Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Mixing analysis of PLIF images in a multi-stream injection nozzle[1] C. RANDALL TRUMAN, PETER VOROBIEFF, Univ. of New Mexico — We present quantitative analysis of image sequences of multi-stream injection nozzle flows with several different injection geometries. Image sequences were acquired by A.M. Ragheb and G.S. Elliott (UIUC) using planar laser-induced fluorescence (PLIF) in iodine to visualize flow mixing. The injection nozzle was comprised of a slot, ejector and injector block, with rows of ejector and injector holes along the slot length. The ejector flow exits in an underexpanded state so that upon expanding it forces the slot and injector flows together to enhance mixing. For this study, the diameter and geometry of ejector holes were varied to assess their effect on mixing. Two configurations of ejector holes were used, each with two different diameters for a total of 4 cases with data collected at downstream stations. We carried out a quantitative mixing analysis for these configurations, using two parameters to quantify the mixing. The first parameter, the mixing quality criterion, is assessed from the statistics of the PLIF image intensity histograms, which are bimodal for poorly-mixed flows and have a single peak in well-mixed flows. The second parameter is mixing interface length. Our analysis shows that one injection scheme significantly enhances mixing by stretching the mixing interface.

[1]sponsor: Missile Defense Agency Phase II SBIR to CU Aerospace

C. Randall Truman
Univ. of New Mexico

Date submitted: 11 Aug 2009 Electronic form version 1.4