Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Experimental and modeling study of the flow over a skewed bump[1] DAVID S. CHING, CHRISTOPHER J. ELKINS, JOHN K. EATON, Stanford Univ — Three-dimensional separated flows can be very sensitive to geometry and inlet conditions, such that a small change in the geometry or the upstream boundary layer could cause the flow structure to change drastically. This study examines the geometric sensitivity of a skewed bump with axis ratio 4/3 by changing the angle of the bump with respect to the flow. The three-dimensional, three-component mean velocity field was acquired using Magnetic Resonance Velocimetry (MRV) for several bump angles. The flow is dominated by large coherent vortices in the wake. For a symmetric case, two counter-rotating vortices exist in the wake, but when the bump is skewed relative to the oncoming flow one vortex structure is much stronger and overwhelms the other vortex. A comparison to RANS simulations found that the RANS simulations predict the velocity fields with reasonable accuracy within the separation bubble, but are very inaccurate downstream of reattachment. Using a time-resolved MRV sequence, the shedding frequency of the wake was determined for two bump angles. Hot-wire anemometry confirmed the shedding frequencies found from the MRV data and observed that the shedding frequency is sensitive to the bump angle at low bump angles, but is insensitive at high bump angles.

[1]Funding provided by the Office of Naval Research

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Date submitted: 22 Jul 2016 Electronic form version 1.4