Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Upstream and Downstream Influence in STBLI Instability PINO MARTIN, STEPHAN PRIEBE, CLARA HELM, University of Maryland — Priebe and Martín (JFM, 2012) show that the low-frequency unsteadiness in shockwave and turbulent boundary layer interactions (STBLI) is governed by an inviscid instability. Priebe, Tu, Martín and Rowley (JFM, 2016) show that the instability is an inviscid centrifugal one, i.e Görtlerlike vortices. Previous works had given differing conclusions as to whether the low-frequency unsteadiness in STBLI is caused by an upstream or downstream mechanism. In this paper, we reconcile these opposite views and show that upstream and downstream correlations co-exist in the context of the nature of Görtler vortices. We find that the instability is similar to that in separated subsonic and laminar flows. Since the turbulence is modulated but passive to the global mode, the turbulent separated flows are amenable to linear global analysis. As such, the characteristic length and time scales, and the receptivity of the global mode might be determined, and low-order models that represent the low-frequency dynamics in STBLI might be developed. The centrifugal instability persists even under hypersonic conditions. This work is funded by the AFOSR Grant Number AF9550-15-1-0284 with Dr. Ivett Leyva.

Clara Helm
University of Maryland

Date submitted: 01 Aug 2016 Electronic form version 1.4