

PLASMA PROCESSES, INC.

LOW-COST, NON-ERODING PROPULSION
AND HOT GAS COMPONENTS



Net Shape Throats

36

Topic Number: N00-056
(NAVSEA)

SBIR Investment: \$842K
Project Revenue: \$2.66M

Plasma Processes, Inc.

4914 Moores Mill Road
Huntsville, AL 35811
(256) 851-7653
www.plasmapros.com
timmck@plasmapros.com
Timothy McKechnie

About the Technology

Integrated High Payoff Rocket Propulsion Technology (IHRPT) is a nationwide defense system initiative to improve rocket propulsion technology. In order to meet this objective, ultrahigh-temperature, non-eroding energy management devices are required to constrain propellants operating at temperatures in excess of 6,000 degrees Fahrenheit and pressures greater than 2,000 pounds per square inch. Plasma Processes, Inc. (PPI) has developed low-cost, zero-erosion, net-shape refractory and ceramic propulsion, and hot-gas valve components that have successfully completed subscale hot-fire testing.

Rocket nozzle throat inserts are manufactured using PPI's Vacuum Plasma Spray (VPS) net shape manufacturing technique, a coating process in which a combination of high-melting and chemically stable refractory metals and their ceramics are sprayed onto a mandrel of the desired shape under vacuum or low pressure. The technique eliminates machining issues inherent with brittle, refractory materials and deposition rates. In addition to reducing the cost of rocket engines and improving performance, VPS technology yields a low recurring component cost after development. PPI's VPS technology is being tested in solid rocket motors for the Standard Missile-3, as part of the Navy's sea-based Aegis ballistic missile defense system that will provide theater-wide defense against medium and long range ballistic missiles.

Military and Commercial Significance

The VPS net shape manufacturing technique lowers rocket-engine costs, improves propulsion performance, and increases payload size. The manufacturing technique offers the flexibility of material choices and incorporates multiple materials within the component structure, through the use of functional gradients, thereby increasing performance and life-cycle. In a series of scale-up tests using a .351-inch diameter valve throat specimen and 4K rocket motor containing either Class 1.3 or Class 1.1 propellant, the PPI nozzle demonstrated less than 0.2 mils/second erosion rate and 90 times less erosion when compared with a 4D Carbon-Carbon throat insert.

About the Company

Plasma Processes, Inc.'s participation in the SBIR and STTR programs has resulted in affordable new technologies and innovative manufacturing techniques. The company has developed diverse technologies with broad applications for markets and product areas in both the military and commercial sectors. Plasma Processes has been awarded the 2002 Turning Goals Into Reality Award by NASA, Alabama Manufacturer of the Year 2000 by the Business Council of Alabama, and Small Business of the Year 2000 by the Huntsville Chamber of Commerce.

APPLICATIONS

- Navy, Air Force, Army, and Missile Defense Agency - Non-eroding nozzles
- Navy, Air Force, Army, and Missile Defense Agency : Joint Common Missile, Compact Kinetic Energy Missile - Solid rocket motors
- Energy industry: Meets high thermal requirement and environmental non-reactivity needs
- Coatings industry: Corrosion protection, electrical resistivity/conductivity, oxidation resistance, thermal protection, wear resistance