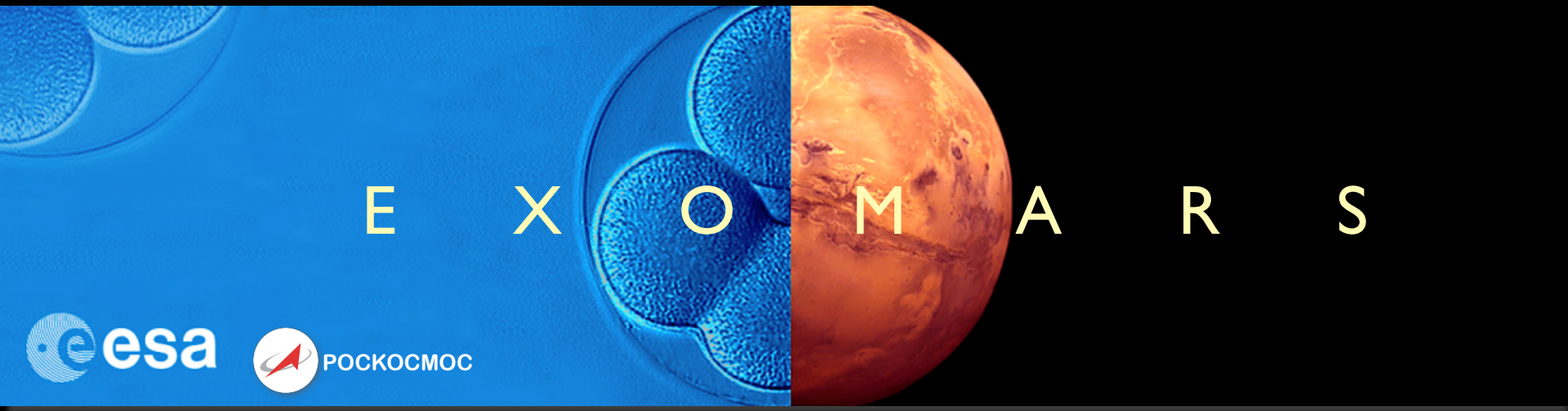
MEUH!
G.LE SUEUR

Mars attaqué…

Michel Viso
Centre national d'études spatiales
Responsable des programmes d'Exobiologie


E X O M A R S
esa
РОСКОСМОС

ExoMars Programme Mission Architecture

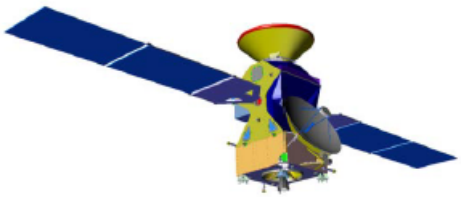
ExoMars Programme: ***two missions launched in 2016 and 2018.***

- **The 2016 mission consists of a Trace Gas Orbiter (TGO) and an EDL Demonstrator Module (EDM)**
- **The 2018 mission consists of a Rover accommodated inside a Descent Module (DM) carried to Mars by a Carrier Module (CM)**
- **Large international cooperation with Roscosmos and some contributions from NASA**

2016 Mission

Proton

Trace Gas Orbiter (TGO)



EDL Demonstrator Module (EDM)

