Flexible Gap Filler for Ablative Thermal Protection Systems, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

NASA's Orion spacecraft will serve as the exploration vehicle that will carry a crew to space, provide emergency abort capability, sustain the crew during the space travel, and provide safe re-entry from deep space return velocities. Planetary aerocapture and entry requires that the crew vehicle be equipped with a Thermal Protection System (TPS) comprised of lightweight, high performance ablator materials. Materials current under development include felt or woven material precursors impregnated with polymers (i.e. PICA) and/or additives to improve ablation and insulative performance, along with the block form of Avcoat ablator. There is a need for advancements in polymers for use in bonding and/or gap fills for tiles of advanced TPS for extreme entry conditions. The ideal binder would be a flexible, low glass transition temperature polymer with a high decomposition temperature/char yield (comparable to phenolic) and a high (>1%) strain-to-failure that is compatible with cured epoxy, phenolic, and/or cyanate ester. Engineers at Luna have developed a novel copolymer elastomer that has a very low glass transition (< -100 degrees F) and a decomposition temperature on par with typical phenolic ablatives. This resin can be highly filled to tune ablative properties and is compatible with glass and carbon fabric substrates.

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: Luna's flexible, ablative gap filler will be enabling for the Thermal Protection System capability on current and future NASA reentry vehicles as well as carbon cloth phenolic ablative liners for nozzles on solid rocket boosters. Variations on Luna's formulation may also find use as robust flexible sealants for spacecraft exterior repair.

To the commercial space industry:

Potential Non-NASA Commercial Applications: Ablative gap

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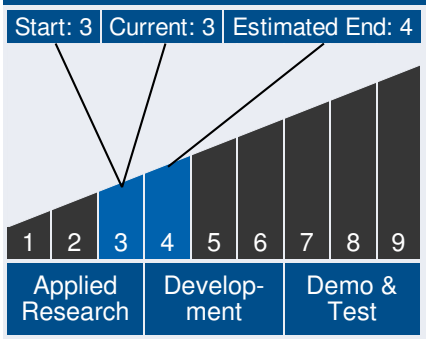
Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

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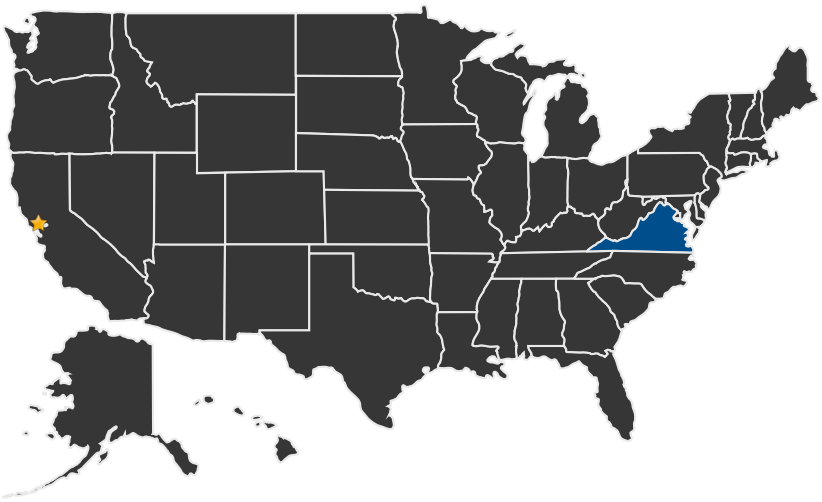
fillers will be useful in commercial space transport reentry vehicles and various ablative liners in both military and commercial rocketry. There is also potential use for this low Tg polymer in hydraulic seals that experience a wide temperature gradient.

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Ames Research Center

Other Organizations Performing Work:

- Luna Innovations, Inc. (Roanoke, VA)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23592)

Management Team *(cont.)*

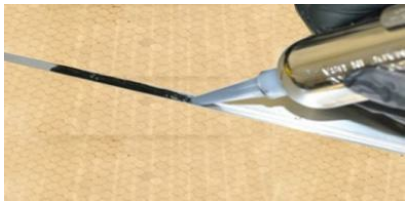
Principal Investigator:

- Benjamin Beck

Technology Areas

Primary Technology Area:
Entry, Descent, and Landing Systems (TA 9)
└ Aeroassist and Atmospheric Entry (TA 9.1)
  └ Thermal Protection Systems for Rigid Decelerators (TA 9.1.1)

IMAGE GALLERY



Flexible Gap Filler for Ablative Thermal Protection Systems, Phase I

DETAILS FOR TECHNOLOGY 1

Technology Title

Flexible Gap Filler for Ablative Thermal Protection Systems, Phase I

Potential Applications

Luna's flexible, ablative gap filler will be enabling for the Thermal Protection System capability on current and future NASA reentry vehicles as well as carbon cloth phenolic ablative liners for nozzles on solid rocket boosters. Variations on Luna's formulation may also find use as robust flexible sealants for spacecraft exterior repair.