Pulsed Plasma Thruster (PPT) Development and Ground Testing in Support of PPT Flight Demonstrations on MightySat

by:

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Abstract. The Pulsed Plasma Thruster (PPT) Space Demonstration is a cooperative effort between the US Air Force, Phillips Laboratory and the NASA-Lewis Research Center. The purpose is to investigate the orbit-raising capability and overall performance of the PPT system on-board a spacecraft and to determine the effects of plume contamination from the thruster on spacecraft instruments. The PPT is scheduled for a January 2000 launch on the MightySat II.1 spacecraft. The MightySat program is managed from the Space Experiments directorate of Phillips Laboratory technology in a timely and cost-effective manner.

The MightySat program office has selected the Orbital/Sub-Orbital Platform (OSP) as the launch vehicle for flight II.1, which has been named Sindri. While mission analysis shows that for OSP insertion at nominal solar flux conditions it is unnecessary to do any orbit raising to maintain a one year mission life for Sindri. The PPT design and testing effort, conducted jointly with NASA Lewis Research Center and Primex Aerospace Corporation, will continue to focus on the critical orbit raising mission from a Space Shuttle insertion orbit.

The breadboard unit of the PPT is in the final phases of ground testing at NASA Lewis Research Center (LeRC) in Cleveland, OH. Currently, NASA is conducting measurements of performance, contamination and lifetime. Testing of the conducted and radiated electromagnetic interference produced by the thruster will also be performed. Modeling of the PPT plume is being performed through grants managed by NASA LeRC. Full flight qualification tests of a protoqual PPT will be conducted at Primex Aerospace and at NASA LeRC, consisting of vibration and thermal tests, an EMC/EMI evaluation, and a verification of other spacecraft interface specifications. Less rigorous acceptance testing on the actual flight unit will be performed prior to delivery to ensure proper operation of the PPT without overstressing the components before spaceflight operations.