOS, University of Minnesota — Skin friction drag reduction through the use of riblets has been a topic of intensive research during the last decades. Main efforts have been placed on both numerical (mainly DNS) and experimental approaches. In spite of the valuable efforts, the fundamental mechanisms that induce drag reduction are not well established. In this study, wind tunnel experiments were performed to quantify the drag reduction in a wind turbine airfoil using different V-groove riblet structures. A full-scale 2.5MW Clipper wind turbine airfoil section (of 1 meter chord length, typical of the 88% blade span), was placed in the freestream flow of the wind tunnel at the Saint Anthony Falls Laboratory, University of Minnesota. Four different sizes of V-groove riblets were tested at different angles of attack at full scale Reynolds number of Re=2.67×106 (based on the airfoil chord length). Force sensors were used to measure Lift and Drag. A combination of single and cross-wire anemometers were also used to study the turbulent scale-to-scale interaction in the near wall region to better understand the physical mechanisms of drag reduction and flow characteristics in that region. The measurements will be used to develop and test the performance of near-wall boundary conditions in the context of RANS and hybrid RANS/LES models.

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Date submitted: 02 Aug 2010 Electronic form version 1.4