

Summary of NASA Progress on the Development and Qualification of a 12-kW Hall-Effect, Solar Electric Propulsion Thruster

Joel W. Robinson, TDM SEP Mission Manager (NASA/MSFC)

George J. Williams, SEP Deputy Project Manager (NASA/GRC)

Dean P. Petters, SEP Contracting Officer Representative (NASA/GRC)

Clayton D. Kachele, SEP Project Manager (NASA/GRC)

Technology Demonstration Missions (TDM) Program Overview

In late 2010, TDM was initiated as part of the NASA portfolio of technology programs. This Level 2 program is **hosted at Marshall Space Flight Center** within the Science and Technology Office.

Objectives

- ❖ Maintain a portfolio of projects that support **STMD's Strategic Investment Plan**.
- ❖ **Partner** with organizations that provide cost sharing.
- ❖ Enable **transition** and/or **infusion** of technologies or capabilities into NASA missions and the Nation's space enterprise.
- ❖ Bridge the gap between **development and mission infusion** by maturing cross-cutting system-level technologies through demonstration in relevant operational environments. (TRL 5-7).

TDM, an uncoupled program, is the largest program in NASA's STMD, representing **38%** of STMD's overall budget in FY23.

TDM's FY23 Budget was **\$448.3M**.

TDM (FTE) workforce has grown from 31 (2011) to **274.8** (2023).

In January 2012, TDM was approved to enter implementation and has since managed **39** projects.

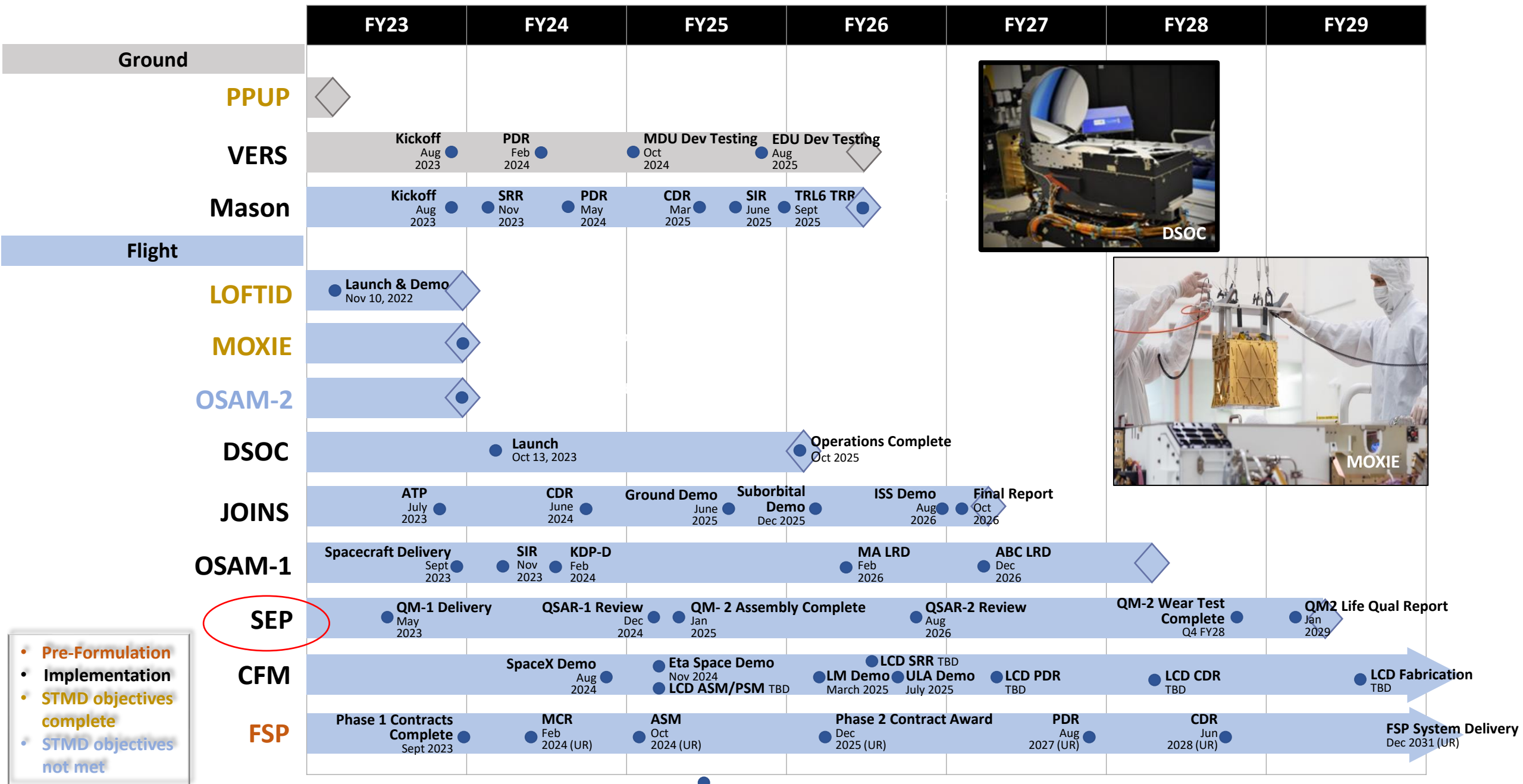
In FY23, a total of **13** technology demonstration projects were managed for STMD.

