

SPACE PROPULSION SYMPOSIUM (C4)  
Missions Enabled by new Propulsion Technology and Systems (6)

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MINI RF-HELICON-DOUBLE-LAYER PLASMA THRUSTER REQUIREMENTS FOR NEW SPACE  
MISSIONS

**Abstract**

This paper presents the feasibility study performed to evaluate the requirements of the Thruster developed under the HPH.com (Helicon Plasma Hydrazine. Combined Micro) project. HPH.com is a project funded by the European Committee within the EU 7th Framework Programme and carried on by an International consortium. Objective of this program is to design, optimize and develop a prototype of a space helicon-based plasma thruster after having carried out deep numerical/theoretical investigation and extensive experimental campaign. The thruster is specifically conceived to be used on board a microsatellite for attitude and position control in order to allow low-cost demonstration-mission. In order to release the requirement of such a kind of system, numerical simulations of possible scenarios have been deeply analysed. To achieve this aim, the University of Bologna, in collaboration with Thales Alenia Space and the University of Padua developed an highly accurate orbital and attitude simulation software. The possibility to easily scale dimensions and performances of these thrusters gives the chance to consider a large number of different missions with different goals and operative regimes from LEO to GEO. In particular a LEO low cost mission to test the thruster prototype performances has been considered and it has been developed a strategy to calculate, with an error of 10% the thrust, combining the results of simulations with optical observations from ground. This new strategy, applicable to any spacecraft, is depicted in the paper. Moreover an innovative application for this thruster is the active debris removal (ADR). For this kind of missions both the ascent phase of a cleaner satellite from the coasting orbit to the debris orbit and the descent phase with the debris attached to the satellite have been simulated. It has been considered a debris of about 500kg in the orbits of 800 and 1400 km. Many simulations have been carried out at different thrust levels, to evaluate the trade-off between thrust and time required for the mission. The diminution of the debris mechanical life time has also been evaluate, considering the compliance with the Inter-agency Space Debris Coordination Committee (IADC) guidelines. The paper firstly presents a general overview of the HPH.com research project, then the methodology and the results

obtained to evaluate the requirements on thruster performances, the mass budget and the power required for the thruster and in the last an overview of different feasible mission scenarios.