+

Roscosmos DSN

ESA ESTRACK

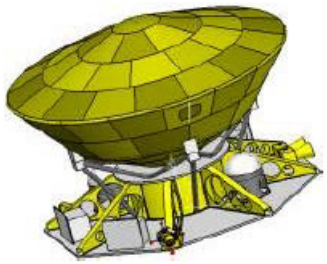
MOCC @ ESOC Spacecraft Operations

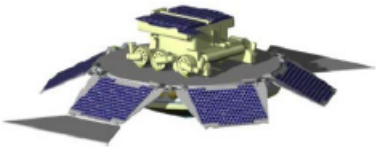
Science Operations Centre ESAC TBC

2018 Mission

Proton

Carrier Module & Descent Module





Rover +ROCC + Landed Platform Ops Centre

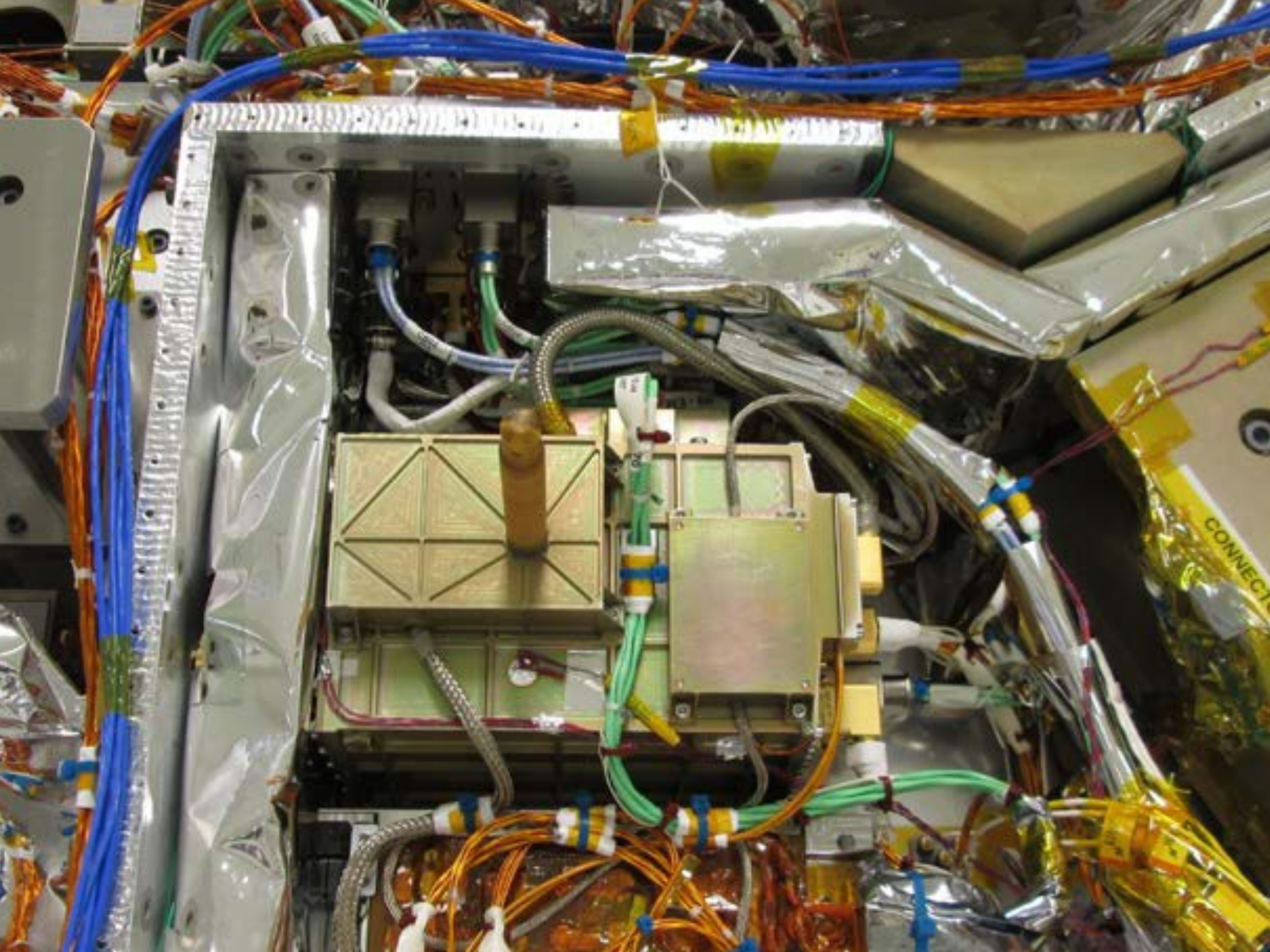
