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Shockwave Boundary Layer Interaction Control Using External Forcing from Nanosecond Repetitively Pulsed Dielectric Barrier Discharge RAVICHANDRA JAGANNATH, LALIT RAJENDRAN, GEORGE SCHMIDT, TANBO ZHOU, SALLY BANE, Purdue University — The interaction between shock waves and turbulent boundary layers is an interesting phenomenon in high speed aerodynamics. The presence of a shock wave creates an adverse pressure gradient leading to boundary layer separation. This interaction causes unsteadiness in the flow where the separation bubble oscillates at low frequency and the shock oscillates at broadband frequency. The cause of this unsteadiness still remains unanswered. Some results show an upstream influence, while others have shown the downstream separation bubble causing the unsteadiness. This uncertainty in the unsteadiness mechanism makes it difficult to find an ideal location for an active flow control actuator. In the past, plasma jets, localized arc filaments and quasi-DC discharges have been used to control the shock unsteadiness. In this study, a nanosecond repetitively pulsed surface dielectric barrier discharge is used on a 25compression corner in Mach 2.5 flow to create an external perturbation in the upstream turbulent boundary layer ahead of the shock wave. The goal is for the external perturbation to be convected downstream and influence the shock oscillation. A combination of schlieren visualization and wall pressure measurements is used to investigate the effect of plasma actuator on shock unsteadiness. The actuator is placed at different locations upstream of the shock to identify the optimal location. The plasma frequency is also varied to identify the optimal frequency for controlling the shock unsteadiness.

Ravichandra Jagannath
Purdue University

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