4.5-kW Hall Effect Thruster Evaluated

Installation of the SPT–140 on the thrust measurement stand.

As part of an Interagency Agreement with the Air Force Research Lab (AFRL), a space simulation test of a Russian SPT–140 Hall Effect Thruster was completed in September 1999 at Vacuum Facility 6 at the NASA Glenn Research Center at Lewis Field. The thruster, shown in the photo, was subjected to a three-part test sequence that included thrust and performance characterization, electromagnetic interference, and plume contamination. SPT–140 is a 4.5-kW thruster developed under a joint agreement between AFRL, Atlantic Research Corp, and Space Systems/Loral, and was manufactured by the Fakal Experimental Design Bureau of Russia. All objectives were satisfied, and the thruster performed exceptionally well during the 120-hr test program, which comprised 33 engine firings.

The Glenn testing provided a critical contribution to the thruster development effort, and the large volume and high pumping speed of this vacuum facility was key to the test's success. The low background pressure (1×10^{-6} torr) provided a more accurate representation of space vacuum than is possible in most vacuum chambers. The facility had been upgraded recently with new cryogenic pumps and sputter shielding to support the active electric propulsion program at Glenn. The Glenn test team was responsible for all test support equipment, including the thrust stand, power supplies, data acquisition, electromagnetic interference measurement equipment, and the contamination measurement system.

The test program provided a comprehensive evaluation of thruster operation in preparation for future flight opportunities. The performance test measured thrust over a wide variety of operating conditions and background pressures to develop an extensive

thruster performance map. The electromagnetic interference test characterized interference caused by thruster operation over a wide range of communication antenna frequencies. The contamination test evaluated plume effects on representative satellite surface samples, such as solar cell cover glasses and optical solar reflectors, during 100 hours of continuous thruster operation.

Early review of the test data indicates very positive results for all test phases. The breadth and success of this test effort will provide a convincing argument for future flight considerations for this thruster technology. Potential applications include orbit station keeping, repositioning, low-Earth-orbit to geosynchronous-Earth-orbit transfer, and deep space maneuvers.

Glenn contacts: Lee S. Mason, (216) 977–7106, Lee.S.Mason@grc.nasa.gov; and Robert S. Jankovsky, (216) 977–7515, Robert.S.Jankovsky@grc.nasa.gov

Author: Lee S. Mason

Headquarters program office: OAST

Programs/Projects: CETDP, STR