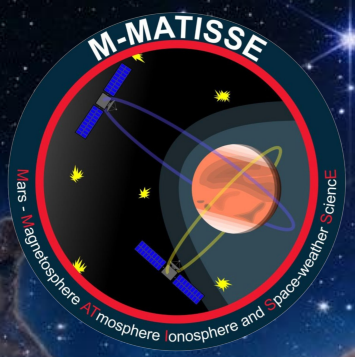
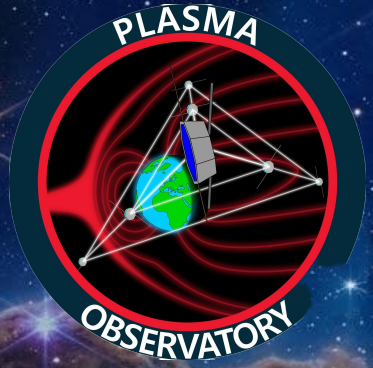




esa
European Space Agency

ESA M7 missions candidates

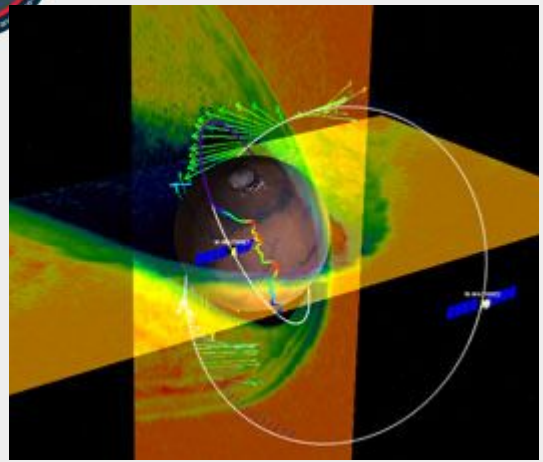
To be launch in ~2037 - 2039

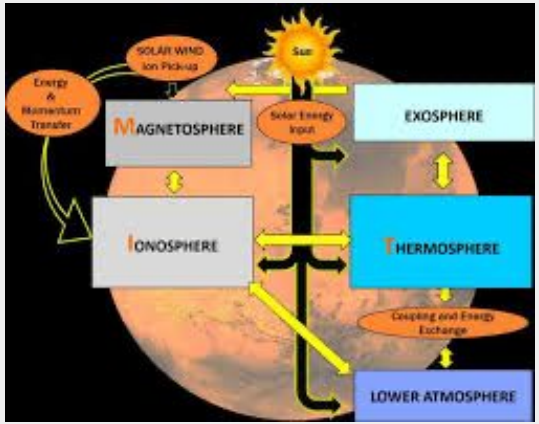
David Píša (Co-PI of M-MATISSE COMPASS)
Institute of Atmospheric Physics CAS

IAP

DEPARTMENT
OF SPACE PHYSICS
INSTITUTE OF ATMOSPHERIC PHYSICS
CZECH ACADEMY OF SCIENCES

M-MATISSE - Mars Magnetosphere ATmosphere Ionosphere and Space-weather SciencE





A concept of **two identical spacecraft** (Henri & Marguerite) orbiting around Mars

An unique constellation for studying **Solar wind-Magnetosphere-Ionosphere** coupling at Mars

Both M-MATISSE spacecraft have 6 scientific instruments.

Henri has periapsis below 270 km and an apoapsis of 3000 km with an inclination of 60°

Marguerite has an inclination of 60°, a periapsis below 270 km and an apoapsis of 10,000 km

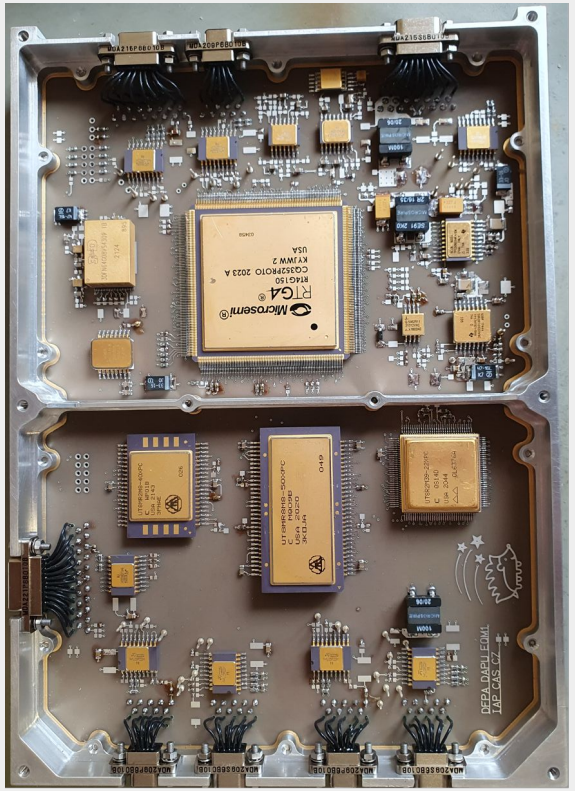
COMPASS - Wave Analyzer and Processing Unit

