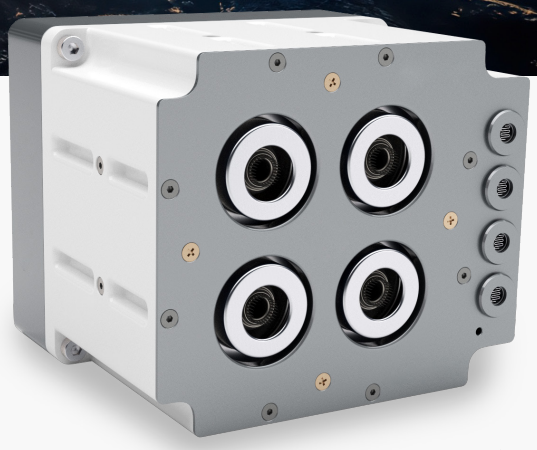
ENPULSION
SPACECRAFT TECHNOLOGY

Micro Starling



Building on the heritage of the legacy Nano propulsion system, Enpulsion has developed a scaled version of the technology to target small and medium size spacecrafts. The **Micro Starling** is engineered in a modular approach to form building blocks that can be arranged for various mission profiles.

The first model was successfully operated in space in Q1 2021.

MODULAR PACKAGE WITH HIGH TOTAL IMPULSE

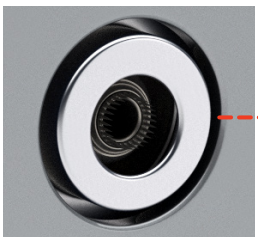
One module and its tank only take up a volume of 1.6 L and can provide more than 50,000 Ns at 4,000 s Isp. The module is simply bolted to the outside of the spacecraft and is used as a standalone unit.

DEBRIS SAFETY

Even during active operation, no part of the thruster is pressurized, and no chemical energy is stored. This means that in case of a collision or impact, there will not be an explosive reaction which could harm the spacecraft and create debris.

HERITAGE ELECTRONICS

The Power Processing Unit is based on the heritage electronics used in the Enpulsion Nano, leveraging exhaustive on-orbit and testing heritage, as well as introducing component lot control and heritage in EEE part selection.



4 Emitters:
Reservoir for 1.3 kg of indium

MATURE TECHNOLOGY

The Micro Starling is a scaled technology of the Nano with a developmental history of over 15 years. During this time, there have been hundreds of emitters tested with a lifetime campaign that has surpassed 30,000 hours of firing without degradation.

DYNAMIC PRECISE THRUST CONTROL

Thrust can be controlled through the electrode voltage which provides excellent controllability from 0.3 mN to 1 mN.

CONTROLLABLE SPECIFIC IMPULSE UP TO 4,500 S

With its efficient ionization process the Micro Starling can deliver higher specific impulse than any other ion propulsion system currently on the market. The thruster is capable of a range of Isp from 1,500 s to 4,500 s.

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STACKED CONFIGURATION

The Enpulsion Micro Starling is a fully integrated propulsion system in a stacked configuration, with the PPU situated directly underneath the thruster head, with the same footprint.

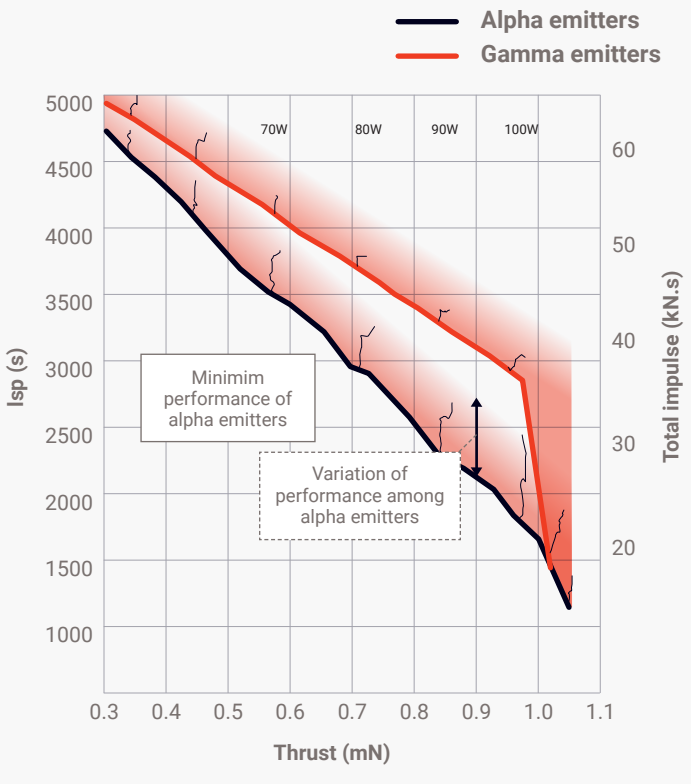
PROPERTIES AND PERFORMANCE

Since the company was founded in 2016, we have delivered hundreds of thrusters to customers worldwide, more than 200 of which are currently in space. Therefore we have developed an empirical understanding of the intrinsic variation of the performance and parameters of emitters in these thrusters in their production process and in their application in different types of missions. This enables us to offer our customers our new Emitter Selection Service which allows you to select between two distinct types of crown emitters:

Alpha (α) emitters provide the best balance between price, performance, and fastest delivery times. This is the perfect solution for commercial constellation applications.

Gamma (γ) emitters are hand-picked for their peak performance and are especially appropriate for your missions in deep space, exploration, and others where emitter output needs to be taken to extremes.

DYNAMIC THRUST RANGE[1]	300 µN - 1 mN
NOMINAL THRUST	1 mN
SPECIFIC IMPULSE	1,500 - 4,500 s
PROPELLANT MASS	1.3 kg
TOTAL IMPULSE[2]	Up to 50 kNs
TOTAL SYSTEM POWER	30 - 120 W
POWER AT NOMINAL THRUST	105 W
OUTSIDE DIMENSIONS Thruster head PPU box	 140 x 120 x 98.6 mm 140 x 120 x 34.0 mm
MASS (DRY / WET) INCLUDING PPU	2.6 kg / 3.9 kg
HOT STANDBY POWER[3]	10 - 15 W



1 The Micro Starling can be operated at a wide range of thrust and specific impulse, depending on the power level available. The operational envelope is based on total system power including typical heater and neutralizers consumption. Performances shown above correspond to maximum thrust to power curves for different grades of emitters.

2 Strongly dependent on emitter option. See performance map for selection options.

3 Dependent on accommodation and resulting thermal environment.