Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Scalar and Velocity Field Measurements in Variable Density Jets in Crossflow[1] DANIEL GETSINGER, LEVON GEVORKYAN, CORY HENDRICKSON, OWEN SMITH, ANN KARAGOZIAN, UCLA — This experimental study explores both unforced and acoustically forced behavior of variable density transverse jets via simultaneous acetone PLIF and PIV measurements. Jets composed of mixtures of helium and nitrogen are injected normally from a converging nozzle into an air crossflow. The jet-to-crossflow density ratio S is varied among test cases by changing the proportions of nitrogen and helium as well as the fraction of seeded acetone. A recent study[2] determined that transverse jets (of Reynolds number $Re_j = 1800$) likely transition to global instability in response to sufficient lowering of the jet-to-crossflow density ratio S (below 0.45-0.40) and/or momentum flux ratio J (below 10). This transition is characterized by weak shear layer instabilities that are easily overcome by external forcing for the convectively unstable (high S and J) case, and strong pure-tone oscillations resistant to external forcing for the globally unstable (low S and J) case. The effect of this instability transition on jet dynamics and mixing is examined here, as are alterations in the velocity field that may be associated with the behavior of the instabilities.

[1]Supported by NSF grant CBET-0755104 and the NASA GSRP.
[2]Getsinger, et al., AIAA Paper 2011-0040, 2011

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Date submitted: 03 Aug 2011 Electronic form version 1.4