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

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APPLICATION OF AN ADVANCED MICRO-PROPULSION SYSTEM TO THE DELFFI FORMATION-FLYING DEMONSTRATION WITHIN THE QB50 MISSION

Abstract

In the proposed paper, an advanced T3 micro-propulsion system will be considered to propel the twin DelFFi satellites developed by Delft University of Technology.

The DelFFi project is a formation flying technology demonstration which will take place in the framework of the QB50 program, an international mission incorporating a network of 50 CubeSats in Low-Earth orbits for lower thermosphere and re-entry research. The proposed contribution from Delft University of Technology is represented by two triple-unit CubeSats based on the design of the Delfi-n3Xt satellite (scheduled for launch in September 2012). These twin satellites will be kept in an along-track formation, and an on-board propulsion system will be used to ensure separation between the two satellites and maintain a predetermined distance by counteracting drifting.

The T3μPS is a cold gas micro-propulsion system developed by TNO, Delft University of Technology and University of Twente, capable to provide a predefined thrust level in a range from 1 to 10 mN. The system includes cool gas generators operating with nitrogen stored in solid phase, a plenum tank, a thruster valve and a micro-nozzle; its total mass (including mechanical and electrical interfaces) is less than 140 g. In-flight qualification of the T3μPS will take place on board of the Delfi-n3Xt satellite.

The paper will evaluate various existing micro-propulsion systems for their capability to be used in the DelFFi technology demonstration mission, and a detailed trade-off between several potential candidates will be presented and discussed. In particular an advanced T3 propulsion system including a MEMS micro-resistojet will be illustrated, showing that it is capable to meet the requirements relative to drag control for relative formation flying and controlled re-entry of the twin DelFFi satellites while adhering to the mission mass, volume and power constraints. Conclusions will be drawn, including a general Road Map for the future development and qualification activities of the proposed propulsion systems.