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Near acoustic field of a high aspect ratio supersonic Single Expansion Ramp Nozzle EPHRAIM GUTMARK, BHUPATINDRA MALLA, University of Cincinnati, KAILAS KAILASANATH, ANDREW CORRIGAN, RYAN JOHNSON, KAMAL VISWANATH, Naval Research Laboratory — The near acoustic field of a supersonic jet issued from a high aspect ratio Single Expansion Ramp Nozzle (SERN) is characterized. The impact of extended expansion ramps with different lengths past the exit of the nozzle is determined. The nozzle under study has throat aspect ratio (AR) of 9 and the lengths of the extension ramps range from 2.1 inches to 9 inches. The design Mach number of the nozzle is 1.5. The study is performed in the over-expanded flow regime, at two nozzle pressure ratios (NPRs) of 2.5 and 3.0. For a nozzle without a ramp the jet starts to screech at NPR 2.5 and its amplitude increases until it reaches its maximum at NPR=3.0. This study shows that expansion ramps can completely mitigate the flapping instabilities along with a significant reduction in the Broad-band Shock associated Noise (BBSN) and in the turbulent mixing noise. The current study focuses on the near-field of the jet and aims to identify the locations of the acoustic sources, their directivity patterns, and changes in those characteristics when extended expansion ramps of different lengths are added.

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