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No. 2 - Early Ion Drive Performance

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After more than 32 hours of accumulated thrust, the SMART-1 electric propulsion system (EPS), with a SNECMA PPS-1350-G Hall-Effect thruster, is now fully tuned for nominal operations under space conditions.

The thruster performance and discharge stability are very good and confirmed by the measurements of total spacecraft acceleration over an orbit. As planned, the EPS commissioning had started during the fourth orbit with a venting sequence of the xenon subsystem in order to eliminate any presence of water vapour and oxygen. Then a first firing sequence of 50 minutes was completed successfully with the nominal cathode followed by a 6 minutes sequence at full power on the redundant one. This sequence was interrupted by discharge flame out after the thruster had remained in a high oscillation mode. After a complete electrical check of the system, the thruster was fired successfully on the primary cathode for 2.5 hours.

The start-up sequence has been optimized to limit these oscillation effects and the actuation logic of the pressure regulation improved in order to avoid current and voltage overshoots. These improvements have been made possible because of the specific SMART-1 characteristics of the EPS to be able to modulate the power and the xenon flow with simple telecommands. Since then, some 29 hours of continuous thrust have increased the orbit semi-major axis by some 300 kilometres with some 300 g of xenon consumed.

The ion drive

Finally, with the help of the EPDP (Laben, Italy) and SPEDE (FMI, Finland) payload instruments, a lot of new information to be further processed and analysed is being acquired on the possible effects of the space environment on some typical EPS characteristics as experienced during ground testing. The SMART-1 mission plays perfectly its role of technology demonstration mission in the space environment and will strongly contribute to the acceptance of electric propulsion as a fully mature and flight-proven technology.

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