TDM Partners

- The Technology Demonstration Missions (TDM) Program conducts:
 - Space flight demonstrations to advance technologies and transition these new capabilities to NASA exploration missions and potentially to industry and other Government agencies.
 - Ground-based testing to advance technologies from component validation in a relevant environment to system model or prototype demonstration in an operational environment.



Technology Demonstration Missions (TDM) Portfolio at a Glance



Application Transition

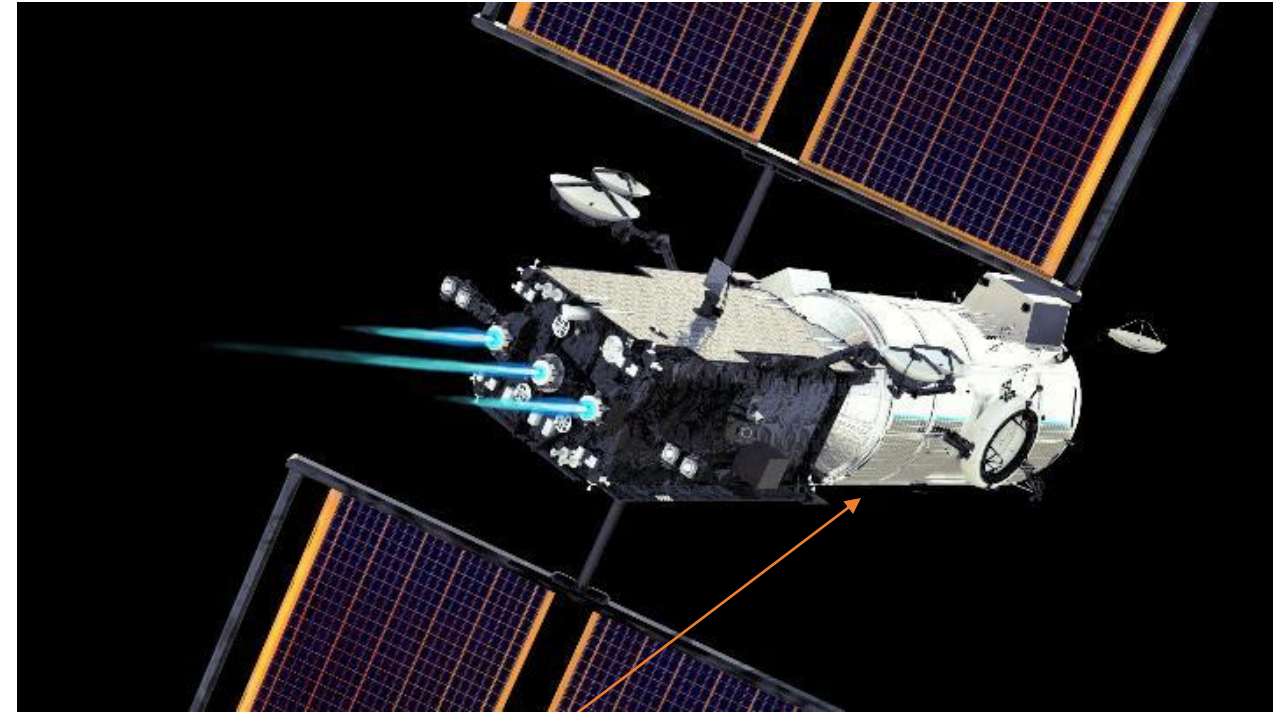
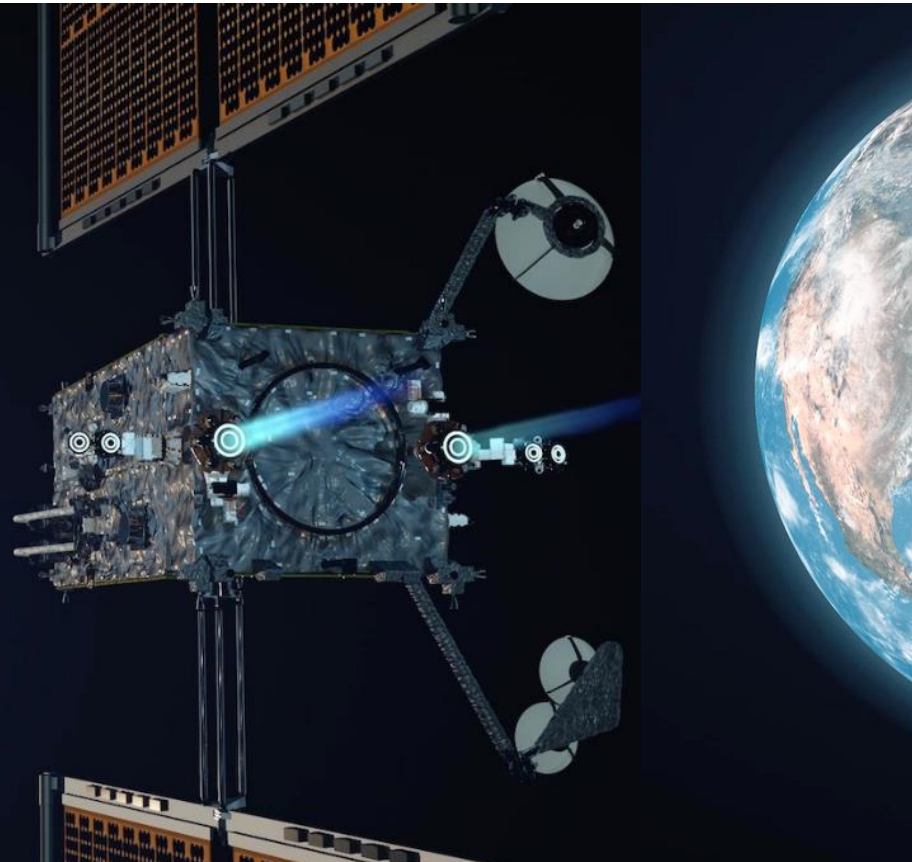
Initially slated for the Asteroid Redirect and Robotic Mission

