REGULUS

Iodine electric propulsion system integration in CubeSats' platforms and testing

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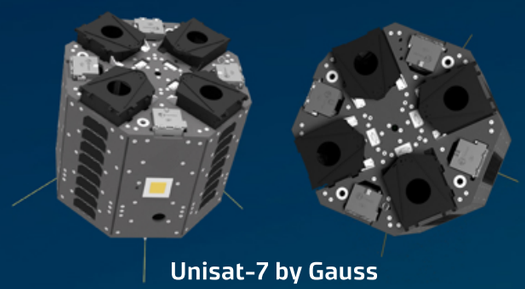
THE SYSTEM

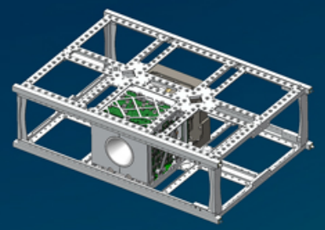
REGULUS is an electric propulsion (EP) system for CubeSats at TRL8 and now waiting for the IoD flight in late 2020. REGULUS system is provided for integration with all electronics, fluidic line, iodine tank and structures for total mass below 3 kg. Thanks in particular to the Magnetically Enhanced RF Plasma Thruster (MEPT) technology and the use of iodine propellant, the system can provide 3000Ns of total impulse in a 93.8 x 95.0 x 150.0 mm volume performance, fitting in a 1.5U Cubesat.
REGULUS includes the whole propulsion package for integration in CubeSats and MicroSats as well as small CubeSat carriers. The system is composed by the thruster, the electronics (PPUs and PCU), the fluidic line and the tank. The main features of REGULUS are the presence of a simple architecture, a thruster with no neutralizer and grids, no high DC-voltage PPU and the use of solid iodine as propellant, that can be substituted with Xenon fluidic line and tank when required. Its first mission will be onboard of Unisat-7 by GAUSS. The flight will take place in late 2020 in a Soyuz flight. During the mission, REGULUS will allow Unisat-7 to perform an orbit descending maneuver, drag compensation in VLEO and decommissioning.

THE TECHNOLOGY

REGULUS is based on a Magnetic Enhanced Plasma Thruster MEPT.
A helicon source uses RF power to efficiently generate high density plasma within a cylindrical chamber. Plasma acceleration is based on ambipolar diffusion forced by the strong electromagnetic field generated by the antenna, and the acceleration mechanism of the magnetic nozzle. A key advantage of the system is that a neutral plasma is ejected, thus a neutralization system is not required. The main components of such a technology are a dielectric tube, inside which the ionization of the neutral gas propellant takes place; a RF antenna, that works in the MHz range and which provides the power to ionize the gas; magnets which produce a magneto-static field that enhances the plasma confinement and provides the magnetic nozzle effect downstream the source exhaust.

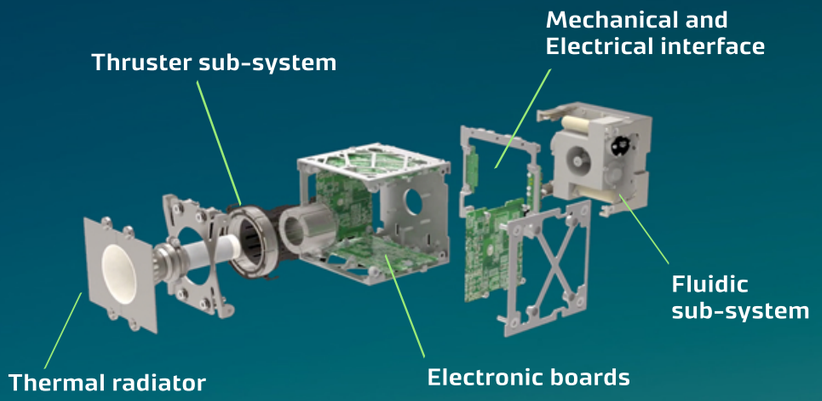


Unisat-7 by Gauss



6U CubeSat Structure

SIMPLE
VERSATILE
AFFORDABLE
DESIGNED FOR SMALLSAT



KEY ASPECT

Key Features	Benefits
Use of solid Iodine	Volume reduction No pressurized tank Easy transportation
MEPT Technology	Propellant choice versatility (Iodine, Xenon, Argon, others) No neutralizer, no electrodes, no grids
Complete propulsion package	Standard data and mechanical interfaces Internal data and signals management
High customization possibilities	Ready both Xenon and Iodine fluidic lines and feeding systems Proven performance at higher thruster scales Modular system for satellite accommodation management

TECHNICAL SPECIFICATIONS

Parameters	Values
Thrust	0.6 mN @50W (0.25-0.7) mN
Specific Impulse	600s @ 50W (up to 700s)
Total Impulse	3000-11000 (up to unlimited) Ns
Required power	50 W (range 20-60 W)
Mass Flow	0.1 mg/s
Propellant	Solid Iodine (I2)
Volume	93.8 x 95.0 x 150.0 mm @ 3000 Ns 93.8 x 95.0 x 150.0 mm @ 11000 Ns
Weight	2.5 kg @ 3000 Ns

APPLICATIONS

	Orbital changes	CubeSat decommissioning	Drag compensation
REGULUS-A Configuration	6U orbital changes for a total of 500 km altitude in 1.7 month overall	6U decommissioning from 750 km altitude in 1.6 month	6U 3 years life guaranteed @ 300 km 6U > 5 years life guaranteed @ 350 km
REGULUS-B Configuration	12U orbital changes for a total of 950 km altitude in 6 months overall	12U from 1200 km altitude in 6.0 months Decommissioning is guaranteed from higher altitudes	12U > 6 years life guaranteed @ 300 km
	Still propellant onboard for formation flying and/or decommissioning	Natural orbital decay of 1 month considered @ 350 km	Without compensating propulsion: 1U 21.6 days @ 300 km

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