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Investigation of Two-Phase Supersonic Combustion in Hypersonic Flight FOLUSO LADEINDE, Stony Brook University — The authors initial studies on compressible turbulence and combustion in high-speed flows were done via DNS in collaboration with the Late Professor Edward E. OBrien in several joint publications on the topic. However, the authors focus has evolved, and the transport of momentum, energy, and chemical species in supersonic spray combustion for systems that approximate the scramjet engine in hypersonic flight is of current interest. Many advantages can be derived from the use of liquid fuels, such as the higher heat release and ease of storage and handling. The system in question is complicated by the interaction of many effects, including those due to combustion, evaporation, turbulence, shock waves, and their interactions. Consequently, not many studies have addressed the issues. Based on the parameters for the application of interest, the point-particle approach via the Eulerian-Lagrangian formulation is followed in the present endeavor. This approach introduces explicit force and energy sources, some of which involve history integrals. The significance of these sources is investigated in terms of their roles in the rather complex drop breakup mechanism in the presence of shockwaves, and the eventual evaporation and combustion to provide the needed propulsive force. The progress made by the author will be reported.

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