Project Introduction

ET Materials, LLC developed the first ever electrically controlled extinguishable solid propellant (ECESP). The original propellant developed under Air Force SBIR contracts became known as ASPEN. The start/stop capabilities were first demonstrated in end burning configurations that operated by feeding the propellant against stationary electrodes. Continuing research by ET Materials led to a new family of ECESP propellants prepared as solution solid propellants. These propellants provided higher performance than the ASPEN, but are more electrically conductive. This feature was not as desirable as first thought because the electrode gap has to be much narrower to cause the propellant to ignite at the surface, which makes it more difficult to scale for larger motors. The high conductance of the propellant makes it ideal for a MEMS application as the propellant can be cast in thin layers. Since the propellant will only sustain combustion when electrical power is supplied stacked layers of the propellant could be ignited separately without causing ignition of neighboring layer. This provides more versatility than similar MEMS designs utilizing conventional solid propellants. In the Phase I study "micro cluster thrusters" will be fabricated and tested under vacuum conditions to establish the power and controller requirements.

Anticipated Benefits

The electrode design proposed in this program is very compatible with standard semiconductor (layered) manufacturing. Thus, microactuators operating from on demand gas generation could lead to a new class of pneumatically powered nano-robotic devices. NASA would be able to implement this technology for any of their missions utilizing small spacecraft for forming satellite or spacecraft constellations. The small size and simplicity would allow their use in the extended boons of an atypical spacecraft. The technology, also, is very attractive for larger satellites requiring refueling such as DARPA’s Orbital Express Program.
Primary U.S. Work Locations and Key Partners

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<thead>
<tr>
<th>Organizations Performing Work</th>
<th>Role</th>
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<th>Location</th>
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</thead>
<tbody>
<tr>
<td>Marshall Space Flight Center (MSFC)</td>
<td>Lead Organization</td>
<td>NASA Center</td>
<td>Huntsville, AL</td>
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<tr>
<td>ET MATERIALLL LLC (Formerly ECOTECH)</td>
<td>Supporting Organization</td>
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Project Management

Program Director: Jennifer L Gustetic
Program Manager: Carlos Torrez
Project Manager: Chris Protz
Principal Investigator: Charles Grix

SBIR/STTR
Solid State MEMS Thrusters Using Electrically Controlled Extinguishable Solid Propellant, Phase I
Completed Technology Project (2005 - 2005)

For more information and an accessible alternative, please visit: https://techport.nasa.gov/view/5229