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Injection and Disruption of Supersonic Droplets[1] Y.J. KIM, R.G. CERFF, J.C. HERMANSON, University of Washington — The disruption of simulated fuel droplets in supersonic flow is examined experimentally in a draw-down supersonic wind tunnel. Mono-disperse 100 μm diameter neat fluid droplets are generated using a droplet-on-demand generator upstream of the tunnel entrance. The droplets are accelerated in the supersonic flow, achieving supersonic velocities relative to the surrounding air. The droplets are imaged by direct close-up single- and multiple-exposure imaging. The latter technique allows measurement of the droplet velocity, from which the Mach number relative to the droplet, as well as the Weber number, are determined. The droplets reach a relative Mach number of as high as 1.7 and Weber numbers as high as 260. Droplet deformation and breakup patterns for these conditions can be classified into four different flow regimes by considering the changes in the Weber with downstream distance as the droplet accelerates. The drag coefficients associated with the droplet disruption under locally supersonic conditions are generally higher than those expected for solid spheres.

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