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Control of Shock-Induced Boundary Layer Separation by using Pulsed Plasma Jets[1] BENTON R. GREENE, NOEL T. CLEMENS, The University of Texas at Austin, Austin, TX, DANIEL MICKA, Creare, Inc., Hannover, NH — Shock-induced turbulent boundary layer separation can have many detrimental effects in supersonic flow including flow instability, fatigue of structural panels, and unstart in supersonic inlets. Pulsed plasma jets (or "spark jets"), which are characterized by high bandwidth and the ability to direct momentum into the flow, are one promising method of reducing shock-induced separation. The current study is focused on investigating the efficacy of plasma jets to reduce the separated flow induced by a compression ramp in a Mach 3 flow. Three different 3-jet actuator configurations are tested: 20° pitched, 45° pitched, and 22° pitched and 45° skewed. The jets are pulsed at frequencies between 2 kHz and 4 kHz with duty cycles between 5 and 15%. The shock wave is generated using a 20° compression ramp, and the location of the shock-induced separation is visualized using surface oil streak visualization as well as particle image velocimetry. The results of the study show that of the three configurations, the plasma jets pitched at 20° from the streamwise direction cause the greatest reduction in separation, and when pulsed at a frequency of 3.2 kHz and 12% duty cycle can reduce the size of the separation region by up to 40%.

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