NASA SBIR/STTR Technologies

Hybrid Approach for Modeling Chemical Kinetics and Turbulence Effects on Combustion- Instability

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Subcontractor: Gloyer-Taylor Laboratories

Identification and Significance of Innovation

1. **Combustion instability poses a significant schedule and cost risk to development of new rocket engines.**
2. **System level tools for combustion instability analysis exist but the use a simplified representation of many of the relevant processes, e.g., combustion.**
3. **Develop a tool to incorporate detailed computation of distributed combustion and heat release into an existing combustion instability analysis tool (UCDS).**

Estimated TRL (1 – 9) at beginning and end of contract:
Begin 2- End (4-5)

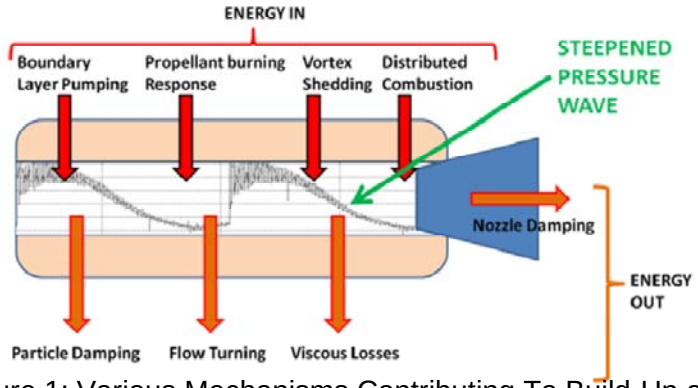

Figure 1: Various Mechanisms Contributing To Build-Up and Dissipation of Combustion Instabilities

Technical Objectives and Work Plan

1. **Perform 2D CFD simulations using both RANS and LES with a range of chemistry models for a single injector combustion chamber.**
2. **Develop method to integrate CFD results in UCDS process to predict instability characteristics.**
3. **Characterize importance of detailed chemical kinetics in the instability modes of the combustion chamber.**
4. **Characterize importance of turbulence-chemistry interactions in the predicting instability modes**

NASA and Non-NASA Applications

- **Instability analysis in rocket engines, gas turbine combustors, ramjets and scramjet by NASA, DOD and OEMs.**
- **The instability analysis tool will be useful to gas turbine manufacturers in gas turbine combustors for civilian energy and aviation applications .**
- **The software tool developed will allow cost-effective design and analysis of combustion systems with reduced susceptibility to instability.**

Firm Contacts
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