Abstract Submitted
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A Mechanism by Which Nose Bluntness Suppresses Second-mode Instability JOSEPH KUEHL, ARMANI BATISTA, ARHAM AMIN KHAN, University of Delaware — A physical mechanism by which nose bluntness suppresses second-mode instability is proposed. Considered are 7 degree half-angle straight cones of various nose bluntness radii at tunnel conditions relevant to the AFOSR-Notre Dame Large Mach 6 Quiet Tunnel (Lakebrink et al. 2018). It is shown that second-mode suppression is achieved via entropy layer modulation of the basic state density gradient. A weakening of the density gradient disrupts the acoustic resonance necessary to sustain second-mode growth. These results are consistent with the thermoacoustic interpretation (Kuehl 2018) which posits that second-mode instability can be modeled as thermoacoustic resonance of acoustic energy trapped within an acoustic impedance well. Furthermore, the generalized inflection point criteria of Lees and Lin (1946) is applied to develop a criteria for the existence of second-mode instability based on the strength of the basic state density gradient. Lakebrink, M. T., K. G. Bowcutt, T. Winfree, C. C. Huffman and T. J. Juliano 2018. Journal of Spacecraft and Rockets. 55 (2) 315-321. Kuehl, J. 2018. AIAA Journal, 1-8, 10.2514/1.J057015. Lees, L., and Lin, C.-C., 1946. NACA TR 1115.

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