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Author: Dr. Marco Manente
Italy, m.manente@t4innovation.com

Dr. Fabio Trezzolani
Italy, f.trezzolani@t4innovation.com
Dr. Nicolas Bellomo
T4i, Italy, n.bellomo@t4innovation.com
Dr. Mirko Magarotto
University of Padova - DII/CISAS, Italy, mirko.magarotto@studenti.unipd.it
Dr. Elena Toson
T4i, Italy, e.toson@t4innovation.com
Mr. Riccardo Mantellato
CISAS – "G. Colombo" Center of Studies and Activities for Space, University of Padova, Italy, riccardo.mantellato@studenti.unipd.it
Dr. Francesco Barato
University of Padova - DII/CISAS, Italy, francesco.barato@unipd.it
Prof. Daniele Pavarin
CISAS – "G. Colombo" Center of Studies and Activities for Space, University of Padova, Italy, daniele.pavarin@unipd.it

MAGNETIC ENHANCED PLASMA PROPULSION SYSTEM FOR SMALL-SATELLITES IOD DEVELOPMENT

Abstract

Miniaturized satellites have become increasingly common in recent years. In order to enable different mission scenarios, satellite platforms as small as CubeSats (U-class spacecraft) require versatile, low-cost, compact and reliable propulsion systems.

The Magnetic Enhanced Plasma (MEP) technology is a good candidate as propulsion system for small satellites. In fact, its main features are: (i) a simple architecture consisting in a discharge chamber, an antenna and a magnetic field generator, (ii) no need for neutralizer and grids, (iii) no need for the PPU to provide high voltage DC output. Thanks to these peculiarities the MEP propulsion system is characterized by a long lifetime and a low cost. In particular, it can work with different propellants (such as Ar, Kr, Xe, Air, CO_2) without significant modifications to the system geometry. Because of this last feature it seems extremely promising to investigate the employment of Iodine as propellant, which is particularly appealing for space applications thanks to its capability of being stored in the solid state, thus resulting in a huge reduction of the storage volume. Vice-versa, for a fixed amount of storage volume the employment of Iodine, rather than Xenon, can lead to an increase of the stored propellant mass of 4-5 times. Therefore the Iodine propellant could enable new concepts of space missions in particular in the small-satellites and CubeSat segment.

T4i, the Spin-Off of the University of Padova founded by its Space Propulsion group, is currently developing REGULUS, a compact propulsion system based on a MEP technology, satisfying CubeSat standard requirements; the REGULUS system has been successfully operated with Xe propellant. REGULUS will be fully operational at the beginning of 2019 when an In Orbit Demonstration (IOD) has been

planned. In this work we will describe: (i) the design of REGULUS operated with Iodine, (ii) the fluidic line, sensors, and security procedures employed in the ground test, (iii) the design of a Iodine fluidic line for CubeSat space applications, (iv) new mission scenarios which the use of Iodine propellant will enable.