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Investigation of a Turbulent Spot in a Hypersonic Cone Boundary Layer[1] JAYAHAR SIVASUBRAMANIAN, HERMANN FASEL, University of Arizona — Direct Numerical Simulations (DNS) were performed to investigate the growth and breakdown of a localized disturbance into a turbulent spot in a sharp cone boundary layer at Mach 6. In order to model a natural transition scenario, the boundary layer was pulsed through a hole on the cone surface. The pulse disturbance developed into a three dimensional wave packet which consisted of a wide range of disturbance frequencies and wave numbers. The dominant waves within the resulting wave packet were identified as two dimensional second mode disturbance waves. In addition, weaker oblique waves were observed on the lateral sides of the wave packet. The developing wave packet grows linearly at first before reaching the nonlinear regime and eventually leads to localized patches of turbulent flow (turbulent spot). The wall pressure disturbance spectrum showed strong secondary peaks at the fundamental frequency for larger azimuthal wave numbers. This development indicates that fundamental resonance might be the dominant nonlinear mechanism for a cone boundary layer at Mach 6.

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