Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Controlling turbulent boundary layer separation using biologically inspired 2D transverse grooves[1] AMY LANG, EMILY JONES, FARHANA AFROZ, University of Alabama — It is theorized that the presence of grooves, such as the sinusoidal ones found on dolphin skin or the cavities that form between bristled shark skin scales, can lead to induced boundary layer mixing and result in the control of turbulent boundary layer separation. To test this hypothesis, a series of water tunnel experiments using DPIV studied the characteristics of a flat plate turbulent boundary layer whereby a rotating cylinder was used to induce an adverse pressure gradient and resulting flow separation. The experiments were repeated with the use of a plate covered with two types of grooves, rectangular and sinusoidal, with a spacing of 2 mm in size. Flow similarity of the cavity flow was preserved between the experiments and flow over bristled shark skin scales. Both geometries resulted in a reduction of flow separation as measured by backflow coefficient. In addition, Reynolds stress profiles showed that as the pressure gradient was increased, the sinusoidal geometry outperformed the rectangular grooves in terms of increased mixing close to the wall. The sinusoidal plate also generated a lower momentum deficit within the boundary layer which would indicate a smaller drag penalty.

[1]Support from NSF grant CBET 0932352 and a UA Graduate Council Fellowship is gratefully acknowledged.

Amy Lang
University of Alabama

Date submitted: 31 Jul 2013 Electronic form version 1.4