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Large Eddy Simulation of Mixing within a Hypervelocity Scramjet Combustor DAVID PETTY[1], VINCENT WHEATLEY[2], University of Queensland, CARLOS PANTANO[3], University of Illinois at Urbana-Champaign, MICHAEL SMART[4], University of Queensland — The turbulent mixing of parallel hypervelocity (U = 3230 m/sec, M = 3.86) air-streams with a sonic stream of gaseous hydrogen is simulated using large eddy simulation. The resultant mixing layers are characterized by a convective Mach number of 1.20. This configuration represents parallel slot injection of hydrogen via an intrusive centerbody within a constant area rectangular combustor. A hybrid shock-capturing/zero numerical dissipation (WENO/TCD) switch method designed for simulations of compressible turbulent flows was utilized. Sub-grid scale turbulence was modeled using the stretched vortex model. Visualizations of the three dimensional turbulent structures generated behind the centerbody will be presented. It has been observed that a span-wise instability of the wake behind the centerbody is initially dominant. Further downstream, the shear-layers coalesce into a mixing wake and develop the expected large-scale coherent span-wise vortices.

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