

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

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FINMECCANICA COLD GAS MICRO-PROPULSION IN ORBIT PERFORMANCES: LISA
PATHFINDER AND MICROSCOPE

Abstract

Nowadays the Cold Gas Micro Propulsion technology can be considered as a flight-proven one, not only because of GAIA (in its nominal orbit Sun-Earth L2 since more than two years) contributing to build-up of a three-dimensional map of about one billion stars, but also thanks to the extremely accurate control of LISA Pathfinder Spacecraft, that, based on a drag-free attitude control, drifting around L1, allowed the science mode to be successfully started on 1st March, 2016. LISA Pathfinder was successfully put in orbit by the small European launcher VEGA, where Finmeccanica also contributed by means of the Safeguard Sub-system equipment (a set of six for each launch) and reached L1 after its about 1.5 million kilometers journey. Micro-propulsion Sub-system was successfully commissioned well before reaching L1, thanks to the already established sun-pointed orientation during transfer orbit. First data collected and transmitted confirmed an operation fully nominal; this means that the fine thrusts guaranteed by cold gas micro-thrusters will actively contribute to maintain the two gold-platinum test masses floating inside the spacecraft like “spaceships in a spaceship”. This positive feedback further secured the forthcoming missions: Microscope (a CNES/ONERA/ESA mission), where all Micro-propulsion flight HW was delivered by Finmeccanica to CNES – Toulouse, successfully integrated onto space-craft, and soon ready to be launched from French Guyana, by a Soyuz rocket, together with Sentinel 1B, and Euclid, the latest started project (currently closing Phase B2 at Preliminary Design Review). Each of the twelve micro-thruster composing the LISA PF Micro-Thruster Assembly (MTA) is operated in closed loop control and features a 0 - 1000 N thrust range with a commanding resolution of 0.1N , very low noise spectrum level and fast response time. The very low level of thrust and the thrust very fine and fast throttling are essential to meet unprecedented attitude and rate stability performances.

And after LISA PF, Microscope and Euclid, cold gas micro-propulsion technology would be ready to help any other challenging scientific (or formation flying) mission to become a reality.

The paper presents a review of the on-ground and in-flight achievements of the Cold Gas Micro Propulsion technology on board of LISA Pathfinder and (at the time of Conference) of Microscope as well, in its operational orbit and the lessons learned.