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Coherent structures in a supersonic complex nozzle[1] ANDREW MAGSTADT, MATTHEW BERRY, MARK GLAUSER, Syracuse Univ — The jet flow from a complex supersonic nozzle is studied through experimental measurements. The nozzles geometry is motivated by future engine designs for high-performance civilian and military aircraft. This rectangular jet has a single plane of symmetry, an additional shear layer (referred to as a wall jet), and an aft deck representative of airframe integration. The core flow operates at a Mach number of $M_{j,c} = 1.6$, and the wall jet is choked ($M_{j,w} = 1.0$). This high Reynolds number jet flow is comprised of intense turbulence levels, an intricate shock structure, shear and boundary layers, and powerful corner vortices. In the present study, stereo PIV measurements are simultaneously sampled with high-speed pressure measurements, which are embedded in the aft deck, and far-field acoustics in the anechoic chamber at Syracuse University. Time-resolved schlieren measurements have indicated the existence of strong flow events at high frequencies, at a Strouhal number of $St = 3.4$. These appear to result from von Kàrmàn vortex shedding within the nozzle and pervade the entire flow and acoustic domain. Proper orthogonal decomposition is applied on the current data to identify coherent structures in the jet and study the influence of this vortex street.

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Andrew Magstadt
Syracuse Univ

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