Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

**The role of particle-turbulence interactions on the pressure field near high-speed shear flows** JESSE CAPECELATRO, GREGORY SHALLCROSS, University of Michigan, DAVID BUCHTA, University of Illinois Urbana-Champaign — Heavy particles in turbulent flows, such as water droplets in air, are well-known to modify the carrier-phase velocity fluctuations. In high-speed flows, the turbulence provides a mechanism to radiate pressure fluctuations, which are usually considered in the safety and reliability of engineering applications, such as those environments near high-speed jets on aircraft carriers. In this presentation, we analyze the potential for reducing near-field pressure fluctuations via turbulence modulation by a disperse phase. Direct numerical simulations of particle-laden mixing layers are conducted for a range of Mach numbers, volume fractions, and Stokes numbers. Different turbulence regimes are identified based on the strength of interphase coupling characterized by the mass loading. The pressure intensity is observed to decrease with a comparable decrease in the turbulent kinetic energy. This reduction is found to be transient as the average volume fraction decreases with shear layer growth. In addition, we derive an evolution equation for the pressure variance in the presence of a disperse phase to quantify the particle-turbulence coupling mechanisms responsible for the observed reduction.

Jesse Capecelatro
University of Michigan

Date submitted: 28 Jul 2017 Electronic form version 1.4