Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Transient unsteadiness of SWBLI in an axisymmetric geometry WOUTIJN J. BAARS[1], The University of Melbourne, CHARLES E. TINNEY[2], The University of Texas at Austin — Shock wave boundary layer interactions (SWBLIs) inside an axisymmetric large area ratio nozzle ($M_e = 5.58$) are studied by way of unsteady wall pressure measurements. First, a case of non-transient SWBLI is considered by operating at a nozzle pressure ratio of 28.7, at which a RSS structure forms with trapped annular separation bubbles [Baars et al. AIAA J. 50:1, 2012]. Conditional selection of the data [Erengil and Dolling, AIAA J. 29:5, 1991] resemble similar unsteady features as encountered in nominally 2D interactions. That is, 1) pressures increase in the separated regions as the incipient separation shock translates downstream, and vice versa, which indicates a breathing behavior, and 2) the PDF of the time between shock crossings in the intermittent region is highly skewed, e.g. the shock zero frequency is 33% of the most probable frequency. Secondly, ramping the pressure ratio sweeps the shock system over the transducers and allows the study of transient SWBLI. Time-frequency analyses reveal global features of the unsteady wall signatures, such as low-frequency oscillations in separated regions, and it is identified that nozzle shut-downs are more energetic than start-ups.

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Date submitted: 02 Aug 2013 Electronic form version 1.4