Power & Propulsion Element (PPE)

(2) 12 kW AEPS Thrusters (Aerojet Rocketdyne)

(4) 6 kW Busek Thrusters

Trip time to NRHO – 5 months

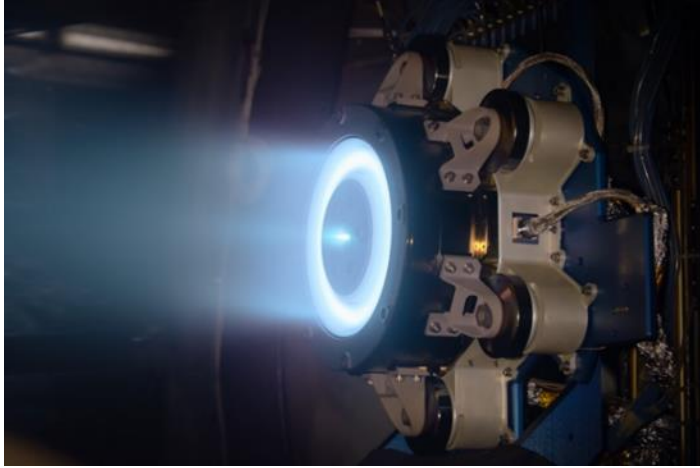


PPE + Addition of HALO Module = Co-manifested Vehicle (CMV)

Added center 12 kW thruster and gimbaled outboard 12 kW thrusters

Trip time to NRHO – 13 months

Component & Assembly Level Testing



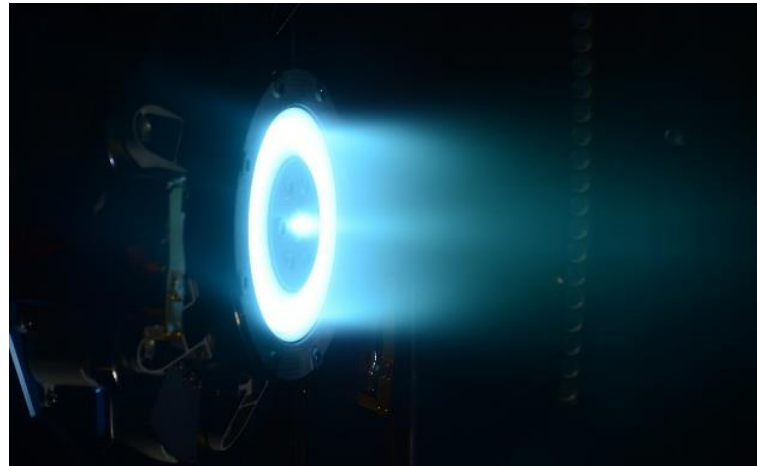
First hotfire of ETU-1, 8/15/19

ETU-2 ignition, 10/20/19

Engineering Test Units designed to support an EP String configuration including Power Processing Unit and Xenon Flow Controller.

