

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

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IONSAT: CHALLENGING THE ATMOSPHERIC DRAG WITH A 6U NANOSATELLITE.

Abstract

Small and microsattellites, now proven to be of great importance for science, telecommunication and many other applications, need an effective propulsion system to unleash their full performances and autonomy. Electric propulsion in particular will provide them the ability to perform new high delta-v manoeuvres and control their orbit, especially at low altitude. Nonetheless, the apparent complexity of integrating and operating a complete electric propulsion system in a smallsat was not obviously compatible with university projects. Here we present a mission design and a feasibility study for a 6U CubeSat propelled by an iodine NPT-30i miniaturized thruster developed by ThrustMe. This student project is also supported by CNES and the Ecole Polytechnique, in Paris, to be ready for launch in the early 2020s. The phase A planning of this project showed that the stand-alone propulsion system can be embedded in a 6U CubeSat and be used in the frame of a coherent mission over more than a year. Deployable solar generators, aerobraking strategies and large battery capacities allow the satellite to perform orbit changes and station-keeping at 300km from any orbit inclination. As part of the phase A study, the design of an attitude control system relevant to orbit changes is presented, as well as a first thermal analysis of a 6U CubeSat able to generate more than 50W of power. The mission analysis that led to the unusual choice of a spacecraft able to tackle any orbit is explicated. The general resulting structure and subsystems integration to comply with such constraints is also presented. It is designed to intelligently find a middle ground between aerodynamics and total power supply with deployable solar panels and a displaced center of mass. With the usual reserves, this feasibility study tends to show that propulsion for smallsats is

available and has reached milestones in terms of costs and ease of integration that make it compatible with university projects.