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Active Control of Supersonic Jets in Ideally and Non-ideally Expanded Flow Regimes Using Plasma Actuators[1] MO SAMIMY, R. MICHAEL SNYDER, JIN-HWA KIM, IGOR ADAMOVICH, Gas Dynamics and Turbulence Laboratory, The Ohio State University — We have developed and used localized arc filament plasma actuators (LAFPAs) for control of high-speed and high Reynolds number jets. We utilize high amplitude and high bandwidth capabilities of LAFPAs to excite various instabilities of the jet. Our past effort has included successful control of Mach 0.9 jet with a nozzle exit diameter of 2.54 cm and a Reynolds number of 0.8×10^6. The current effort is focused on control of a Mach 1.3 jet operating at design and off-design flow regimes with Reynolds number over a million. The control authority and effects over various forcing Strouhal numbers and azimuthal modes in the jets with fully expanded Mach number of 1.3 (ideally expanded) and 1.4 (underexpanded) are similar to those in the Mach 0.9 jet. However, the control authority and effectiveness are significantly reduced in the jet with fully expanded Mach number of 1.2 (overexpanded). It is speculated that potential separation of the turbulent boundary layer just upstream of the nozzle exit under adverse pressure gradient and/or the oblique shock wave attached to the nozzle exit change(s) the instability characteristics of the jet rendering the control ineffective.

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