2016

2016

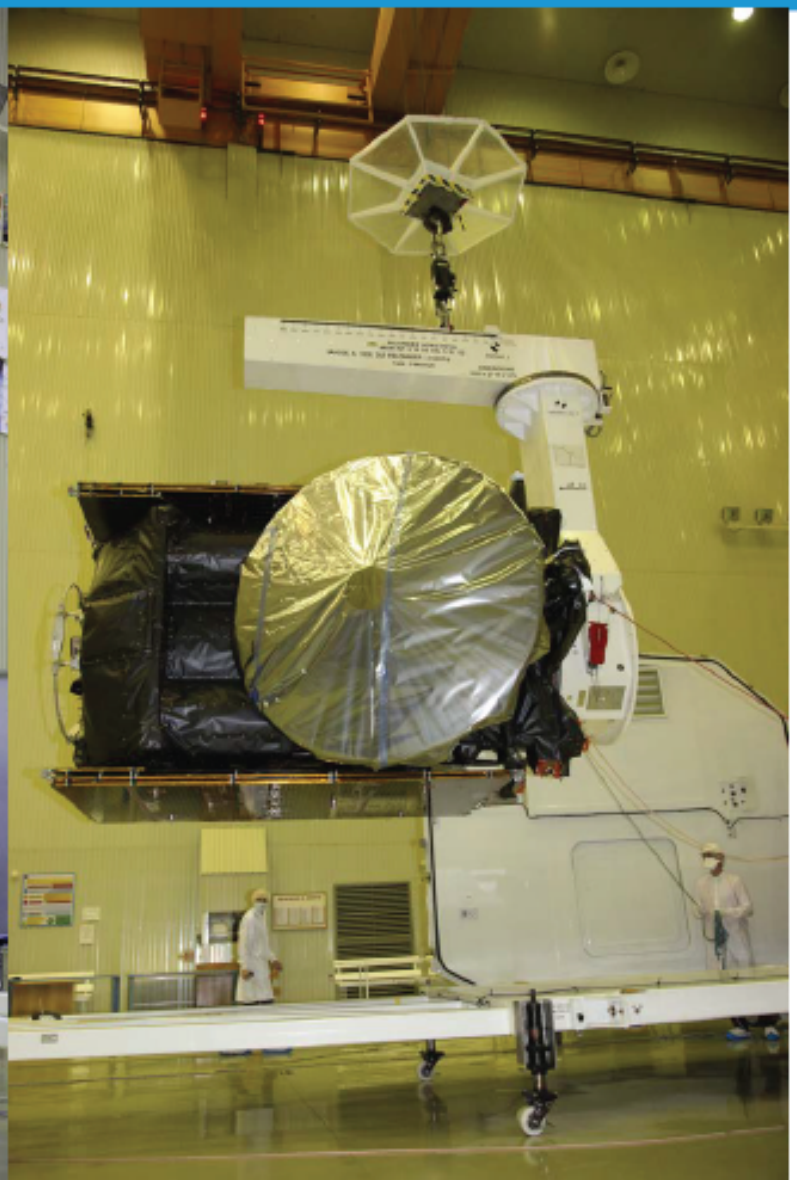
- Schiaparelli
  - Démonstration d'atterrissage
  - Science de surface
    - Conditions d'environnement
    - Champs électriques dans l'atmosphère
    - Opacité de l'atmosphère
  - Test des procédures de gestion d'un appareil au sol

