Abstract Submitted
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Analysis of Shear Layer Structures from Time Resolved Schlieren Images of Supersonic Multi-Stream Rectangular Nozzle Flow[1] CHRISTOPHER HAUCK, JACQUES LEWALLE, MARK GLAUSER, Department of Mechanical and Aerospace Engineering, Syracuse University, Syracuse, New York — Operational guidelines for new jet engines result in extreme flow physics. Using a Single-Expansion-Ramp-Nozzle [SERN], Syracuse University and The Ohio State University study the effects of variable operating conditions, nozzle configurations, and deck plate geometries on jet development and far-field acoustics. Identifying noise sources will allow the implementation of control systems to reduce the overall sound pressure levels. Building off previous APS presentations, Ruscher 2015 and Tenney 2018, this project uses time resolved (100 and 400 kHz) Schlieren imaging. Through filtering, these Schlieren images show dark "blobs" convecting along the top shear layer, and seemingly synchronized "bands" propagating off the exit shock wave. Upon analysis, these flow structures occur at a frequency of 34kHz. The frequency of the phenomena are due to von-Karman streets from the third-stream splitter plate, triggering Kelvin-Helmholtz Instabilities [KHI] in the shear layers. Analysis is occurring on the relationship between the KHI occurrences and resulting aeroacoustics. Ongoing work includes processing alternate image orientations and new data acquisition for variable splitter and deck plates.

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