Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Large-eddy simulation of accelerating boundary layers GIUSEPPE DE PRISCO, ANTHONY KEATING, UGO PIOMELLI, ELIAS BALARAS, University of Maryland — Large-eddy simulation of flat-plate boundary layers in favorable pressure gradients (FPG) are performed for two different acceleration parameters. The high-acceleration case is in good agreement with the experimental data by Fernholz and Warnack [JFM, vol. 359, 329 (1998)]. Substantial reduction in turbulent kinetic energy and shear stress production, strong decorrelation of u and v fluctuation, and a reduction of the bursting frequency indicate that the accelerated boundary layer is in a laminar-like state when the pressure-gradient parameter K exceeds a threshold value. Near the wall, the turbulent shear stress becomes negligible compared with the viscous stresses. In the region of peak acceleration the pressure gradient is larger than the turbulent momentum transport and balances the viscous stress; in the low-K case, on the other hand, turbulent transport remains dominant over the pressure gradient. Downstream of this region, the boundary layer has a fast re-transition to turbulence. In the low K case, the boundary layer does not depart significantly from equilibrium. Research supported by the AFOSR.

Anthony Keating
University of Maryland

Date submitted: 02 Aug 2005 Electronic form version 1.4