Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Real fuel effects on flame extinction and re-ignition XINYU ZHAO, BIFEN WU, CHAO XU, TIANFENG LU, University of Connecticut, JACQUELINE H CHEN, Sandia National Laboratories — Flame-vortex interactions have significant implications in studying combustion in practical aeronautical engines, and can be used to facilitate the model development in capturing local extinction and re-ignition. To study the interactions between the complex fuel and the intense turbulence that are commonly encountered in engines, direct numerical simulations of the interactions between a flame and a vortex pair are carried out using a recently-developed 24-species reduced chemistry for n-dodecane. Both non-premixed and premixed flames with different initial and inlet thermochemical conditions are studied. Parametric studies of different vortex strengths and orientations are carried out to induce maximum local extinction and re-ignition. Chemical-explosive-mode-analysis based flame diagnostic tools are used to identify different modes of combustion, including auto-ignition and extinction. Results obtained from the reduced chemistry are compared with those obtained from one-step chemistry to quantify the effect of fuel pyrolysis on the extinction limit. Effects of flame curvature, heat loss and unsteadiness on flame extinction are also explored. Finally, the validity of current turbulent combustion models to capture the local extinction and re-ignition will be discussed.

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Date submitted: 30 Jul 2016 Electronic form version 1.4