Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Effects of High-Order Schemes and Turbulence Models on Supersonic Combustion of Liquid Jet in Cross Flow KEN ALABI, TTC Technologies, Inc., Centereach, NY 11720 USA, FOLUSO LADEINDE, Stony Brook University, Stony Brook, NY 11794-2300 USA, WENHAI LI, TTC Technologies, Inc., Centereach, NY 11720 USA — In this study, we investigate the effects of various numerical schemes, which are mostly high-order, and different turbulence models, on combustion in liquid jets in supersonic cross flow. The baseline models for two-phase (liquid/gas) flow and evaporation, which include the modeling of the primary and secondary breakup of liquid injectants and the modeling of the evaporation and fate of the spherical particles that result from the breakup models, are based on Sirignano's approach, with Spalding-like closures. The Eulerian-Lagrangian approach is implemented. Several variations of the weighted essentially-non-oscillatory (WENO) schemes are used for spatial discretization, with different turbulence-combustion modeling approaches, including the approaches of laminar flamelets and transported mass fractions. The results show the advantages of high-order (spatial) schemes relative to the second-order approximate factorization procedure of Beam-Warming. Approaches investigated for improving the computational efficiency of the otherwise expensive two-phase flow calculations will be discussed.

Foluso Ladeinde
Stony Brook University, Stony Brook, NY 11794-2300 USA

Date submitted: 01 Aug 2015 Electronic form version 1.4