Project Introduction

Monofilament Vaporization Propulsion (MVP) is an innovative new propulsion technology targeted at secondary payload applications. The approach with MVP, rather than using exotic propellants to achieve maximum specific impulse and system performance, is to use an inexpensive, inert, solid propellant. This enables the use of a propulsion system on lower budget missions by lowering the unit cost (no valves or pressure vessels), and minimizes range safety expenses. By using a commercially available, space rated polymer as propellant, MVP overcomes potential issues associated with liquid propellants such as freezing, over-pressurization, degradation (of tank wall and/or propellant itself), and cg perturbations due to sloshing. As a result, MVP’s standalone risk to the primary payload is no greater than that of a CubeSat not equipped with propulsion. MVP harnesses technology used in 3D printing applications to feed propellant into proven electrothermal propulsion technology developed by CU Aerospace. To date, MVP has demonstrated a continuous 105 seconds specific impulse with 20 W input power, with 107 seconds peak. Phase II performance is expected to exceed 130 seconds. This should provide 900 N-s total impulse with a 1U (10 cm x 10 cm x 10 cm) system, attributable to the high storage density and permissible thin walled construction. A 4 kg, 3U CubeSat equipped with MVP could achieve 250 m/s Delta-V while expending less than 25 W during operation. CU Aerospace will design, fabricate, and deliver a 1U MVP system to NASA at the end of the Phase II program.

Anticipated Benefits

The MVP thruster system supports the NASA Roadmap for In-Space Propulsion Systems, nonchemical propulsion. MVP offers CubeSats and other small satellites a propulsion capability sufficient for various orbital maneuvers with several millinewtons of thrust requiring minimal thrust-control ACS and a minimal volume and system integration cost. The baseline MVP, occupying a 1U volume, has minimal impact on the CubeSat bus and payload. The solid propellant has no handling, storage, or operational restrictions beyond those of the CubeSat. The ease of handling and storage for the solid propellant can extend operation to planetary missions with no additional monitoring or controls.

The MVP thruster will provide a compact, light-weight, non-hazardous, propulsion technology solution that will be made available in a family of sizes that can meet the differing needs of users in DOD, industry, and academia for CubeSat and small-satellite missions. MVP will require no safety equipment for storage, transportation, integration, and testing, and place no demanding requirements on the launch provider, making it an ideal low-cost solution for industry, research, and academic small-satellite propulsion needs.
Primary U.S. Work Locations and Key Partners

<table>
<thead>
<tr>
<th>Organizations Performing Work</th>
<th>Role</th>
<th>Type</th>
<th>Location</th>
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</thead>
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<tr>
<td>★ Glenn Research Center(GRC)</td>
<td>Lead Organization</td>
<td>NASA Center</td>
<td>Cleveland, OH</td>
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Primary U.S. Work Locations

Illinois

Images

Briefing Chart Image
Monofilament Vaporization Propulsion (MVP) System, Phase II

Project Management
Program Director: Jennifer L Gustetic
Program Manager: Carlos Torrez
Principal Investigator: Curtis Woodruff

Technology Maturity (TRL)
Start: 4
Current: 4
Estimated End: 6

Target Destination
Earth

For more information and an accessible alternative, please visit: https://techport.nasa.gov/view/93651