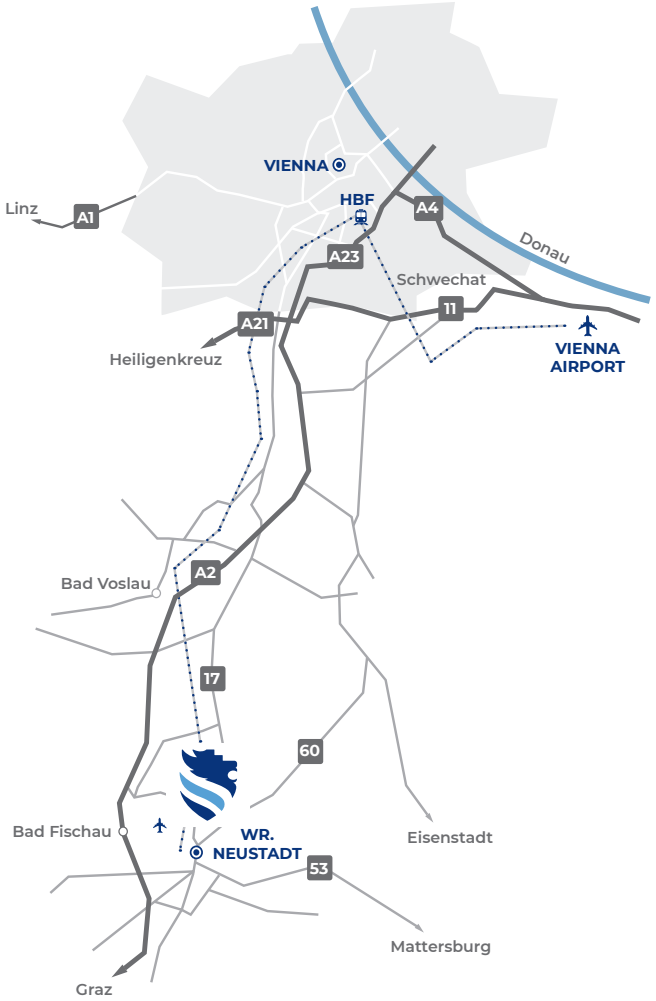
ABOUT FOTEC

FOTEC Forschungs- und Technologietransfer GmbH is the research and technology subsidiary of the University of Applied Sciences in Wiener Neustadt. The company was founded in 1998.

Our interdisciplinary team of experts carries out industrial and funded research and development projects. The execution of such projects is done in close cooperation with the University of Applied Sciences Wiener Neustadt, especially with the departments of Mechatronics, Microsystems Engineering, Business Engineering and Aerospace Engineering.

FOTEC serves orders from industry and also takes on technological and scientific challenges within the framework of national and international research and cooperation projects. These are enabled and supported by the national funding agency FFG, the European Space Agency ESA and the European Commission.



HOW TO REACH US

FOTEC resides in the city of Wiener Neustadt
in the direct vicinity of the University of Applied Sciences,
40 km south of Vienna.

CONTACT

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FOTEC
Research Subsidiary of
— FH Wiener Neustadt —

FIELD EMISSION ELECTRIC PROPULSION TECHNOLOGY

FEEP TECHNOLOGY AND DEVELOPMENT

FROM LMIS TO FEEP

While LMISs are primarily used as charge balancing device for spacecraft, FEEP thrusters allow correcting and maintaining the orientation of a large satellite and orbital changes of smaller satellites.

Evolution of the FOTEC LMISs over the last two decades (from left to right).

EXPERIMENT	SPACECRAFT	LMIS	OPERATION TIME
LOGION	MIR	3	24 h (1991)
MIGMAS/A	MIR	1	120 h (1991 – 94)
EFE-IE	GEOTAIL	8	600 h (1992)
PCD	EQUATOR-S	8	250 h (1998)
ASPOC	CLUSTER	32	Ariane 5 Launch Failure (1996)
ASPOC-II	CLUSTER-II	32	6516 h (2000)
COSIMA	ROSETTA	2	unknown
ASPOC/DSP	DoubleStar	4	8979 h (2004 – 2007)
MMS ASPOC	MMS	32	since 2015 (still in operation)

FEEP TECHNOLOGY IN-ORBIT DEMONSTRATION

This innovative thruster concept developed and improved over the years, culminated with the first ever in-orbit-demonstration of such technology in early 2018, where the first miniaturized stand-alone propulsion system, suitable for a CubeSat, was successfully operated: the IFM Nano Thruster.

