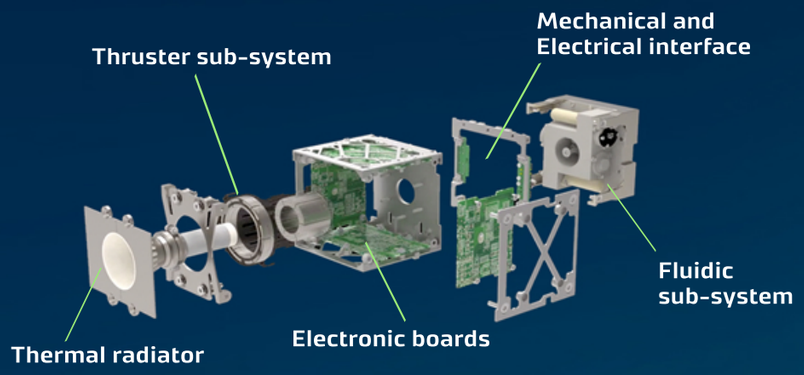
REGULUS

CubeSat Propulsion System: In-Orbit Operations

N. Bellomo, F. Milza, E. Toson, D. Pavarin, M. Duzzi, M. Manente,
F. Trezzolani, R. Mantellato, M. Minute, D. Scalzi

ELECTRIC PROPULSION

REGULUS is T4i first Electric Propulsion system in space. Its technology is based on a Magnetic Enhanced Plasma Thruster (MEPT) and it is designed to fit in a 1.5 U volume. We implement ECSS standards tailored for CubeSat applications and we use COTS components for electronics and fluidics. The system is designed to work with Iodine, but other gases (e.g., Xenon, Argon, etc.) can be used.



APPLICATIONS

The absence of both electrodes, neutralizers, grids, and any component subjected to deterioration, results in an increased system simplicity, making REGULUS suitable for long term and high Total Delta-v missions, expanding the possible operative scenarios from low-orbit maneuvers (e.g., orbit altitude modification, de-orbiting, station-keeping) to interplanetary ones (requesting adequate changes in tank size and radiation tolerant components).


Altitude changes


Phasing
Station keeping


Decommissioning


Drag Compensation


Collision avoidance

1.5U VOLUME

FOR>6U PLATFORMS

I2 PROPELLANT

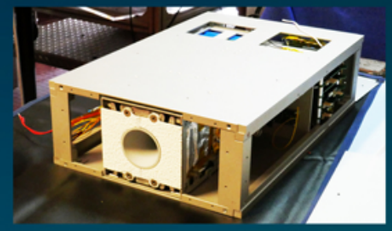
A robust, versatile, and cost-effective propulsion system to provide wide mobility to small satellite platforms and nanosatellite deployers. A Plug&Play propulsion system designed to be easily integrated into different satellite platforms and to match customer's requirements, with minimal customization efforts and costs.

MAIN FEATURES

Thrust	0.25 - 0.65 mN (highly modulable, 0.55 mN @ 50 W)
Specific Impulse	Up to 650 s (550 s @ 50 W)
Input power	30 - 60 W (50 W nominal)
Mass flow	0.1 mg/s
Volume	93.8 x 95.0 x 151.0 mm referred to a Total Impulse of 3000 Ns
Weight	2.5 kg @ 3000 Ns
Electric Interface	12 V DC regulated
Communications	Can-bus or I2C with CSP protocol

INTEGRATION & IOD

REGULUS has been integrated in late 2020 in two different platforms: into the PoliTo CubeSat Platform as part of a broader research program that will lead to testing the integrated system at ESA EPL laboratories and into GAUSS UNISAT-7, with whom REGULUS IOD is performed.



REGULUS integrated in the PoliTo CubeSat Platform (left)
and REGULUS fed with iodine under test (right)



REGULUS integrated in UNISAT-7 (left) and in space (right).

UNISAT-7 is at the moment in an orbit having 564 km altitude, 97.5 inclination.

The first phase of the IOD mission is currently ongoing; the propulsion unit is in fact under commissioning, and several communication tests are ongoing. These tests verify and check the response of all components and subsystems, and the interaction with the spacecraft, to validate its resilience to launch and space environment
After this preliminary phase, Regulus will be turned on. The ignition is expected by mid-July 2021.

The second phase of the IOD mission foresees operations at different power regime and with different actuation profile (e.g., low power continuous operation) and will last until the reservoir is emptied. The total impulse will be approximatively 3000 Ns. Performances will be assessed measuring continuously the orbital parameters of the spacecraft. The final orbit of the spacecraft is expected to be below 400 km. Depending on the overall system performances, operations at very low orbit will be evaluated and possibly performed using a phase of natural orbit decay to save some propellant.

T4i TECHNOLOGY FOR PROPULSION AND INNOVATION

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Contacts:
sales@t4innovation.com
www.t4innovation.com