SPACE PROPULSION SYMPOSIUM (C4)
Electric Propulsion (4)

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# JOINT PULSED PLASMA THRUSTER RESEARCH AT THE UNIVERSITY OF TOKYO AND IRS

**Abstract**

The first PPT & iMPD Workshop in Stuttgart in 2007 motivated the foundation of the International PPT and iMPD Working Group. The group promotes cooperation in development and application of pulsed plasma thrusters. The successful exchange of personal and promising results in recent PPT development at IRS and the University of Tokyo have stimulated efforts at both research facilities to intensify their cooperation in this field. For the first milestone, both cooperation partners will join their expertise and facilities for development of the IRS thruster SIMP-LEX and investigation of future technologies for PPT, i.e., liquid propellant feeding systems. The project SIMP-LEX aims at the development, optimization, investigation and installation of a high-efficiency pulsed plasma thruster into the satellite BW1, part of the Stuttgart Small Satellite Program, bound for Moon. At IRS, during the first phase a specially equipped test facility was installed and operated for extensive life testing of the SIMP-LEX thruster components. Investigations provide important information about the long term operation. An additional PPT test-bed has been established in Japan to enable the diagnostics of the plasma and other physical values related to the discharge process. To obtain a substantial image of the plasma-creating and plasma-propagating processes, a high-speed camera was used to identify and trace the plasma waves. Further, the magnetic field between the electrodes was measured with help of magnetic field probes. In order to compare the results with an analytical approach using the Biot-Savart law, a Rogowski coil was used to determine the discharge current. The magnetic field results of both, theoretical and experimental approaches were compared and the difference was determined and discussed. The plasma waves were identified for different bank energies and conclusions were drawn with respect to the mission requirements. Optimization studies including thermal loads, performance and contamination monitoring were started at IRS and first results obtained as in later phases subsystem testing and qualification will be conducted. SIMP-LEX is scheduled for flight readiness within a period of three years. All steps will be carried out in the scope of two doctoral dissertations, one of which will be provided by the IRS and the University of Tokyo. Steps incorporate a complementary work strategy instead of fixed packages, to comply with the time frame. This will enhance the availability of studies and the flexible allocation of resources.