OBJECTIVES

Despite advances in CFD-appropriate kinetic mechanism reduction for kerosene-range fuels, significant combustion property variation among current and prospective certified fuels remains a challenge for meaningful CFD-advised design of high pressure, low-emissions combustors. This Phase I effort demonstrates our novel meta-model approach by producing mechanisms for two specific jet fuels: a “typical” Jet A/JP-8, as well as synthetic paraffinic kerosene (SPK) derived from natural gas. Phase II will generalize Phase I approach into a stand-alone software package that allows users to generate compact mechanisms spanning the combustion property parameter space relevant to wide range of other conventional and next-generation aviation fuels.

ACCOMPLISHMENTS

KEY MILESTONES MET

Compact Mechanisms for both an alternative, natural-gas derived synthetic kerosene and a conventional petro-derived Jet A kerosene have been developed and demonstrated under the Phase I effort. Present results indicate that, over a very broad range of pressures, temperatures, equivalence ratios, and characteristic times, these Compact Mechanisms well reproduce predictions of global combustion behaviors relative to predictions of significantly larger target chemical kinetic mechanisms.

FUTURE PLANNED DEVELOPMENTS

PLANNED POST-PHASE II PARTNERS

NASA, Woodward Corp., Boeing, Aerospace Engine Companies

PLANNED/POSSIBLE MISSION INFUSION

The Jet A and S-8 compact chemical kinetic mechanisms generated in this Phase I effort directly address NASA SBIR solicitation for technologies that enable low emissions/clean power aircraft combustors. Phase II product foreseen from this program is a stand-alone, novice-friendly compact kinetic mechanism generator software application that can interface with the National Combustion Code (NCC).

PLANNED/POSSIBLE COMMERCIALIZATION

Demand for CFD-appropriate compact models for aviation gas turbine modeling exists outside of NASA as well. The same potential described above for NASA applications should appeal to aviation turbine OEMs, to for-profit producers of CFD software, and to the academic research establishment. It also has automotive (gasoline/diesel) and marine propulsion applications.

CONTRACT (CENTER) NNX14CC70P (GRC)

SOLICITATION-PHASE SBIR 2014-I

SUBTOPIC A3.03 Low Emissions/Clean Power

TA 11.2.1 Software Modeling and Model-Checking

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