Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Coupled Control of Flow Separation and Streamwise Vortical Structures.[1] TRAVIS BURROWS, BOJAN VUKASINOVIC, ARI GLEZER, Georgia Institute of Technology — The flow in offset diffusers of modern propulsion systems are dominated by streamwise vorticity concentrations that advect of low-momentum fluid from the flow boundaries into the core flow and give rise to flow distortion and losses at the engine inlet. Because the formation of these vortices is strongly coupled to trapped vorticity concentrations within locally-separated flow domains over concave surfaces of the diffuser bends, this coupling is exploited for controlling the streamwise evolution of the vortices and thereby significantly reduce the flow distortion and losses. The scale and topology of the trapped vorticity are manipulated at an operating throat Mach number of 0.64 by using a spanwise array of fluidic oscillating jets that are placed upstream of the separation domain. The present investigations demonstrate that the actuation alters the structure of both the trapped and streamwise vortices. In particular, the distribution of the streamwise vortices is altered and their strength is diminished by actuation-induced streamwise vorticity concentrations of opposite sense. As a result, the actuation leads to significant suppression of pressure distortion at the engine inlet (by as much as 60%) at an actuation level that utilizes less than 0.4% of the diffuser's mass flow rate.

[1]Supported by ONR.

Travis Burrows
Georgia Institute of Technology

Date submitted: 01 Aug 2017 Electronic form version 1.4