Abstract Submitted
for the GEC09 Meeting of
The American Physical Society

Plasma Assisted Combustion in a Supersonic Flow[1] HYUNGROK DO, SEONG-KYUN IM, MARK CAPPELLI, MARK MUNGAL, Stanford University — A nanosecond pulsed plasma discharge is used to ignite jet (hydrocarbon and hydrogen) flames in supersonic air cross flows (Ma = 1.7 to 3.0). The flow pattern and shockwaves induced by the fuel jets and flow disturbances are characterized by Schlieren imaging. Planar laser induced fluorescence and emission spectroscopy are employed for imaging the distribution of OH radicals. Two common test model flow configurations (cavity and flat wall) are used with integration electrodes for plasma excitation. Cavity flames are found to be readily enhanced by plasma excitation, with a clear reduction in ignition delay time. However, flame propagation beyond the cavity is limited. A flat wall configuration combining an upstream subsonic oblique fuel jet and a downstream sonic transverse fuel jet is shown to provide a more favorable flow condition for jet flame ignition and propagation. The OH distribution in the vicinity of the discharge confirms jet flame ignition by the plasma. Experimental results are validated using a simple theoretical/numerical model. The reduction in the ignition delay and other qualitative features are validated by the model.

[1]Sponsored by AFOSR/MURI program.

Hyungrok Do
Stanford University

Date submitted: 12 Jun 2009 Electronic form version 1.4