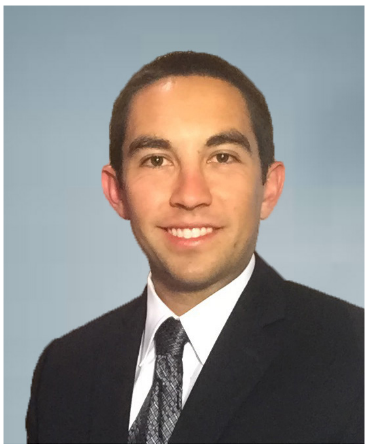
UNIVERSITY OF MARYLAND

THE BURGERS PROGRAM FOR FLUID DYNAMICS
FLUID DYNAMICS REVIEWS SEMINAR SERIES

AN EXPERIMENTAL INVESTIGATION OF HYPERSONIC BOUNDARY-LAYER TRANSITION ON SHARP AND BLUNT SLENDER CONES



Thursday, October 24, 2019 | 2:30 - 3:30pm
2164 Martin Hall, DeWALT Seminar Room

Guest Speaker

RICHARD KENNEDY

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ABSTRACT

The state of the boundary layer on the surface of a hypersonic vehicle has profound impacts on heat flux, skin friction, and control surfaces. Understanding and predicting the laminar-to-turbulent transition of a hypersonic boundary layer is thus a key challenge associated with efficient hypersonic vehicle design. This talk presents results from a series of experiments performed to investigate the instability mechanisms leading to transition on sharp and blunt slender cones in freestream Mach numbers ranging from 6 to 14. High-speed schlieren visualizations are used to track individual instability features, and a calibration of the schlieren system combined with novel image-processing techniques enables time-averaged quantitative measurements. For sharp-nose cones, second-mode instability waves appear within the boundary layer and become amplified until they break down to turbulence. Good agreement is observed between the schlieren measurements, surface pressure measurements, and computational results of the second-mode most-amplified frequencies and integrated spatial amplification rates. For blunt-nose cones, elongated structures associated with nonmodal growth are the primary instability features appearing in the visualizations. The features exhibit strong content between the boundary-layer and entropy-layer edges and are steeply inclined downstream. Simultaneously acquired surface pressure measurements reveal high-frequency pressure oscillations typical of second-mode instability waves associated with the trailing edge of the nonmodal-growth features.

BIO

Richard Kennedy is a PhD candidate working under the supervision of Dr. Stuart Laurence in the High-Speed Aerodynamics and Propulsion Lab at the University of Maryland. He earned his B.S. in Aerospace Engineering at the University at Buffalo, M.S. in Aeronautics at Caltech, and M.S. in Fluid Mechanics at École Polytechnique. His research is in the area of experimental hypersonics. In particular, his work focuses on using high-speed schlieren visualizations to make non-intrusive measurements.

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