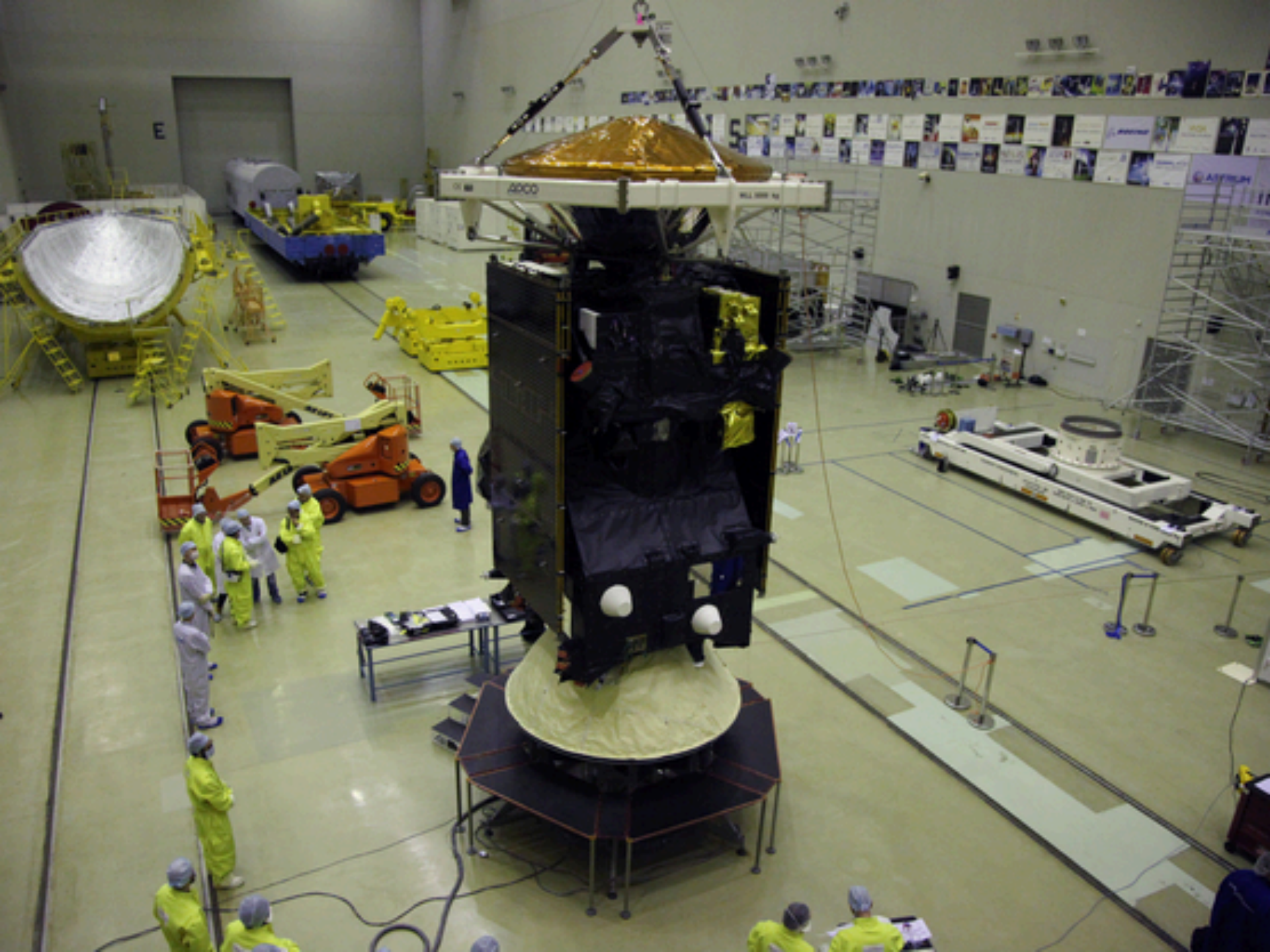
2016

- TGO
  - Étudier l'atmosphère martienne et notamment les composés gazeux à l'état de trace (NOMAD-ACS)
  - Mesurer la quantité d'eau présente dans le premier mètre (FREND)
  - Prendre des images à partir de l'orbite (CASSIS)
  - Relayer les Télécommunication du sol vers la Terre et vice versa (ELECTRA)



