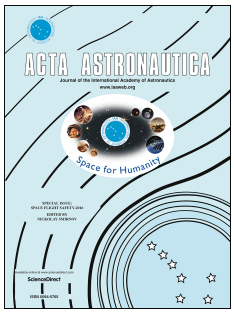
Accepted Manuscript



Shock wave structures in the wake of sonic transverse jet into a supersonic crossflow

Chang-hai Liang, Ming-bo Sun, Yuan Liu, Yi-xin Yang

PII: S0094-5765(18)30334-5

DOI: 10.1016/j.actaastro.2018.04.009

Reference: AA 6809

To appear in: *Acta Astronautica*

Received Date: 14 February 2018

Revised Date: 3 April 2018

Accepted Date: 6 April 2018

Please cite this article as: C.-h. Liang, M.-b. Sun, Y. Liu, Y.-x. Yang, Shock wave structures in the wake of sonic transverse jet into a supersonic crossflow, *Acta Astronautica* (2018), doi: 10.1016/j.actaastro.2018.04.009.

Shock wave structures in the wake of sonic transverse jet into a supersonic crossflow

Chang-hai Liang, Ming-bo Sun*, Yuan Liu, Yi-xin Yang

Science and Technology on Scramjet Laboratory, National University of Defense Technology, Changsha, 410073, China

Corresponding author: sunmingbo@nudt.edu.cn

Abstract: This study experimentally and numerically investigated the flow physics of a sonic transverse gaseous jet under a Ma=2.95 supersonic crossflow. NPLS (Nanoparticle-based Planar Laser Scattering) and oil flow techniques were combined to achieve experimental visualization, while RANS (Reynolds-averaged Navier-Stokes) model was used to carry out the numerical simulation. Under the supersonic crossflow with jet-to-crossflow momentum flux ratio (J) of 7.7, the typical structures, including a bow shock, a barrel shock, horseshoe vortex, and separation zones, were clearly observed by the NPLS techniques. V-shape separation bubbles and V-shape collision shocks were identified based on the oil-flow results. Detailed flow fields around the V-shape separation bubble were then revealed by numerical calculations. It is shown that the collision shock induced V-shape separation bubbles can further affect the Mach disk, the reflected shock and the barrel shock. The reflected shock deflects the collision shock toward the two flanks. The collision shock intersects with the barrel shock, influencing the shape of the Mach disk. In addition,