Advanced Materials and Fabrication Techniques for the Orion Attitude Control Motor

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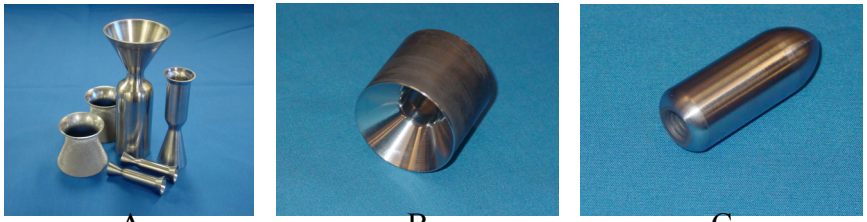
Identification and Significance of Innovation

•A key component of the Orion Launch Abort System (LAS) is its Attitude Control Motor (ACM). Testing of the ACM valve assembly has resulted in failures of hot-gas components during firings.
•Based on these results, alternative materials with higher temperature capability are needed.
•Electrochemical forming techniques will be developed for near net shape fabrication of ACM hot gas components.
•Both rhenium and rhenium coated graphite composite materials will be evaluated.
TRL at the conclusion of Phase I: 4



A B C

A) Near-net shape formed rhenium and tungsten nozzles and thrust chambers. B) and C) Rhenium coated graphite nozzle and pintle that has been successfully hot-fire tested at 3800 psi and 5500°F.

Phase II Technical Objective & Work Plan

•Develop electrochemical forming parameters necessary to produce near-net-shape formed ACM components comprised of rhenium and rhenium coated graphite.
•Produce a representative rhenium flow distributor and harvest specimens for evaluation.
•Perform room and elevated temperature materials properties testing on electrochemically formed rhenium specimens.
•Evaluate the ability to reduce the cost and weight of ACM components by producing a rhenium coated graphite flow distributor.
•Perform preliminary thermal cycle tests of the rhenium coated graphite flow distributor to demonstrate proof-of-concept.
Subcontractors: Southern Research Institute

NASA and Non-NASA Applications

•Targeted NASA application is the ACM for the Orion LAS. Other NASA applications include in-space propulsion components, nuclear power/propulsion, microgravity containment crucibles and cartridges.
•Targeted commercial applications include net-shape fabrication of refractory and platinum group metals for rocket nozzles, crucibles, heat pipes, and propulsion subcomponents; and advanced coating systems for x-ray targets, sputtering targets, turbines, rocket engines, wear and thermal/electrical insulation.

Firm Contacts

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NON-PROPRIETARY DATA