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Particle-turbulence-acoustic interactions in high-speed free-shear flows GREGORY SHALLCROSS, Univ of Michigan - Ann Arbor, DAVID BUCHTA, Univ of Illinois - Urbana-Champaign , JESSE CAPECELATRO, Univ of Michigan - Ann Arbor — Experimental studies have shown that the injection of micro-water droplets in turbulent flows can be used to reduce the intensity of near-field pressure fluctuations. In this study, direct numerical simulation (DNS) is used to evaluate the effects of particle-turbulence-acoustic coupling for the first time. Simulations of temporally developing mixing layers are conducted for a range of Mach numbers and mass loadings. Once the turbulence reaches a self-similar state, the air-density shear layer is seeded with a random distribution of mono disperse water-density droplets. For M=0.9 to M=1.75, preliminary results show reductions in the near-field pressure fluctuations for moderate mass loadings, consistent with experimental studies under similar conditions. At high speed, the principle reduction of the normal velocity fluctuations, which increases with particle mass loading, appears to correlate to the reduction of the near-field radiated pressure fluctuations. These findings demonstrate that the DNS reproduces the observed particle-turbulence-acoustic phenomenology, and its complete space–time database can be used to further understand their interactions.

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