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Direct Numerical Simulation of Acoustic Noise Generation from the Nozzle Wall of a Hypersonic Wind Tunnel[1] JUNJI HUANG, LIAN DUAN, Missouri Univ of Sci Tech, MEELAN CHOUDHARI, NASA Langley Research Center, MISSOURI UNIV OF SCI TECH TEAM, NASA LANGLEY RESEARCH CENTER TEAM — Direct numerical simulations (DNS) are used to examine the acoustic noise generation from the turbulent boundary layer on the nozzle wall of a Mach 6 Ludwieg Tube. The emphasis is on characterizing the freestream acoustic pressure disturbances radiated from the nozzle-wall turbulent boundary layer and comparing it with acoustic noise generated from a single, flat wall in an unconfined setting at a similar freestream Mach number to assess the effects of noise reverberation. In particular, the numerical database is used to provide insights into the pressure disturbance spectrum and amplitude scaling with respect to the boundary-layer parameters as well as to understand the acoustic source mechanisms. Such information is important for characterizing the freestream disturbance environment in conventional (i.e., noisy) hypersonic wind tunnels.

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