Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Effects of Local Wall Cooling on Hypersonic Boundary-Layer Stability on a Blunt Cone[1] FURKAN OZ, KURSAT KARA[2], Oklahoma State University — The transition location from a laminar to turbulent flow is a critically important parameter in the development of hypersonic aircraft. It has a significant impact on aerodynamic heating, drag force, engine performance, and vehicle operation. Earlier studies showed that cooling the surface of the body stabilizes the first mode; however, it destabilizes the second mode. This study aims to investigate the stabilization and excitation behaviors of local cooling strips embedded in the vehicle surface. The cooling process can be achieved actively or passively. Active cooling systems circulate coolant to transfer heat from a hot surface to somewhere cold. Passive cooling systems rely on changing material properties. In this study, we numerically investigated several cooling strategies that can be achieved in cooling applications. We developed a direct numerical simulation (DNS) solver and linear stability theory (LST) code to investigate the hypersonic flow stability over a 5-degree half-angle blunt cone with a 0.001-inch bluntness radius at Mach 6. Employing local cooling strips may balance the stabilization of the first mode and destabilization of the second mode. As a result of this, the transition may be delayed or controlled.

[1]The computing for this project was performed at the OSU High Performance Computing Center at Oklahoma State University supported in part through the National Science Foundation grant OAC1531128.
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Date submitted: 02 Aug 2020 Electronic form version 1.4