SPACE PROPULSION SYMPOSIUM (C4)
Joint Session between IAA and IAF for Small Satellite Propulsion Systems (8-B4.5A)

Author: Dr. Nicola Melega
Sitael Spa, Italy

HET BASED PROPULSION SYSTEM ONBOARD THE HETSAT MISSION

Abstract

HETsat project is currently under development at SITAEL under an ESA GSTP contract and represents one of the first applications of a Hall Effect based, electric thruster, onboard a microsatellite platform. The flight segment of this mission is based on the SITAEL S-50/S-75 platform that has been adapted to carry out the in-orbit validation of the SITAEL HT-100 low power thruster system. Mission main goals are the achievement of at least 1000 hours of operation and 1000 ignitions to be accomplished in a 2 years LEO mission. This paper will describe the current status of development of the mission, with a special attention to the propulsion system which is here also the mission payload. Based on Hall Effect propulsion, this is an affordable system designed to significantly extend the capabilities of mini satellites operating in Low Earth Orbit and to enable new classes of EP-based missions. The system is conceived with a design-to-cost approach, minimizing its size and mass and is designed to operate at a power level lower than 200W, including margins. The overall propulsion subsystem layout is presented in the paper together with the main steps in its design and on-ground qualification process. The main components are: the Propellant Tank Assembly (PTA), the Propellant Management Assembly (PMA), the Propulsion Processing Unit (PPU) along with the Propulsion Control Unit (PCU) and the Hall Thruster Unit (TU) consisting of the anode module and two cathodes. The thruster to be installed on the satellite is the HT100 low power Hall Effect Thruster developed by SITAEL in the course of the last two years and already tested on ground against typical structural loads and thermal-vacuum cycles. The thruster also went through an extended endurance test in 2015, demonstrating an operational life well in excess of 2000 hours and cumulating a total impulse of 75 kNs. The mission foresees a continuous change in the spacecraft orbital altitude thanks to the use of the thruster that will fire only during the eclipse period and for 30 minutes every 4 orbits. In this way, even the limited power budget, typical of this kind of applications, is enough to sustain the thruster operations for the entire mission duration.