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Correlations Between Large-scale Flow Structures and Acoustic Signatures in an Axisymmetric Jet[1] ANDREW MAGSTADT, MATTHEW BERRY, ZACHARY BERGER, PATRICK SHEA, MARK GLAUSER, Syracuse Univ — In a test campaign studying jet noise, simultaneous far-field acoustic measurements and near-field particle imaging velocimetry (PIV) data were sampled from a supersonic underexpanded axisymmetric jet operating at a Reynolds number of 1.3x10ˆ6. Using overlapping snapshots from three adjacent cameras, separate images of the velocity field were stitched together to form an uninterrupted window. Centered about the axis of the jet, the effective field of view spanned two jet diameters in the cross-stream direction (r) and seven diameters in the streamwise direction (z). This area proved to be sufficiently large to capture important scales of supersonic flow relevant to noise generation. Specifically, Proper Orthogonal Decomposition (POD) has extracted particular energy modes thought to be associated with the large-scale instability wave, shock cells, and turbulent mixing characteristic of supersonic noise. As example, time-dependent modal correlations present evidence linking the existence of shock cells to screech tones. From the data gathered, these experimental and analytical techniques are believed to be valuable tools in isolating energy-based flow structures relevant to noise generation.

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