Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Measurement of Fluctuating Wall Pressures Beneath a Supersonic Turbulent Boundary Layer STEVEN BERESH, JOHN HENFLING, RUSSELL SPILLERS, BRIAN PRUETT, Sandia National Laboratories — Accurate measurement of fluctuating wall pressure spectra beneath a supersonic turbulent boundary layer has proven elusive, such that a compilation of past efforts exhibits an alarming degree of scatter and hinders the development of engineering models. Recent experiments conducted in Sandia's Trisonic Wind Tunnel up to Mach 3 have provided wall pressure data to frequencies exceeding 100 kHz to help reconcile conflicts in the historical data. Data were acquired using piezoresistive silicon pressure transducers effective at low- and mid-range frequencies, then supplemented by piezoelectric quartz sensors capable of detecting very high frequency events. The two sensor types were dynamically calibrated against a condenser microphone reference standard, then combined into a single curve describing the wall pressure spectra. Such spectra show that an increase in Mach number produces a reduction in the normalized magnitude, though the shape of the spectra remain similar; Reynolds number effects were detectable but considerably smaller for the range of test conditions. Results are compared with historical data and consequences of the measurement limitations are discussed.

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Date submitted: 06 Aug 2009 Electronic form version 1.4