Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

IR thermography measurements on roughness induced transition.
FRANCESCO AVALLONE, University of Naples Federico II, FERRY F.J. SCHRIJER, Delft University of Technology, GENNARO CARDONE, University of Naples Federico II — The current investigation focusses on the effect of surface protrusions and indentations on the occurrence of transition. The objective of this work is to characterize the roughness-induced transition in the hypersonic Ludwieg tube of Delft University of Technology at Mach 7.5 and a unit Reynolds number ranging from $8 \cdot 10^6 m^{-1}$ to $14 \cdot 10^6 m^{-1}$. The tests are carried out on a 200 mm long, 5° compression ramp on which the 1 and 2 mm high tripping elements were positioned at 30 and 60 mm from the leading edge. This configuration resulted in a non-dimensional trip height k/δ ranging from 0.5 to 1 where k is the trip height and δ the laminar boundary layer thickness at the trip location. Measurements were performed for isolated and distributed three-dimensional roughness elements having various shapes (cylinder, square, swept ramp, half sphere) and dimensions. Additionally two dimensional cavities and three dimensional cavities are tested and their effectiveness is compared to the protruding elements. The flow field downstream of the roughness elements is analyzed by means of quantitative infrared themography and schlieren visualization. Finally some first results obtained using particle image velocimetry are presented.

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Date submitted: 01 Aug 2013 Electronic form version 1.4