Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Flow Visualization of a von Kármán Ogive Forebody with Plasma Actuation JOHN FARNSWORTH, ZACHARY FRANCIS, REID WITT, CHRIS PORTER, THOMAS MCLAUGHLIN, US Air Force Academy, USAF Academy, CO
— The flow field around an axisymmetric forebody at a moderate angle of attack can produce a significant side force, and thus a yawing moment, on the body. The side force results from an asymmetric vortex state and therefore pressure distribution that forms on the body. This asymmetric vortex state originates from a convective instability in the flow field, meaning that minor geometric or flow disturbances near the apex of the model can perturb the flow into an asymmetric state. In the current experiments two single dielectric barrier discharge plasma actuators are used to perturb the flow and control the vortex state. Smoke flow visualization techniques were utilized to better understand the behavior of the vortices under plasma actuation. It was found that the vortex state responds proportionally to the voltage of the plasma actuation. Additionally, the response of the vortex state to control changed drastically with changes in Reynolds number, suggesting a relation between the blowing ratio and the behavior of the vortex state.

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Date submitted: 03 Aug 2012 Electronic form version 1.4