



## NASA SBIR/STTR Technologies



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

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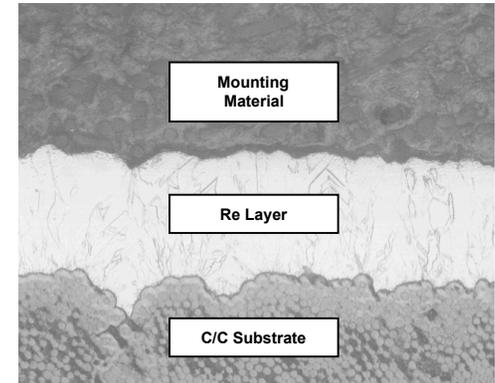
#### Identification and Significance of Innovation

- Currently, NASA & PWR plan to employ a Noveltex® or Naxeco® 3-D C/C nozzle extension from a foreign supplier on the J-2X.
- Plasma Processes Inc., and subcontractor ATK Launch Systems, propose a program with the primary goal of demonstrating an improved C/C composite nozzle extension for use on the J-2X.

Expected TRL Range at the end of Contract: TRL4-TRL5

#### Technical Objectives and Work Plan

- Subcontract ATK Launch Systems to optimize 2-D C/C preform manufacturing methods (e.g. tape-wrap & involute) in an attempt to increase interlaminar shear strengths, thus making 2-D C/C composite interlaminar shear strengths comparable to 3-D C/C.
- Investigation of oxygen protective coatings for C/C composite materials. C/C coupons will be provided by ATK. Investigation will include employment of laser surface treatment to enhance adhesion & durability of coatings.
- Evaluation of oxygen protective coatings via microstructural characterization, adhesion strength (ASTMC633-79) & rocket motor torch testing
- Develop design(s) for subcomponent hot fire testing in Phase II.
- Investigate domestic scale-up to full size J-2X nozzle extension.



Uncoated & coated C/C exit cones      EL-formed Re on C/C substrate

#### NASA and Non-NASA Applications

- Leading edges & control surfaces for hypersonic aircraft
- Propulsion components for space access & 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

#### Firm Contacts

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**NON-PROPRIETARY DATA**