Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Large-scale Motions in a Separated Turbulent Boundary layer
SURANGA DHARMARATHNE, Purdue University, HUMBERTO BOCANEGRA EVANS, Texas Tech University, ALI HAMED, University of Illinois, BURAK AKSAK, Texas Tech University, LEONARDO CHAMORRO, University of Illinois, MURAT TUTKUN, University of Olso, LUCIANO CASTILLO, Purdue University
— Proper orthogonal decomposition was used to decompose the velocity field measured using particle image velocimetry over a separated turbulent boundary layer for investigating the effect of large-scale motions (LSM) on Reynolds stresses. LSMs are defined here by the fluctuating velocity field that is responsible for 55% turbulence kinetic energy. Results show that $\approx 90\%$ of the Reynolds shear stress, $\overline{uv}$, is due to the LSM. The same motions contribute about 70% of the streamwise component of the Reynolds normal stress, $\overline{u^2}$. Surprisingly, both large-scale and small-scale motions equally contribute to the wall-normal component of the Reynolds normal stress, $\overline{v^2}$. Furthermore, the study reveals the characteristic length scales and frequencies of the LSMs that might be modulated to control the flow separation.

Suranga Dharmarathne
Purdue University

Date submitted: 31 Jul 2017 Electronic form version 1.4