EURISA: developping a European IMU for scientific and commercial applications

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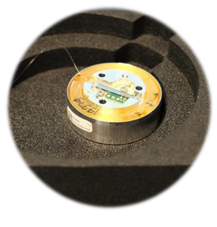
Introduction

- Following the H2020 European project Pioneers on the development of the new generation of a 6-axis instrument for space seismology, EURISA aims at developing a compact, cost-efficient space IMU based on the same compact sensors.
- Propose a COTS IMU addressing of the new space applications:
  - Orbital rendez-vous
  - Carrier module
  - Moon/Mars landing
  - Mars Robotic exploration

Sensors

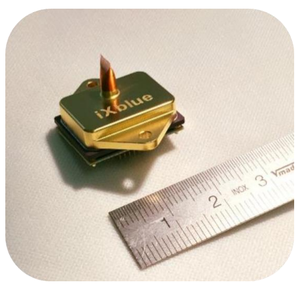
- **3 FOG**

Inherited from Exail product
Retex on 8Mh in orbit GEO
Magnetic shielding
Implemented on **Astrix NS HP**
ARW below $< 2.5\mathrm{m}°/\sqrt{\mathrm{h}}$
No quantisation
No other noise contributors
Stable on all the temperature range $[-15; 55]°\mathrm{C}$



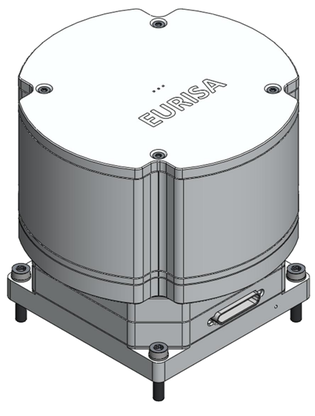
- **3 Accelerometers**

Exail smallest ACC, already implemented on **Umix**



Digitally control sensor electronics: FPGA based
Modelled in temperature through a thermal chamber mounted on a 3-axis rotating table → $50\mathrm{ppm}$ residual scale factor

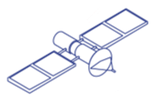
Follow Up



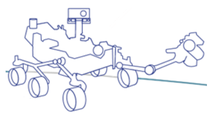
- First prototype assembly late 2024
- Extensive testing at DLR Bremen
  Envrionmental testing
  Vibrations
  Thermal vacuum
  Electromagnetic compatibility
- Extensive testing at DLR Bremen in Spring 2025
- EM fully tested in 2025 in scope of H2020 project
- Design review in 2026
- Space qualification in 2027

Targeted Missions

- COTS IMU for a large range of space applications.
- Each mission requirements frame the specifications

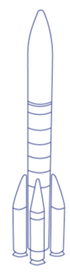


Interplanetary cruises
Pointing requirements
FOG bias (1h) < 0.15°/h
ACC bias < 50µ**g**



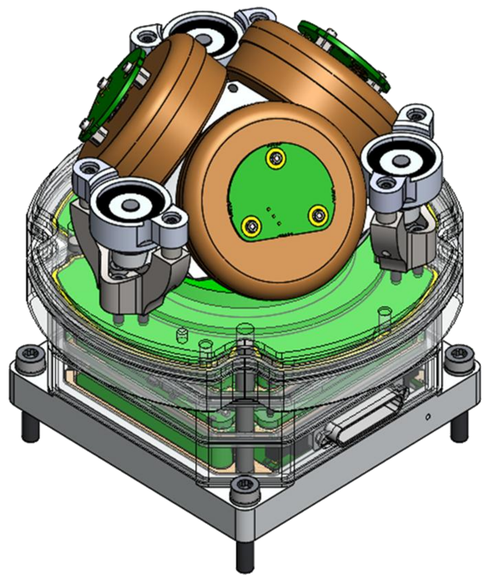
Rover
Limited mechanical footprint and power efficiency

Entry Descent and Landing
Ascent Vehicle
Measurement range
FOG $\pm 100°/s$
ACC $\pm 12\mathbf{g}$
Scale Factor $< 150\mathrm{ppm}$
Full performance in harsh mechanical environment
$11\mathbf{g}\mathrm{RMS}$



IMU Architecture

- 3 FOG + 3 ACC mounted on a corner-cube pyramid
  - Robust orthogonality and harmonisation
  - Low-deformable design
- Damped pyramid
  - Safe for rigourous mechanical environment
- On-board electronics
  - Rad-hard electronics
  - Sensors processing
  - Thermal compensation (model)
  - Lever arm compensation
  - Coning-sculling compensation



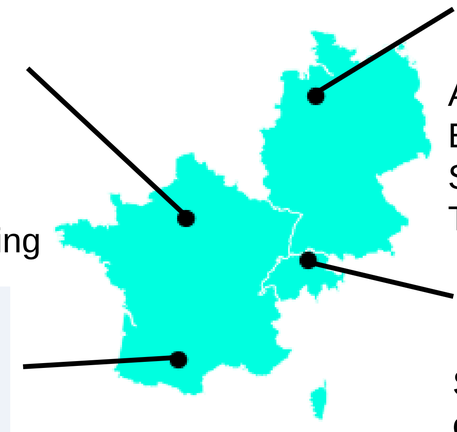
Consortium Partners

exail

Gyroscopes
Accelerometers
Electronics
Algorithms
Assembling and testing

DLR Deutsches Zentrum für Luft- und Raumfahrt
German Aerospace Center

Algorithms
External sensor fusion
Simulation
Test means



ETH zürich

Space accelerometer control electronics

AIRBUS

Market study
Specifications
Expertise

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