Selection of Maxar as Prime contractor on PPE resulted in AR contract focusing on thruster only.

Qual testing now focused on thruster.



JPL Component Test Facility with all Fixtures Installed

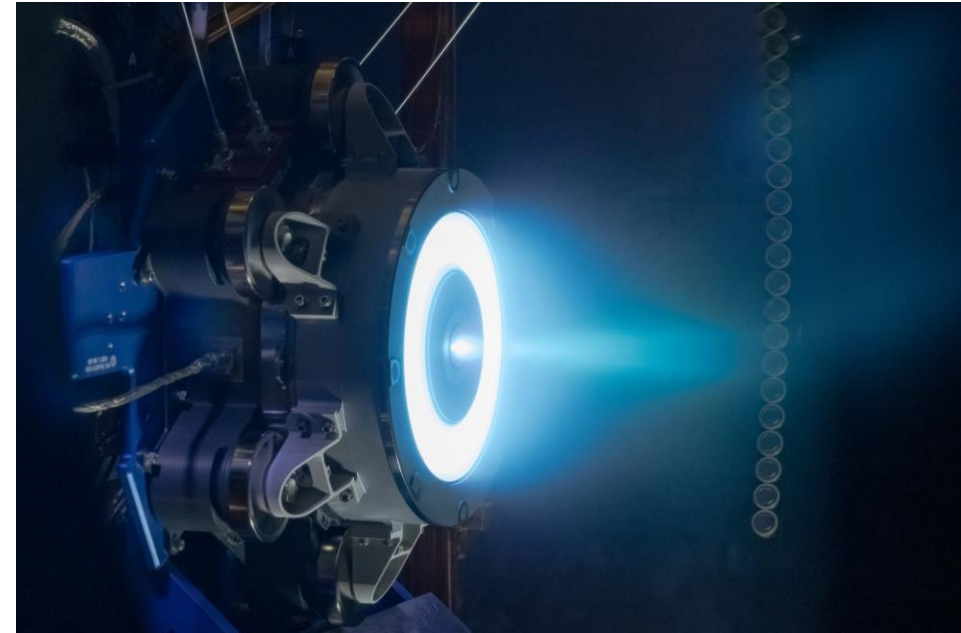
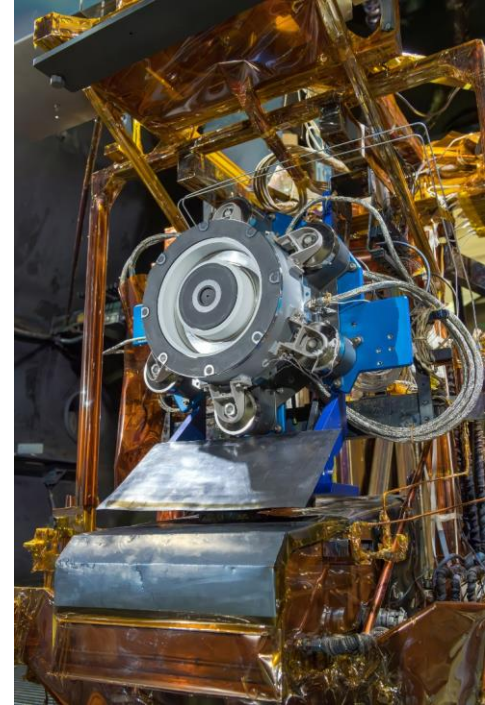
FM's 1-3 and QM-1 in Redmond



Flight model deliveries, post ATP, could begin as early as end of CY2024.

Qualification Thruster Testing

- QM-1 was installed into the GRC VF-5 chamber in July 2023.
- The hardware has completed Acceptance Test Procedures and pre-environmental cycle testing.
- Vibration testing was conducted in Redmond and preparing for shock testing at Moog CSA.
- Later this summer, QM-1 will go through TVAC testing at JPL before returning to GRC for post-environmental testing.
- After ATP of QM-2, the project will embark on a multi-year wear testing campaign cumulating in 23,000 hours of life.



An Example of Future Mission Collaboration

TDM realizes SEP technology has missed the latest M-Class Mission proposals, but could it supplement the selected mission?

Future M and L-Class Missions could benefit from a 12 kW SEP.

The SEP Project has thruster subassemblies in progress for one additional qualification and one additional flight thruster.

Those could be the building blocks to international mission.

Are there other mission partners interested?



Thank you for your time and attention



NASA and Aerojet Rocketdyne Team



STMD/TDM Team