Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

**Chemical Kinetics in the expansion flow field of a rotating detonation-wave engine** KAZHIKATHRA KAILASANATH, DOUGLAS SCHWER, U.S. Naval Research Laboratory — Rotating detonation-wave engines (RDE) are a form of continuous detonation-wave engines. They potentially provide further gains in performance than an intermittent or pulsed detonation–wave engine (PDE). The overall flow field in an idealized RDE, primarily consisting of two concentric cylinders, has been discussed in previous meetings. Because of the high pressures involved and the lack of adequate reaction mechanisms for this regime, previous simulations have typically used simplified chemistry models. However, understanding the exhaust species concentrations in propulsion devices is important for both performance considerations as well as estimating pollutant emissions. A key step towards addressing this need will be discussed in this talk. In this approach, an induction parameter model is used for simulating the detonation but a more detailed finite-chemistry model is used in the expansion flow region, where the pressures are lower and the uncertainties in the chemistry model are greatly reduced. Results show that overall radical concentrations in the exhaust flow are substantially lower than from earlier predictions with simplified models. The performance of a baseline hydrogen/air RDE increased from 4940 s to 5000 s with the expansion flow chemistry, due to recombination of radicals and more production of H2O, resulting in additional heat release.

Kazhikathra Kailasanath
U.S. Naval Research Laboratory

Date submitted: 31 Jul 2014 Electronic form version 1.4