STABILITY AND LONG-TERM PERFORMANCE

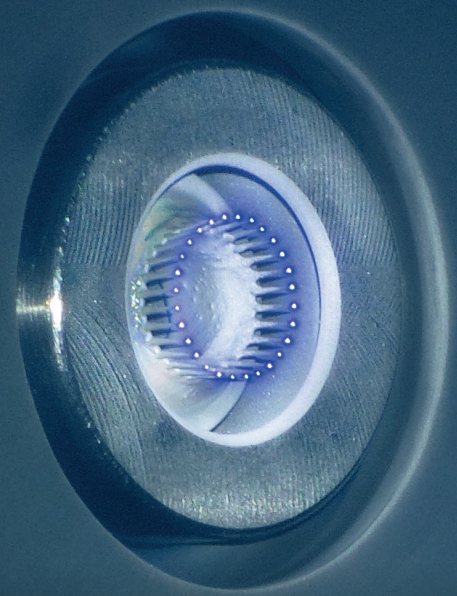
An endurance test of a 28-needle emitter is ongoing and has so far reached more than 36,000 hours of accumulated firing time in the vacuum facility of the Aerospace Laboratory of FOTEC. Even for long-term scientific missions, FOTEC's FEEP technology is the appropriate choice.

FUNCTIONING PRINCIPLE

POROUS TUNGSTEN CROWN EMITTER

In the framework of the FEEP technology development projects, the so-called porous tungsten crown emitter was conceived. This emitter is made of 28 needles which generate thrust by ejecting and accelerating ions.

The field emission is enabled by a strong electrostatic field generated by applying a potential difference in the order of 10 kV between the emitter and the extractor electrode. Apart from the multiple emission sites, the most important feature is the porous tungsten matrix which enables internal flow of the molten liquid metal – in this case, indium – to the very sharp needle tips.



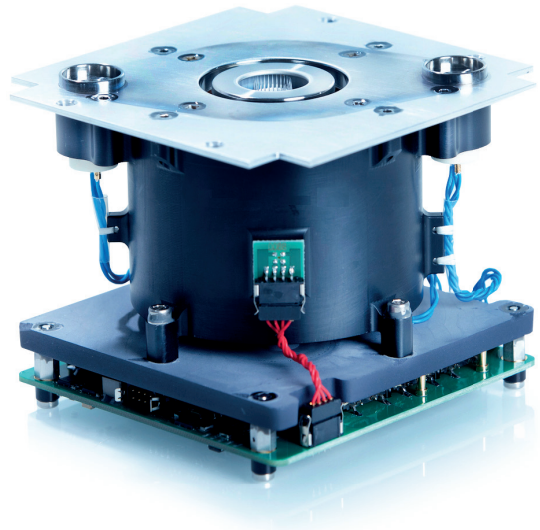
FEEP'S HIGH PRECISION AND STABILITY

FOTEC focuses on the development of a highly reliable propulsion system with a lifetime of several years. Such a system would be suitable for long scientific and Earth observation missions that require an extremely precise high thrust-dynamic, pointing acuracy and highly demanding drag compensation and attitude control.

OUR THRUSTERS

IFM NANO THRUSTER

In order to respond to the market demand of smaller and smaller thrusters that fit into a 1-unit of a CubeSat, FOTEC developed its compact IFM Nano Thruster, which is now mass produced for the global market by the spin-out company ENPULSION.
Apart from the porous tungsten crown emitter, it is comprised of a 230g indium reservoir with a heater and an integrated Power Processing Unit (PPU) to generate high voltages required for operation. The operator simply commands the required thrust via a serial communication interface.



IFM MICRO THRUSTER

Further developments in collaboration with the spin-out ENPULSION led to the development of the IFM Micro Thruster, with higher thrust and increased impulse capability. The IFM Micro Thruster consists of four individual crown emitters with separate propellant reservoirs and redundant heaters.

PARAMETER	IFM NANO	IFM MICRO
Size	10 x 10 x 8,3 cm	14 x 12 x 13.3 cm (incl. PPU)
Mass (wet)	0.9 kg	3.9 kg
Thrust	10 - 350 µN	200 µN - 1.35 mN
Specific impulse	up to 6,000 s	up to 6,000 s
Total impulse	> 5 kNs	> 50 kNs