Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Acoustic structures in the near-field from clustered rocket nozzles ANDRES CANCHERO, Univ of Texas, Austin, CHARLES E. TINNEY[1], The University of Texas at Austin, NATHAN E. MURRAY[2], The University of Mississippi, JOSEPH H. RUF, NASA Marshall Space Flight Center — The plume and acoustic field produced by a cluster of two and four rocket nozzles is visualized by way of retroreflective shadowgraphy. Steady state and transient operations (startup/shutdown) were conducted in the fully-anechoic chamber and open jet facility of The University of Texas at Austin. The laboratory scale rocket nozzles comprise thrust-optimized parabolic contours, which during start-up, experience free shock separated flow, restricted shock separated flow and an end-effects regime prior to flowing full. Shadowgraphy images with synchronized surveys of the acoustic loads produced in close vicinity to the rocket clusters and wall static pressure profiles are first compared with several RANS simulations during steady operations. A Proper Orthogonal Decomposition of various regions in the shadowgraphy images is then performed to elucidate the prominent features residing in the supersonic annular flow region, the acoustic near field and the interaction zone that resides between the nozzle plumes. POD modes are used to detect propagation paths of the acoustic waves and shock cell structures in the supersonic shear layer. Spectral peak frequencies on the propagation paths are associated with the shock cell length, which are responsible for generating broadband shock noise.

[1]Aerospace Engineering & Engineering Mechanics
[2]National Center for Physical Acoustics

Andres Canchero
Univ of Texas, Austin

Date submitted: 01 Aug 2014 Electronic form version 1.4