Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Swirling Turbulent Jet Structure Characterization Using Proper Orthogonal Decomposition of Flow Visualization Images[1] JONATHAN NAUGHTON, RICHARD SEMAAN, University of Wyoming — Planar Laser Scattering (PLS) was used to acquire instantaneous cross-sectional images of a swirling jet. The jet was seeded with small oil droplets whereas the ambient air was unseeded. Light from a laser sheet passing through the jet was scattered from the droplets and imaged using a camera. Proper Orthogonal Decomposition (POD) was applied to ∼1000 images to determine the energy containing structure in the flow. A POD implementation was used that took advantage of axisymmetry to assure structure consistent with the flow. The results indicate that jets with a degree of swirl that exceeded a certain threshold exhibit an increased importance of the second azimuthal mode in the near-field as compared to a non-swirling jet. At distances further downstream, the mode two dominance decreases and mode one has an increased importance. Reconstructions of the swirling jet using the dominant modes provides evidence that the swirling jet contains very different turbulent structure in the near field as compared to non- swirling jets. The findings of this work are consistent with recent experimental and theoretical studies and provide guidance for future studies characterizing the structure responsible for swirling jet's unique behavior.

[1]This work supported in part by AFOSR.

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Date submitted: 09 Aug 2010 Electronic form version 1.4