

Bang-Bang Propellant Feed System (BBPro) ACO

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Project Overview

- This project will operate a next generation Hall thruster, provided by GRC, with a high-flow rate feed system incorporating a bang-bang pressure regulation system (BBPRS), designed and manufactured by Maxar.
- This project aims to advance the maturity of the propellant pressure regulation system, by providing valuable data to validate the BBPRS thermodynamic model and by testing the hardware in a relevant environment (vacuum).
- Furthermore, this demonstration will advance development of high flow rate xenon pressure regulation in preparation for high power Solar-Electric Propulsion (SEP) critical to future lunar and Mars missions.

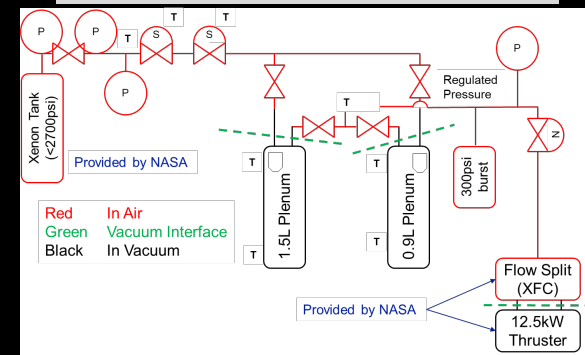
Technical Approach

- Maxar will test their breadboard BBPRS in GRC's Vacuum Facility 6 (VF-6), operating with NASA's Hall Effect Rocket with Magnetic Shielding (HERMeS) Test Demonstration Unit 3 (TDU-3) Hall thruster (12.5kW).
- The goal is to collect data required to confirm proper operation of the new BBPRS at high flow rates, while also collecting the data required to validate Maxar's thermodynamic modeling simulation of the system with xenon and krypton.

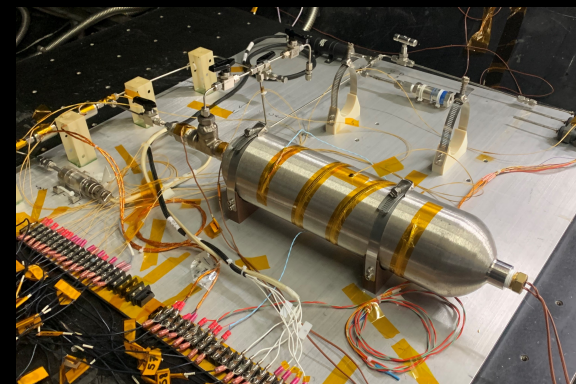
Results/Summary

- A System Requirement Review (SRR) for the BBPRS test was performed by the MAXAR and NASA team
- Tests of the BBPRS in vacuum were performed at MAXAR facilities in July 2021.
- MAXAR and NASA team have been coordinating test setup and schedule at NASA GRC. The test is planned for FY22 Q1.

Schematic of BBPRS layout @NASA GRC



Photograph of the BBPRS during testing at Maxar



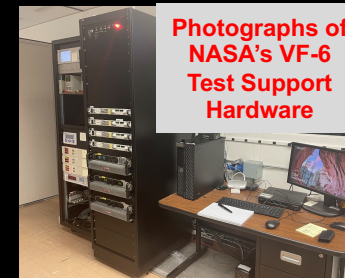
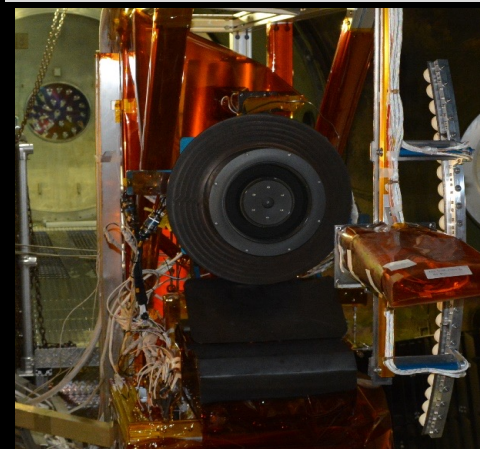
Contributing Partners

- HEOMD PPE and STMD TDM SEP projects are contributing test hardware.
- This project will piggyback on an existing test campaign, which would leverage the hardware setup in GRC's VF-6. The test setup that will be leveraged in this test campaign includes:
 - Hall Effect Rocket with Magnetic Shielding (HERMeS) Test Demonstration Unit 3 (TDU-3) Hall thruster
 - Test support setup in VF-6 that includes:
 - Power console
 - Data acquisition system
 - Thrust stand
 - Plasma probes
- NASA GRC and MAXAR are executing on BBPRS and NASA GRC VF-6 test setup modification to facilitate execution of ACO BBPRS & HERMeS TDU-3 test

Infusion and Transition Plan

- As both government and industry are moving towards higher SEP power, target markets for this product are both NASA missions and commercial communications satellites.
- This ACO is developing a new, reliable xenon propellant feed system that will be capable of scaling to next generation high-throughput Hall thrusters, for high-power SEP missions to the Moon and Mars.
- In addition, the BPRS can also be utilized as a drop-in replacement for current mechanically regulated feed systems in communication satellites. This new pressure regulation architecture aims to increase overall satellite reliability, subsequently decreasing cost of conventional satellite missions.
- The proposed technology will make a significant impact on the commercial space sector by both enabling very high-power SEP, and by making existing SEP systems more reliable.
- In addition to the previously mentioned target markets, there are commercial companies looking to colonize the solar system.

Photograph of NASA's TDU-3 inside VF-6



Photographs of NASA's VF-6 Test Support Hardware

