Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Vortex Generation in Jet Vectoring Plasma Actuators JAMEY JACOB, CEREN OZTURK, MICHAEL BOLITHO, Oklahoma State University — Jet vectoring flow control is demonstrated using plasma synthetic jet actuators (PSJA). The PSJA is a geometric variant of a plasma actuator, consisting of a symmetric electrode array that results in a counterflowing region of dielectric barrier discharge plasma. Quiescent flow PIV measurements of the PSJA reveal that the flowfield on actuation resembles that of a zero-mass flux or synthetic jet that is useful for flow control, particularly separation reduction, except with jet formation under both steady and pulsed operation. Like synthetic jets, unsteady pulsed actuator operation results in formation of multiple vortex rings and the jet momentum is found to be controlled by the pulsing frequency. While increasing the input power increases the maximum jet velocity, an optimum range of pulsing frequencies and actuator dimensions are observed to exist in order to maximize jet momentum. By asymmetrically varying the plasma input parameters, it is possible to control the jet angle and it is shown that vectoring using high frequency pulsing similar to synthetic jets is more effective than vectoring by modifying steady control inputs. Differences in control effectiveness are due primarily to the time scales associated with the vortex formation. Cross-stream vortex generation for separation control is demonstrated and the changing vortex characteristics from the different PSJA parameters are observed and discussed.

Jamey Jacob
Oklahoma State University

Date submitted: 04 Aug 2008 Electronic form version 1.4