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**Large eddy simulation of an underexpanded sonic jet** CATHERINE GORLE, Stanford University, MIRKO GAMBA, FRANK HAM, Stanford University, CENTER FOR TURBULENCE RESEARCH, PSAAP TEAM — Large eddy simulations (LES) for an underexpanded sonic jet in quiescent flow have been performed using the explicit spatially-filtered compressible Navier-Stokes solver Charles. The unstructured finite volume method uses a blended central-upwind scheme in smooth flow regions to minimize artificial damping of resolvable turbulence scales and switches to a third order WENO method and an HLCC approximate Riemann solver to capture discontinuities. Time discretisation is performed with an explicit third order Runge Kutta scheme. The simulations reproduce the conditions of an experiment where single-shot Schlieren imaging of the jet is used to investigate the instantaneous and time-averaged steady-state structure of the barrel shock and the jet far-field growth rate. A pseudo-time sequence of the formation of the barrel shock that tracks the jet injection transient is also constructed. A comparison of the shock structure and time scale of the jet formation obtained from the LES and the experiment is presented, showing a good agreement in the shock structure. Future work includes a similar study for an underexpanded sonic jet in a supersonic cross flow, and will also focus on the investigation of turbulent mixing.

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