

SPACE PROPULSION SYMPOSIUM (C4)
Electric Propulsion (4)

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RESULTS FROM THE QUALIFICATION TEST CAMPAIGN AND FIRST FLIGHT OF A PULSED
PLASMA THRUSTER FOR CUBESATS (PPTCUP)**Abstract**

Pulse Plasma Thrusters (PPTs) represent one of the first examples of electric propulsion successfully employed in space, being the Zond-2 (USSR) and the LES-6 (USA) the first satellites to have used this kind of thruster. From then on, PPTs have been designed and developed, focusing not only on high energy (up to 100 J) devices, but also on low energy (≤ 10 J) thrusters that may be used for pico, nano and micro satellite orbital and/or attitude control. Mars Space Ltd, the University of Southampton and Clyde Space Ltd have designed and developed a PPT for cubesat application called PPTCUP. This thruster is fully compatible with the cubesat standard, having a maximum power consumption of 2.5W, a total mass of 270g and dimensions of 100x100x30mm. PPTCUP is able to provide a total impulse (I_{tot}) of 42Ns and a thrust throttleable from $38\mu\text{N}$ to virtually zero. PPTCUP can be used for a variety of mission including orbit keeping, drag compensation, de-orbiting and formation flying. In particular the PPTCUP I_{tot} capability is enough to double the lifetime of 3U cubesat on a circular orbit with 250km altitude. Its small impulse bit value ($38\mu\text{Ns}$) allows for fine control needed for tight formation flight. An engineering model PPTCUP has already undergone a life test demonstrating 160% of its required lifetime and demonstrating no performance degradation during life. In this paper the results of the PPTCUP qualification campaign will be reported. Particular emphasis will be placed on the results obtained from the structural testing, EMC characterization and life-test. Structural testing will be carried out to ensure that the thruster will survive the launch loads. This series of tests will be carried out in agreement with the NASA GFSC standards and will include sine sweep testing, resonance sweeps and random vibration testing. EMC testing will be carried out to characterize the EM noise produced by the thruster. In particular EMC testing will include conducted and radiated emissions, conducted and magnetic susceptibility and magnetic property testing. Once again, the EMC tests will be carried out in agreement with NASA GEVS. After structural and vibration testing will be carried out the thruster will undergo a complete lifetest to demonstrate its full total impulse capability. PPTCUP will have its first flight in May 2014 on-board of a 3U cubesat from the University of Brasilia. Results relative to PPTCUP performances in space will also be presented.