Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Direct Numerical Simulations of Turbulent Boundary Layers Over A Circular Aperture QI ZHANG, DANIEL BODONY, University of Illinois at Urbana Champaign — Motivated by the use of acoustic liners to reduce jet engine and aircraft noise, we use direct numerical simulation to study the interaction of a turbulent Mach 0.5 boundary layer with a circular aperture connected to a honeycomb cavity under acoustic excitation. The geometry and flow conditions correspond to experiments conducted at NASA Langley. The hole, whose diameter is on the order of the boundary layer's momentum thickness, interacts with the boundary layer in qualitatively different ways depending on the acoustic forcing amplitude. The influence of the hole on the boundary layer is quantified under a range of acoustic excitations and the details of the hole/boundary layer interaction will be presented. The acoustic impedance of the hole is determined, compared to experimentally educed values, and related to the dynamics of the hole/boundary layer interaction. These analyses will be helpful for improved understanding and low-order models of aircraft acoustic liners at realistic operating conditions.

Qi Zhang
University of Illinois at Urbana Champaign

Date submitted: 03 Aug 2012 Electronic form version 1.4