Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Vorticity Transport on a Flexible Wing in Stall Flutter[1] JAMES AKKALA, JAMES BUCHHOLZ, University of Iowa, JOHN FARNSWORTH, University of Colorado - Boulder, THOMAS MCLAUGHLIN, United States Air Force Academy — The circulation budget within dynamic stall vortices was investigated on a flexible NACA 0018 wing model of aspect ratio 6 undergoing stall flutter. The wing had an initial angle of attack of 6 degrees, Reynolds number of 1.5×10^5 and large-amplitude, primarily torsional, limit cycle oscillations were observed at a reduced frequency of $k = \pi fc/U = 0.1$. Phase-locked stereo PIV measurements were obtained at multiple chordwise planes around the 62.5% and 75% spanwise locations to characterize the flow field within thin volumetric regions over the suction surface. Transient surface pressure measurements were used to estimate boundary vorticity flux. Recent analyses on plunging and rotating wings indicates that the magnitude of the pressure-gradient-driven boundary flux of secondary vorticity is a significant fraction of the magnitude of the convective flux from the separated leading-edge shear layer (Wojcik and Buchholz, J. Fluid Mech. 2014; Buchholz et al. AIAA Paper 2014-0071), suggesting that the secondary vorticity plays a significant role in regulating the strength of the primary vortex. This phenomenon is examined in the present case, and the physical mechanisms governing the growth and evolution of the dynamic stall vortices are explored.

[1]This work was supported by the Air Force Office of Scientific Research through the Flow Interactions and Control Program monitored by Dr. Douglas Smith, and through the 2014 AFOSR/ASEE Summer Faculty Fellowship Program (JA and JB).

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Date submitted: 01 Aug 2014 Electronic form version 1.4