Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Control and Scaling of Radius-Vectored Turbulent Boundary Layers using Plasma Actuators THOMAS CORKE, RYAN HEWITT, University of Notre Dame — An experiment was performed to examine the performance and scaling of single dielectric barrier discharge plasma actuators for vectoring an approaching turbulent boundary layer around a circular radius. The experiment consisted of a suspended flat plate on which a turbulent boundary layer developed. The trailing edge of the plate had removable sections forming 90 degree turns with different radii ranging from 6.4 to 12.7 cm. The flow around the circular radii was documented with particle tracers introduced upstream in the boundary layer, surface flow visualization, and by measured velocity profiles. The surface visualization was a mixture of an evaporating oil and white china clay. This was used to quantitatively measure the turning angle of separation. Turning angles of the flow were documented for a range of free-stream speeds and boundary layer thicknesses with and without plasma actuator control. The results indicated a minimum sensitivity to free-stream speed and boundary layer thickness. There was a strong sensitivity to the turning radius. For flow control, the sensitivity of the flow vectoring to actuator amplitude increased with decreasing turning radius. This suggests a strategy for flow turning using compound shapes of different radii.

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Date submitted: 03 Aug 2007 Electronic form version 1.4