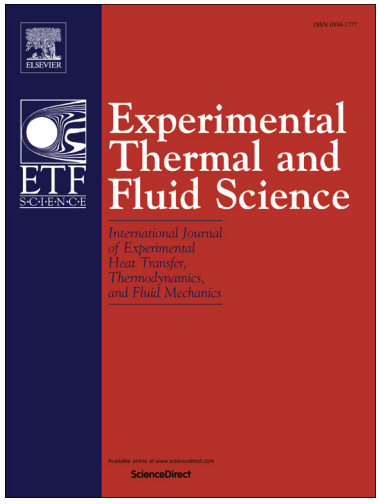

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PII: S0894-1777(17)30115-2
DOI: http://dx.doi.org/10.1016/j.expthermflusci.2017.04.017
Reference: ETF 9079

To appear in: *Experimental Thermal and Fluid Science*

Received Date: 8 June 2016
Revised Date: 14 February 2017
Accepted Date: 9 April 2017

Please cite this article as: T. Chandra Sekar, A. Kushari, B. Mody, B. Uthup, Fluidic Thrust Vectoring using Transverse Jet Injection in a Converging Nozzle with aft-deck, *Experimental Thermal and Fluid Science* (2017), doi: http://dx.doi.org/10.1016/j.expthermflusci.2017.04.017

Fluidic Thrust Vectoring using Transverse Jet Injection in a Converging Nozzle with aft-deck

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ABSTRACT

This paper summarizes the results of an experimental study carried out to implement fluidic thrust vectoring in yaw direction using transverse jet injection in a converging nozzle with an elliptic exit and triangular shaped aft-deck. The study was restricted to low subsonic flow regime typical for Unmanned Aerial Vehicle (UAV) applications. The momentum of the core nozzle flow was kept constant while varying the momentum of the secondary-jet. The surface pressure distribution, exhaust jet velocity field and thrust were measured. Secondary-jet injection was found to create a virtual exit plane at an angle to the stream wise direction of the nozzle flow resulting in the turning of the core-jet away from the injection slot and turning the direction of thrust (termed vectored thrust). The angle of the vectoring was found to increase with increase in momentum of the secondary-jet but only up to a certain maximum. The vectoring was found to increase the static pressure at the nozzle inlet, which is a very crucial observation in this study as it is directly related to engine performance. The secondary-jet injection was found to reduce the width of the core-jet and the magnitude of this reduction was found to increase in stream wise direction and also increase with increase in the momentum of the secondary-jet. Core flow behavior was different in the region with aft-deck compared to region without aft-deck. Jet spreading was expedited by the secondary-jet and aft-deck. Multiple shear layers were present in the flow with the secondary-jet switched on, which were otherwise absent. Secondary-jet injection was found to result in the formation of vortices with axes oriented along the direction of the secondary-jet at the injection slot and these vortices convect downstream with the core flow. These vortices were found to excite the shear layer, resulting in better jet mixing and hence augment the mass entrainment by the core flow.

NOMENCLATURE

A	-	Area at nozzle inlet (m^2)