Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

A study of entropy rise across supersonic pressure exchange enhancing rotors KARTIK BULUSU, CHARLES GARRIS, The George Washington University — Pressure exchange can be envisioned as a process where work is done by a fluid with high kinetic energy on another fluid with relatively low kinetic energy by utilizing the non-steady pressure forces at the fluid-fluid interface in the laboratory frame of reference. A novel supersonic ejector based on this process was conceptualized and offers non-dissipative flow induction, improved efficiency and environmental benefits. Entropy production in such devices holds the key to any efficiency improvements and therefore, entropy generation from flow structures such as oblique shocks under supersonic flow conditions was studied using schlieren photography. Oblique shocks emanating from the apexes of three cone-vane type of rotors (Truncated Ramp Vane, Ramp Vane and Double cone type) of different semi-cone vertex angles (20 deg., 10 deg., 25 deg. respectively), designed to produce pressure exchange were captured for upstream mach numbers (M=1.5, 1.75, 2) in air. Entropy rise across the oblique shocks was estimated from shock angle measurements and compared to a theoretical entropy rise. Analysis revealed that Double Cone Rotor produced three orders of magnitude higher entropy rise than the Ramp Vane Rotor. Furthermore, an increase in entropy rise (approximately 0.5 orders of magnitude) due a small angle of attack (2.5 deg.) was observed in the Ramp Vane Rotor.

Kartik Bulusu
The George Washington University

Date submitted: 06 Aug 2010 Electronic form version 1.4