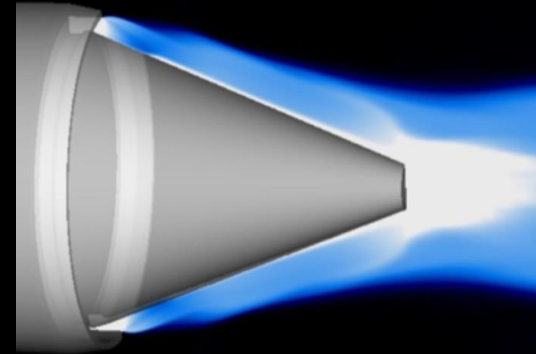


Rotating Detonation Rocket Engine (RDRE)

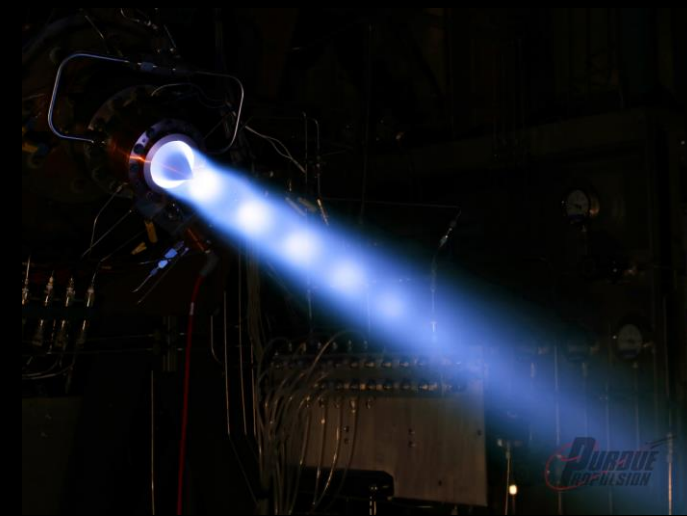
H. Douglas Perkins
NASA Glenn Research Center

RDRE Computational Tools and Design Methodologies

NASA GRC, in coordination with MSFC, is developing RDRE-specific computational tools and design methodologies to enable the development of RDRE configurations for In-Space and Lander propulsion applications. RDRE's take advantage of the pressure rise and high flame speed of detonation to provide higher specific impulse in a shorter combustor length than a traditional chemical rocket.



GRC RDRE Nozzle Simulation



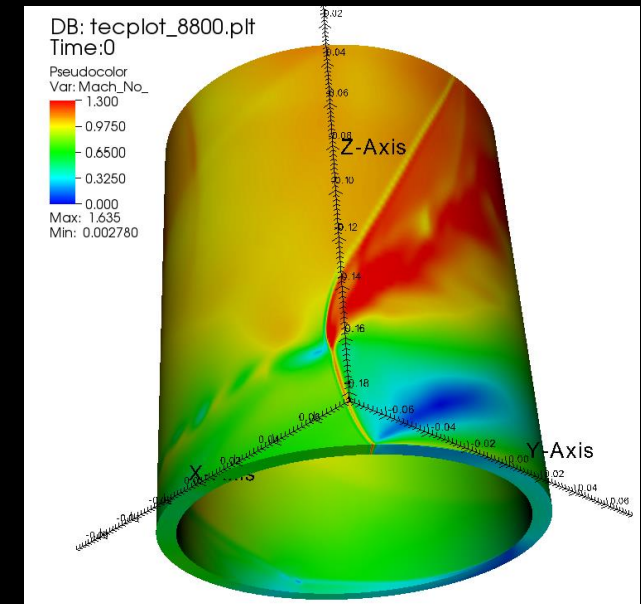
Purdue RDRE In Operation

Technical Approach

This seedling project is developing a suite of mixed-fidelity computational and analytical tools designed to reduce model run times from months down to days and even hours, replacing high fidelity models previously thought to be necessary to capture the complex combustion and fluid physics of RDRE's. This improvement in run time allows for detailed analysis to be used for conceptual design, and not just for end of design verification.

Initial Results/Summary

- Initiated project in March, 2020
- Completed initial CFD model of Purdue RDRE test rig in support of STMD ESI grant.
- Developed and validated reduced/mixed grid-density modeling approach that provided a 350% improvement in model run time.
- Developed and validated a mixed kinetic/equilibrium chemistry modeling technique that improved model run time by an additional 45%



GRC RDRE Combustor Annulus Simulation