Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Boundary Layer Entrainment and Combustion in a Transverse Jet in Supersonic Crossflow[1] WILL HELTSLEY, MIRKO GAMBA, GODFREY MUNGAL, RONALD HANSON, Stanford University — Recent experiments have reconstructed the 3D structure of the combustion regions around burning jets-in-supersonic-crossflow using OH-PLIF in multiple orthogonal planes. A sonic hydrogen jet with a momentum-flux ratio of $J = 4$ was injected normally into high temperature air crossflows at two freestream conditions: (a) T= 1250 K, M= 2.7, P= 25 kPa, and (b) T= 1500 K, M= 2.4, P= 25 kPa. These freestream conditions produce stable combustion in the shear layer of the jet at $J = 4$. The $T = 1500$ K case also produces an intermittently reacting recirculation region in the shock foot region at the front of the jet, and a highly reactive boundary layer. The boundary layer ignites in the recirculation region, wraps around the jet at the base of the jet's bow shock cell and develops downstream where it is entrained into the jet wake. This previously unreported fuel entrainment and ignition in the near field boundary layer may be a significant mechanism for ignition and flame stabilization in the far field of such transverse jets.

[1]Sponsored by AFOSR/MURI, J Tishkoff, Technical Monitor.

Godfrey Mungal
Stanford University

Date submitted: 06 Aug 2009 Electronic form version 1.4