Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

LES Modeling of Supersonic Combustion at SCRAMJET Conditions[1] ZACHARY VANE, GUILHEM LACAZE, JOSEPH OEFELEIN, Sandia Natl Labs — Results from a series of large-eddy simulations (LES) of the Hypersonic International Flight Research Experiment (HIFiRE) are examined with emphasis placed on the coupled performance of the wall and combustion models. The test case of interest corresponds to the geometry and conditions found in the ground based experiments performed in the HIFiRE Direct Connect Rig (HDCR) in dual-mode operation. In these calculations, the turbulence and mixing characteristics of the high Reynolds number turbulent boundary layer with multi-species fuel injection are analyzed using a simplified chemical model and combustion closure to predict the heat release measured experimentally. These simulations are then used to identify different flame regimes in the combustor section. Concurrently, the performance of an equilibrium wall-model is evaluated in the vicinity of the fuel injectors and in the flame-holding cavity where regions of boundary layer and thermochemical non-equilibrium are present.

[1]Support for this research was provided by the Defense Advanced Research Projects Agency (DARPA)

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Date submitted: 26 Jul 2016 Electronic form version 1.4