Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Large-eddy simulation of crackle in heated supersonic jets[1]
JOSEPH W. NICHOLS, SANJIVA K. LELE, Stanford University, Stanford, CA, FRANK E. HAM, Cascade Technologies, Inc., Palo Alto, CA, STEVE MARTENS, GE Global Research, Niskayuna, NY, JOHN T. SPYROPOULOS, Naval Air Systems Command, Patuxent River, MD — Crackle noise from heated supersonic jets is characterized by the presence of strong positive pressure impulses resulting in a strongly skewed far-field pressure signal (Ffowcs Williams et al., 1975). These strong positive pressure impulses are associated with N-shaped waveforms involving a shock-like compression, and thus is very annoying to observers when it occurs. In this talk, the origins of these N-shaped waveforms is investigated through high-fidelity large-eddy simulations (LES) applied to an over-expanded supersonic jet issuing from a faceted military-style nozzle. Two different levels of heating are considered. From the LES, we observe N-shaped waves associated with crackle to emerge directly from the jet turbulence. Furthermore, even at this extreme near-field location, we find that the emergent waves are already well-organized, having correlation over significant azimuthal distances.

[1]Computational resources were provided by a DoD HPCMP Challenge Project allocation at the ERDC and AFRL supercomputing centers.

Joseph W. Nichols
Stanford University, Stanford, CA

Date submitted: 03 Aug 2012 Electronic form version 1.4