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Abstract #XXX (to be filled by the organizers)

Preferred Topics: SUSTSP / SYSINT / REUSSA (3 maximum from the list of topics)

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Type: Oral

Status of corresponding author: Regular

For student corresponding author: student member of one of the following:

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Title

## Hybrid Flow Control on Hypersonic Flow Shock Wave Boundary Layer Interactions: Combination of Micro-Ramp and Jet Blowing

### Authors

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### Abstract

The impact of passive and passive-active flow control on Shock Boundary Layer Interaction (SBLI) in high-speed aerodynamics has been investigated in this work. SBLI frequently happens when the flow travels faster than speed of sound. In real application, SBLI can be found in supersonic and hypersonic vehicles such as X-43 and X-51A where the Mach number lies in between Mach 1 to 5. In high speed flow, the flow is greatly affected by SBLI as the propulsion system of scramjet engine itself suffers a large upstream or downstream pressure disturbance leading to occurrence of engine unstart and flow distortion. Therefore, flow control has been introduced to solve this disastrous events. In this study, a combination of micro-ramps as passive flow control and blowing jets as active flow control has been developed to investigate the SBLI in high-speed flow aerodynamics. The micro-ramp height will be 80% (MR80) and 60% (MR60) from the boundary layer height ( $\delta$ ). The injection blowing will be positioned upstream with a 0.3 to 2.2  $\delta$  coefficient momentum. Experiments were done in a Mach 5 wind tunnel using a flat plate and shock generator model. It has been demonstrated that the use of a micro-ramp with a blowing jet position in between the micro-ramps delays and reduces the adverse pressure gradient, as well as slightly decreasing the separation flow. This have been proven with a best performance of 20% separation delay by adapting the blowing jet with micro-ramp at a coefficient momentum of 9.40 and MR60 respectively.