Abstract Submitted
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Azimuthal hotwire measurements in a transitional boundary layer on a flared cone in a Mach 6 quiet wind tunnel[1] JERROD HOFFERTH, WILLIAM SARIC, Texas A&M University — Hotwire measurements of second-mode instability waves and the early stages of nonlinear interaction are conducted on a sharp-tipped, 5°-half-angle flared cone at zero angle of attack in a low-disturbance Mach 6 wind tunnel at $Re = 10 \times 10^6$ m^{-1}. Profiles of mean and fluctuating mass flux are acquired at several axial stations along the cone with a bandwidth of over 300 kHz. Frequencies and relative amplitude growth of second-mode instability waves are characterized and compared with nonlinear parabolized stability (NPSE) computations. Additionally, an azimuthal probe-traversing mechanism is used to investigate the character of the nonlinear stages of transition occurring near the base of the cone. Recent Direct Numerical Simulations (DNS) of a sharp cone at Mach 6 have shown that a fundamental resonance (or Klebanoff-type) breakdown mechanism can arise in the late stages of transition, wherein a pair of oblique waves nonlinearly interacts with the dominant two-dimensional wave to create an azimuthal modulation in the form of Λ-vortex structures and streamwise streaks. The azimuthal measurements will identify periodicity qualitatively consistent with these computations and with "hot streaks" observed in temperature sensitive paints at Purdue.

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Jerrod Hofferth
Texas A&M University

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