Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Shock train unsteadiness induced by separation bubble instabilities ROBIN HUNT, JAMES DRISCOLL, MIRKO GAMBA, University of Michigan — A shock train is a highly three-dimensional system of shock and compression waves that gradually decelerates a supersonic flow in a duct and is typically found in the isolator section of high-speed air breathing engines. These fluid systems exhibit what we term inherent unsteadiness, which are self-excited fluctuations of the shock train system about its time-average position even with nominally constant inflow and outflow conditions. We have found that the instabilities of the separation bubbles within the shock train system contribute to the shock unsteadiness. The existence of boundary layer separation along the shock train is generally an accepted or assumed feature of shock trains. However, its properties, such as the point of separation, its length and thickness, are not well defined from works in the literature. Here, we present two-component particle image velocimetry measurements to examine the separation bubble characteristics and determine the physical structure of the perturbations that the separation bubble creates.

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Date submitted: 04 Aug 2017 Electronic form version 1.4