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On the Reduction of High-speed Jet Noise with Heating DANIEL BODONY, SANJIVA LELE, Stanford University — For turbulent axially symmetric (in the mean) jets it is known that for jet velocities U_j greater than 0.7 times the ambient speed of sound a_∞ heating reduces the jet's radiated acoustic output. The cause of the noise reduction, however, has remained unknown. Using large-eddy simulations (LES) we examine this issue by computing the radiated noise of two high-speed jets at velocity $U_j/a_\infty = 1.47$: one jet is heated to a static-to-ambient temperature ratio 2.3 while the other is unheated. The directly-computed radiated noise is found to reduce by 10 decibels in the peak radiation direction, consistent with experimental data. Using the LES databases we examine the near-field changes with jet heating and attempt to correlate them with changes in the sound field. The analysis suggests that the sound reduction is due primarily to two factors. Relative to the unheated jet: (i) the heated jet has a smaller region of sound generation; and (ii) heating induces temperature-velocity anticorrelation within the jet. Because of item (ii) the radiated sound experiences destructive interference with a corresponding reduction in the total radiated sound.

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