COMPASS: Combined Magnetic and Plasma Sensor Suite

WAPU serves as a common Data Processing Unit

- implements the single common digital interface of COMPASS to the spacecraft
- performs data processing, compression and buffering
- cold redundant unit with more instrument interfaces, based on fast RTG4 FPGA
- Provides on-board classification of wave & dust impacts
- Design heritage – DFP/DAPU (Comet Interceptor)
- Phase B term (BBM/EM AIT) covers 06/2026-12/2028
- **Possible CZ industrial involvement**
  - ECSS-qualified PCB assembly (Phase C/D)

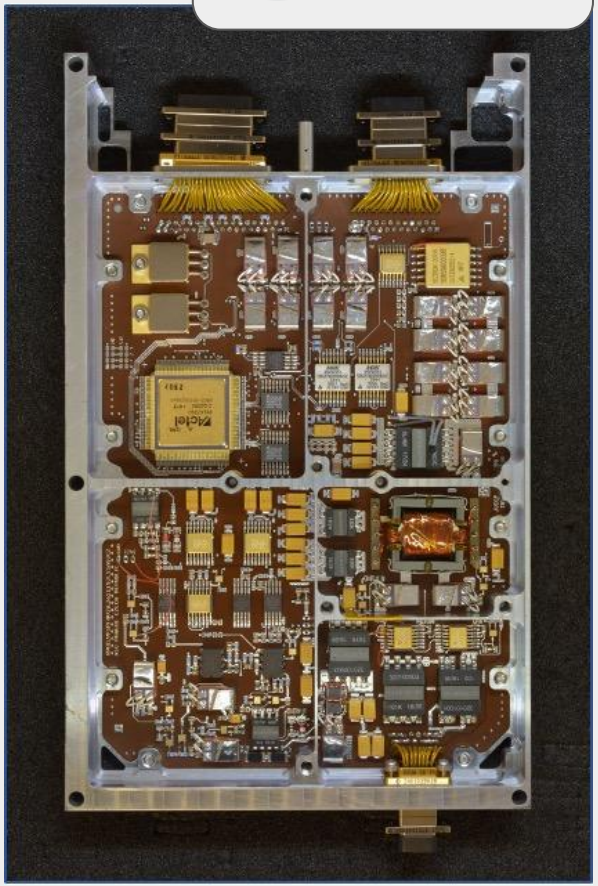
Designed and developed by **Institute of Atmospheric Physics, CAS**
(*Co-PI – David Píša, Technical Lead – Jan Souček*)



C-I DAPU EQM1

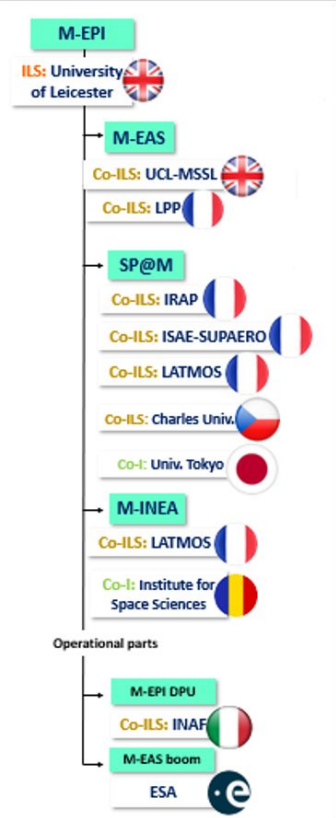
COMPASS - Low Voltage Power Supply (LVPS)

- Designed and developed by **Astronomical Institute, CAS**
  (*Co-PI – Štěpán Štverák, Technical Lead – Jaroslav Laifr*)
- Provides prime power interface of all COMPASS sub-systems to main S/C bus and galvanic isolation of the instrument secondary ground
- Realized as a cold redundant system consisting of two identical and swappable units
- Based on discrete approach of voltage-fed Push Pull DC/DC converters to supply secondary output voltages for the COMPASS subsystems (+3.7V, ± 12V) with total output power of 27 W
- Implements telemetry and telecommand engine in FPGA with LVDS serial link
- Design heritage – LVPS/RPW (Solar Orbiter), LVPS/RPWI (JUICE), GIM/WFI (NewAthena)
- Phase B term (BBM/EM AIT) covers 06/2026-12/2028
- **Anticipated CZ industrial support**
  - Product & Quality Assurance
  - VHDL/FPGA
  - ECSS-qualified PCB assembly (Phase C/D)

