NASA SBIR/STTR Technologies

X9.04-9517 - *Lightweight Nozzle Extension for Liquid Rocket Engines*

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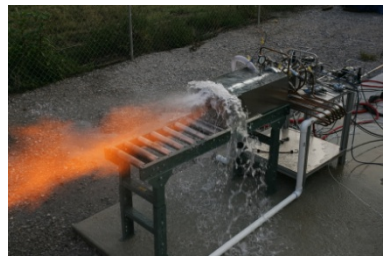
Identification and Significance of Innovation

A metallic nozzle extension (NE) is being considered for the J-2X engine, with C/C composite as a backup. Phase I oxide emissivity coating reduced Haynes 230 (H230) NE wall temperature by nearly 500F. Phase II goal is to develop optimum thermal solutions for a metallic J-2X NE. Working with PWR, high emissivity & thermal barrier solutions will be demonstrated on successively larger components until full size capability is demonstrated. A secondary goal is to continue the demonstration of domestically produced 2-D C/C composite materials & oxygen protective liners for use on liquid rocket engines, such as LSAM.

Expected TRL Range at the end of Contract: TRL5-TRL6

J-2X

Subscale H230 NE With HfB_2 coating



Hot gas testing of subscale NE

Technical Questions to be Answered in PH II

- What are suitable high emissivity & thermal barrier solutions for inner/outer wall of J-2X NE & their weight impact?
- What is the optimum balance between emissivity/thermal barrier coating thickness (i.e. weight) and performance?
- What are the scientific, manufacturing & logistical challenges of applying high emissivity/thermal barrier coatings to full scale J-2X NE?
- What are the scientific & manufacturing challenges associated with fabricating lightweight Ir-lined C/C thrust chambers for LSAM & similar liquid rocket engines?

Technical Objectives and Work Plan

- Thrust I – High Emissivity Coatings for H230 Nozzle Extension
- Thrust II – Thermal Barrier Coatings for H230 Nozzle Extension
- Thrust III – Manufacturing Scale-up
- Thrust IV – Lightweight C/C Thrust Chamber Development
- Thrust V – Commercialization

NASA and Non-NASA Applications

- J-2X nozzle extension
- LSAM Ascent and Descent Engines
- Leading edges and control surfaces for hypersonic aircraft
- Propulsion components for space access and space return vehicles
- Propulsion components for Moon/Mars landing vehicles
- Common Extensible Cryogenic Engine (CECE)
- Nosetips, rocket nozzles & control vanes for strategic/tactical missiles
- Thermal control components for nuclear power applications.
- Crucibles
- High Power X-ray targets

Firm Contacts

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