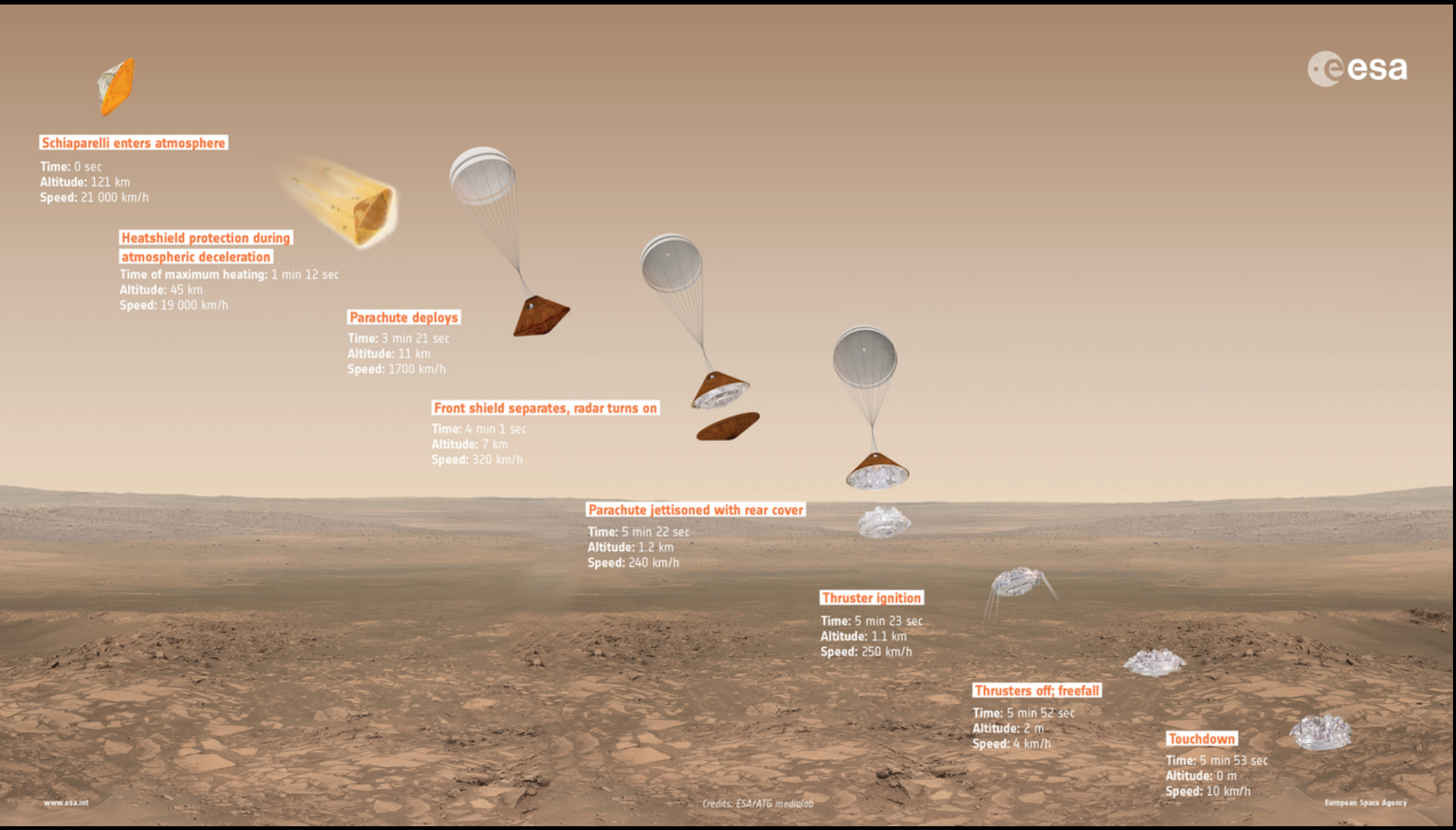
Unpacking TGO and Schiaparelli





2016

- **Dates Clés**
  - **Lancement le 14 mars 2016**
  - **Deep space manouver 28 Juillet**
  - **Séparation le 16 octobre**
    - **Atterrissage le 19 octobre**
    - **Mise en Orbite de TGO le 19 octobre**


esa
Schiaparelli enters atmosphere
Time: 0 sec
Altitude: 121 km
Speed: 21 000 km/h
Heatshield protection during atmospheric deceleration
Time of maximum heating: 1 min 12 sec
Altitude: 45 km
Speed: 19 000 km/h
Parachute deploys
Time: 3 min 21 sec
Altitude: 11 km
Speed: 1700 km/h
Front shield separates, radar turns on
Time: 4 min 1 sec
Altitude: 7 km
Speed: 320 km/h
Parachute jettisoned with rear cover
Time: 5 min 22 sec
Altitude: 1.2 km
Speed: 240 km/h
Thruster ignition
Time: 5 min 23 sec
Altitude: 1.1 km
Speed: 250 km/h
Thrusters off; freefall
Time: 5 min 52 sec
Altitude: 2 m
Speed: 4 km/h
Touchdown
Time: 5 min 53 sec
Altitude: 0 m
Speed: 10 km/h
www.esa.int
Credits: ESA/ATG medialab
European Space Agency

2020

ExoMars Programme Mission Architecture

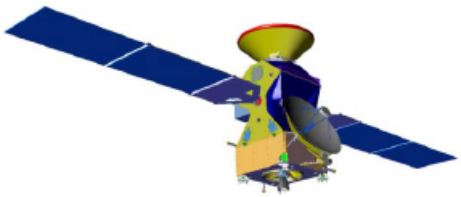
ExoMars Programme: ***two missions launched in 2016 and 2018.***

