ENPULSION

NANO IR³

FIELD EMISSION ELECTRIC PROPULSION (FEEP)

The *ENPULSION NANO IR³* is the next-generation FEEP system based on the flight-proven success story that is the *ENPULSION NANO* (formerly: IFM Nano Thruster). Incorporation of lessons learned from a large number of acceptance test campaigns and in-orbit performance verifications led into an updated electronics design, thermostructural concept, and software functionality. The resulting product – the *ENPULSION NANO IR³* – features increased reliability, radiation tolerance, and environmental resilience, and is configured to enable higher-thrust operating points.

RAD-TOLERANT ELECTRONICS

All EEE components of the *ENPULSION NANO IR³* are procured in lot-controlled batches. Selected sets of these batches are subjected to radiation testing, so that each thruster can be traced back to a fully representative qualification model. EEE components were selected and integrated to be more tolerant to TID and SEE.

FLIGHT HERITAGE

The *ENPULSION NANO IR³* is an updated version of the space proven *ENPULSION NANO* with more than 50 units in space*. It is directly building on its heritage, leveraging the proven design and component selection.

*as per December 2020

PROTECTIVE CASING

The thruster is assembled into a protective casing that shields the electronics from the hazardous space radiation environment, facilitates handling during integration, and allows side mounting.

VERSATILE PERFORMANCE

Thrust can be controlled through the electrode voltages, providing excellent controllability over the full thrust range and a low thrust noise. Due to the efficient ionization process, the *ENPULSION NANO IR³* can provide a higher specific impulse than any other ion propulsion system currently on the market.

SAFE AND INERT SYSTEM

The *ENPULSION NANO IR³* contains no moving parts and the indium propellant is in its solid state at room temperature. Avoiding any liquid and reactive propellants as well as pressurized tanks significantly simplifies handling, integration, and launch procedures.

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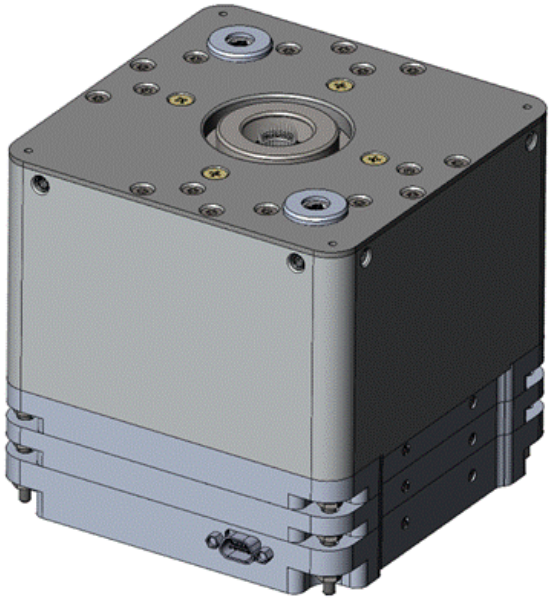
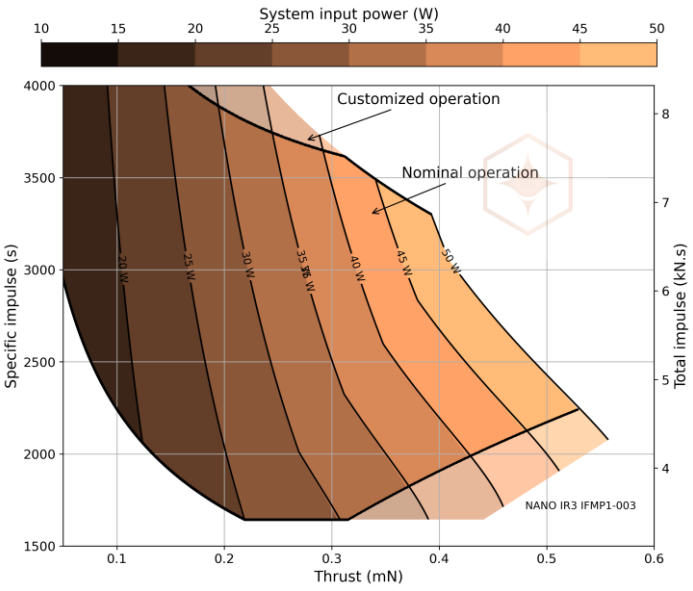


PROPERTIES AND PERFORMANCE

While the required power to operate the *ENPULSION NANO IR³* starts at around 10-15 W, at higher power levels one can choose between high thrust and high specific impulse operation. The *ENPULSION NANO IR³* has been configured to enable thrust values up to 500 µN, and can operate at an I_{sp} range of 1,500 to 4,000 s.

At any given thrust point, higher I_{sp} operation will increase the total impulse, while also increasing the power demand. The thruster can be operated along the full dynamic range throughout the mission. This means that high I_{sp} and low I_{sp} manoeuvres can be included in a mission planning as well as high thrust orbit manoeuvres and low thrust precision control manoeuvres.

DYNAMIC THRUST RANGE	10 TO 500 µN
NOMINAL THRUST	500 µN
SPECIFIC IMPULSE	1,500 TO 4,000 s
PROPELLANT MASS	220 g
TOTAL IMPULSE	MORE THAN 4,000 Ns
POWER AT NOMINAL THRUST	50 W INCL. NEUTRALIZER
OUTSIDE DIMENSIONS	98.0 x 99.0 x 95.3 mm
MASS (DRY / WET)	<1180 / <1400 g
TOTAL SYSTEM POWER	10 – 50 W
HOT STANDBY POWER	5 W
COMMAND INTERFACE	RS422 / RS485
TEMPERATURE ENVELOPE (NON-OPERATIONAL)	-40 TO 95°C
TEMPERATURE ENVELOPE (OPERATIONAL)	-20 TO 40 °C
SUPPLY VOLTAGE	12 V, 28 V, OTHER VOLTAGES UPON REQUEST



Depending on available power, the user can choose from any operational point. Performance model is shown for 12 V configuration.