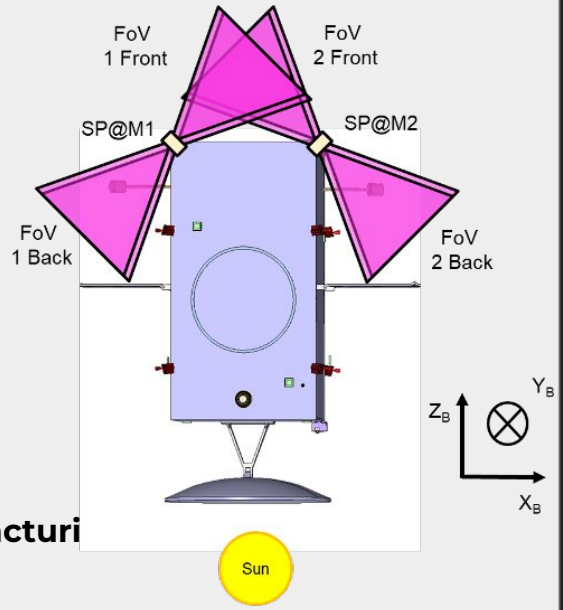


SP@M (Solar Particles @ Mars) instrument

Faculty of Mathematics and Physics
Charles University



Measure energy spectrum & angular distribution of solar energetic electrons (30 keV – 1 MeV)
Time resolution 1 s in burst mode (32 s in nominal mode)
Two identical sensors (SP@M1, SP@M2) on both orbiters, two detection units per sensor (covering opposite directions)
Single-layer solid-state detectors



Data acquisition and processing:

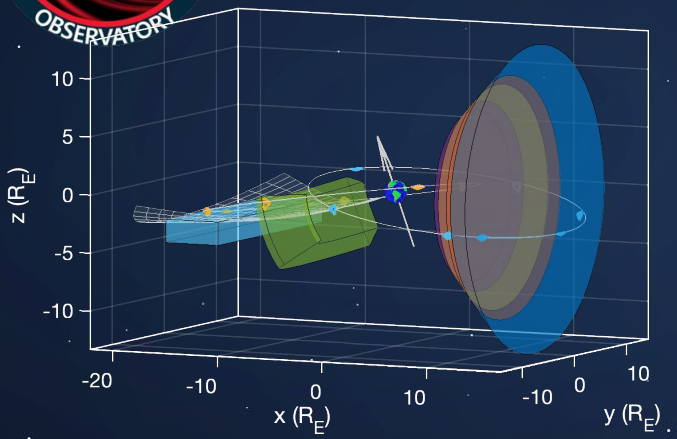
- 2 fast dual-channel ADCs (125 MSps)
- reprogrammable FPGA, digital pulse-processing electronics
- another FPGA (or fast MCU) for instrument command & control
- dual Spacewire interface to the M-EPI DPU (nominal & redundant)

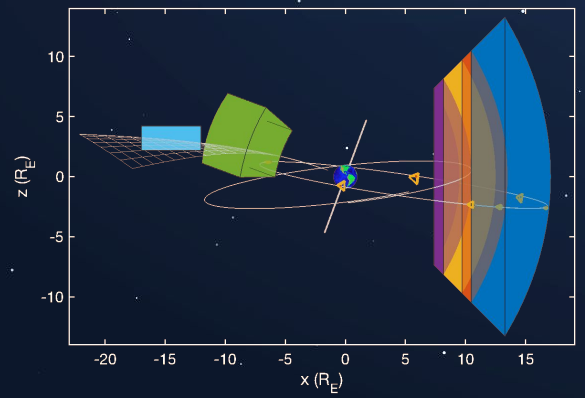
Seeking assistance in:

- **FPGA (I/F) board design, construction & manufacturi flight units)**
- **Board programming & data processing**

Czech Lead: Doc. Lubomír Přech (lubomir.prech@mff.cuni.cz)

Plasma Observatory



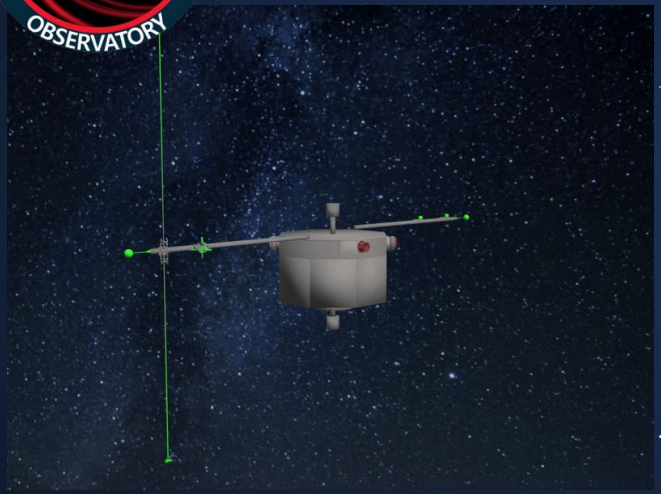


A unique concept for studying wide range of spatio-temporal scales of plasma processes in near-Earth space

Constellation of 7 small spacecraft

- 200 kg dry mass
- apogee 15 Earth radii

Plasma Observatory



Institute of Atmospheric Physics will develop a wave analyzer - instrument to study plasma waves

Wave analyzer developed in collaboration with a French partner organization (LPC2E, Orleans).

- IAP will develop flight software and firmware.
- Hardware contribution is TBC, depending on CNES funding.
-

Possible Czech industry involvement:

- **software / firmware independent validation**
- **Flight HW manufacturing and testing (TBC)**

Year 1

Year 2

Year 3