Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Flow Control in a Transonic Diffuser[1] JEREMY GARTNER, MICHAEL AMITAY, Rensselaer Polytechnic Institute — In some airplanes such as fighter jets and UAV, short inlet ducts replace the more conventional ducts due to their shorter length. However, these ducts are associated with low length-to-diameter ratio and low aspect ratio and, thus, experience massive separation and the presence of secondary flow structures. These flow phenomena are undesirable as they lead to pressure losses and distortion at the Aerodynamic Interface Plane (AIP), where the engine face is located. It causes the engine to perform with a lower efficiency as it would with a straight duct diffuser. Different flow control techniques were studied on the short inlet duct, with the goal to reattach the flow and minimize the distortions at the AIP. Due to the complex interaction between the separation and the secondary flow structures, the necessity to understand the flow mechanisms, and how to control them at a more fundamental level, a new transonic diffuser with an upper ramp and a straight floor was designed and built. The objective of this project is to explore the effectiveness of different flow control techniques in a high subsonic (up to Mach 0.8) diffuser, so that the quasi two-dimensional separation and the formation of secondary flow structure can be isolated using a canonical flow field.

[1]Supported by Northrop Grumman

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Date submitted: 31 Jul 2014 Electronic form version 1.4