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Influences of forebody size on supersonic retropropulsion flowfield dynamics OWEN WILLIAMS, MAXINE TAN, XIUQI YANG, BRENTON HO, University of Washington — Supersonic retropropulsion (SRP) is an enabling technology for landing large payloads on planets such as Mars. To be successful, the retropropulsive jets must establish a stable flowfield that retains as much aerodynamic drag as possible, for efficiency. We lack a detailed understanding of SRP flowfield dynamics and how it varies with jet pressure and thrust. This is especially true for low thrust operation or for complicated geometries. A series of experiments have been undertaken to examine the influences of jet pressure and thrust on jets of different sizes relative to the vehicle forebody. All current experiments were conducted at zero angle of attack. Using a Mach 2 Ludweig tube and high-speed schlieren photography, flowfield topology and variability are investigated. Scaling of shock standoff distance with jet pressure and thrust coefficient is examined. Finally, we explore the conditions for flowfield unsteadiness, analyzing bow shock motion, its dominant frequencies and POD modes.

Owen Williams
University of Washington

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