Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Effect of Pitch Rate on Time Evolution of Surface Topology on a Delta Wing TUNC GORUNEY, DONALD ROCKWELL, Lehigh University — A basic delta wing of moderate sweep angle, representative of Unmanned Combat Air Vehicles (UCAVs) and Micro Air Vehicles (MAVs), undergoes a pitching maneuver. Near-surface flow patterns are visualized by a technique of high-image-density particle image velocimetry for a wide range of pitch rates. Five different universal states are defined during the relaxation process following cessation of the pitching motion. These states involve distinct patterns that can be defined in terms of topological features such as negative (separation) and positive (reattachment) bifurcation lines, saddle points, foci, and nodes. Such universal states can be identified for all pitch rates, extending over an eightfold range. Irrespective of the severity of the flow distortion at the end of the pitching maneuver, the relaxation of the flow involves the same sequence of universal states. The time delay to occurrence of the first universal state is very sensitive to the pitch rate. The delay between subsequent states is, however, nearly independent of pitch rate. Due to the highly three-dimensional nature of the flow, the flow patterns and topological states will also be visualized by stereoscopic particle image velocimetry.

Tunc Goruney
Lehigh University

Date submitted: 30 Jul 2007 Electronic form version 1.4