Abstract Submitted
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Experimental Investigation of Fluid-Structure Interactions in Compressible Cavity Flows JUSTIN WAGNER, KATYA CASPER, STEVEN BERESH, PATRICK HUNTER, RUSSELL SPILLERS, JOHN HENFLING, RANDALL MAYES, Sandia National Laboratories, SANDIA NATIONAL LABORATORIES TEAM — Experiments were performed to understand the complex fluid-structure interactions that occur during internal store carriage. A cylindrical store was installed in a cavity having a length-to-depth ratio of 3.33 and a length-to-width ratio of 1. The Mach number ranged from 0.6 – 2.5 and the incoming turbulent boundary layer thickness was about 30-40% of the cavity depth. Fast-response pressure measurements provided aeroacoustic loading in the cavity, while triaxial accelerometers and laser Doppler vibrometry provided simultaneous store response. Despite occupying only 6% of the cavity volume, the store significantly altered the cavity acoustics. The store responded to the cavity flow at its natural structural frequencies, as previously determined with modal hammer tests, and it exhibited a directional dependence to cavity resonance. Specifically, cavity tones excited the store in the streamwise and wall-normal directions consistently, while a spanwise response was observed only occasionally. The streamwise and wall-normal responses were attributed to the known pressure gradients in these directions. Furthermore, spanwise vibrations were greater at the downstream end of the cavity, attributable to decreased levels of flow coherence near the aft-wall.

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