Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Effect of Synthetic Jet Actuator Spacing on the Performance Enhancement of a Vertical Tail Model MARIANNE MONASTERO, NICHOLAS RATHAY, Rensselaer Polytechnic Institute, EDWARD WHALEN, The Boeing Company, MICHAEL AMITAY, Rensselaer Polytechnic Institute — The use of synthetic-jet-based active flow control to augment the side force produced by vertical tail models through rudder separation control was experimentally investigated in the Rensselaer Polytechnic Institute Subsonic Wind Tunnel. Increasing the side force generated by the vertical tail may lead to a reduction in tail size and, therefore, less drag and fuel consumption. Stereo particle image velocimetry and aerodynamic load data were acquired with a focus on the effect of non-dimensional spacing between jets on the resulting flowfield and forces for a $1/19^{\text{th}}$ scale model based on a Boeing 767 commercial airplane. For some rudder deflections, differing results with active flow control were found when force data for the $1/19^{\text{th}}$ scale model were compared to force data obtained on a larger, $1/9^{\text{th}}$ scale model. Actuator spacing was varied and individual jet momentum coefficient was held constant for these experiments. These results show the need for more fundamental testing to understand why jets are beneficial or detrimental to the augmented side force and how those effects scale-up. A new model was designed to enable a fundamental study of the effect on the flowfield of various jet and model parameters such as sweep angle, jets spacing, rudder chord extent, and rudder deflection.

Michael Amitay
Rensselaer Polytechnic Institute

Date submitted: 24 Jul 2014 Electronic form version 1.4