- **The 2016 mission consists of a Trace Gas Orbiter (TGO) and an EDL Demonstrator Module (EDM)**
- **The 2018 mission consists of a Rover accommodated inside a Descent Module (DM) carried to Mars by a Carrier Module (CM)**
- **Large international cooperation with Roscosmos and some contributions from NASA**

2016 Mission

Proton

Trace Gas Orbiter (TGO)



EDL Demonstrator Module (EDM)

+

Roscosmos DSN

ESA ESTRACK

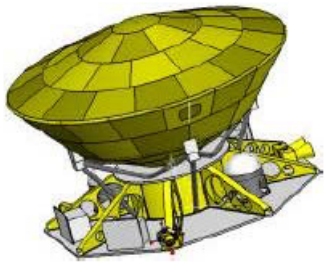
MOCC @ ESOC Spacecraft Operations

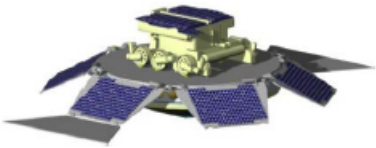
Science Operations Centre ESAC TBC

2018 Mission

Proton

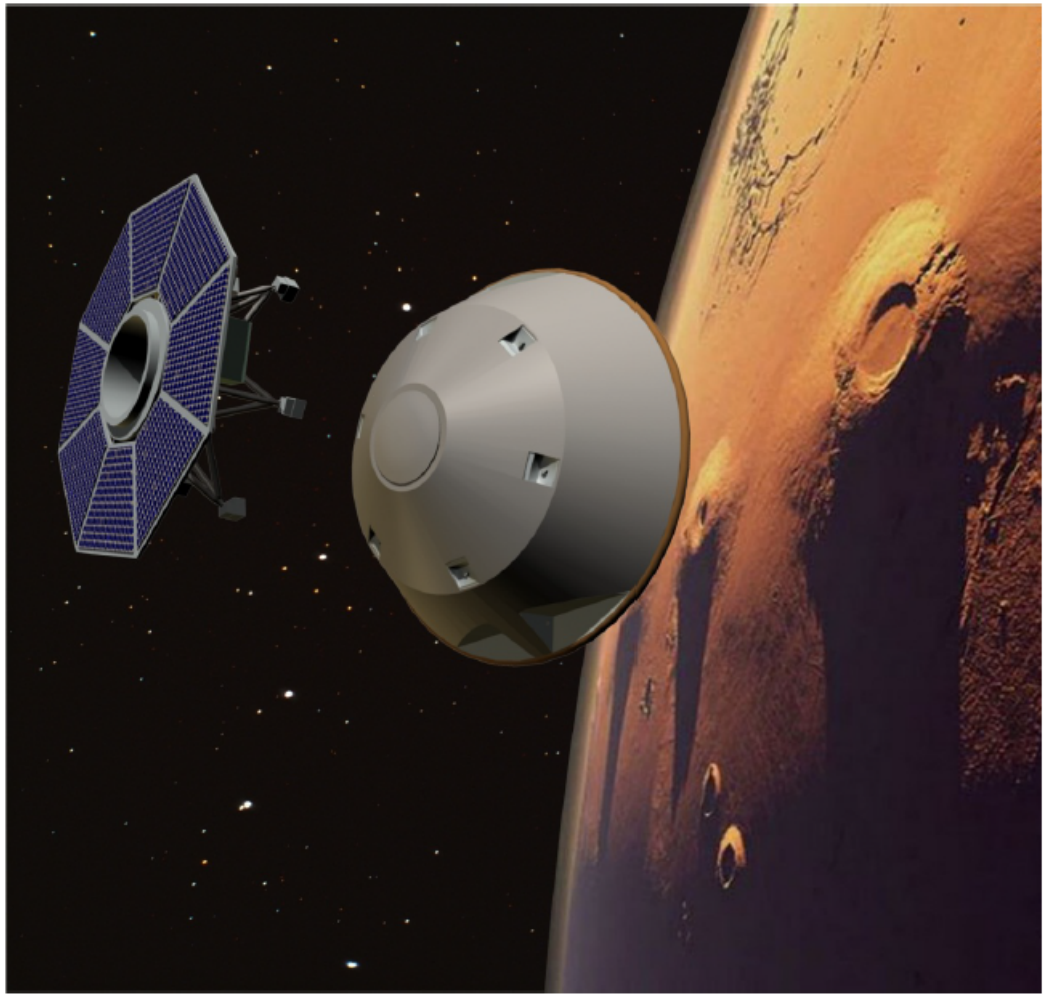
Carrier Module & Descent Module

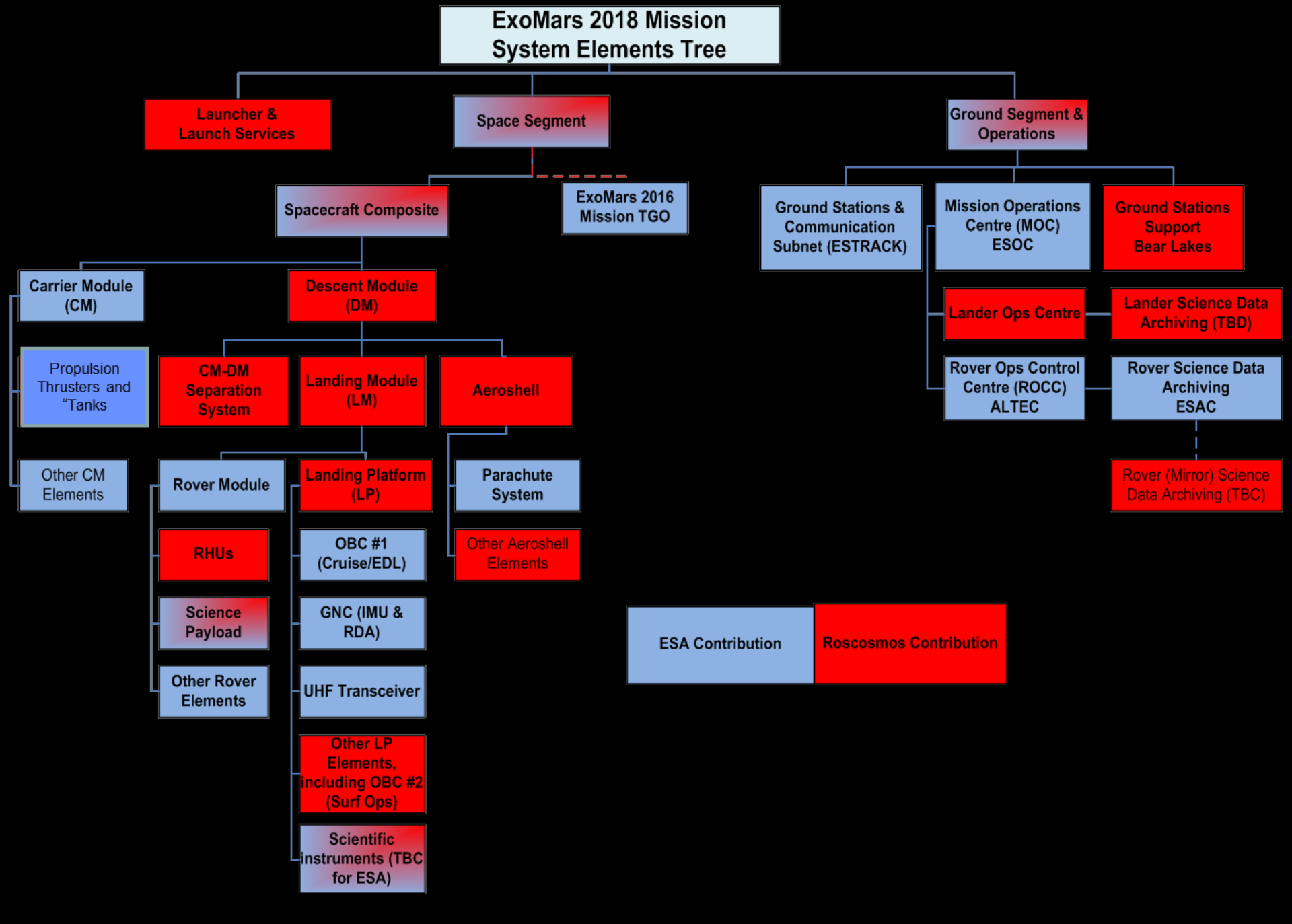




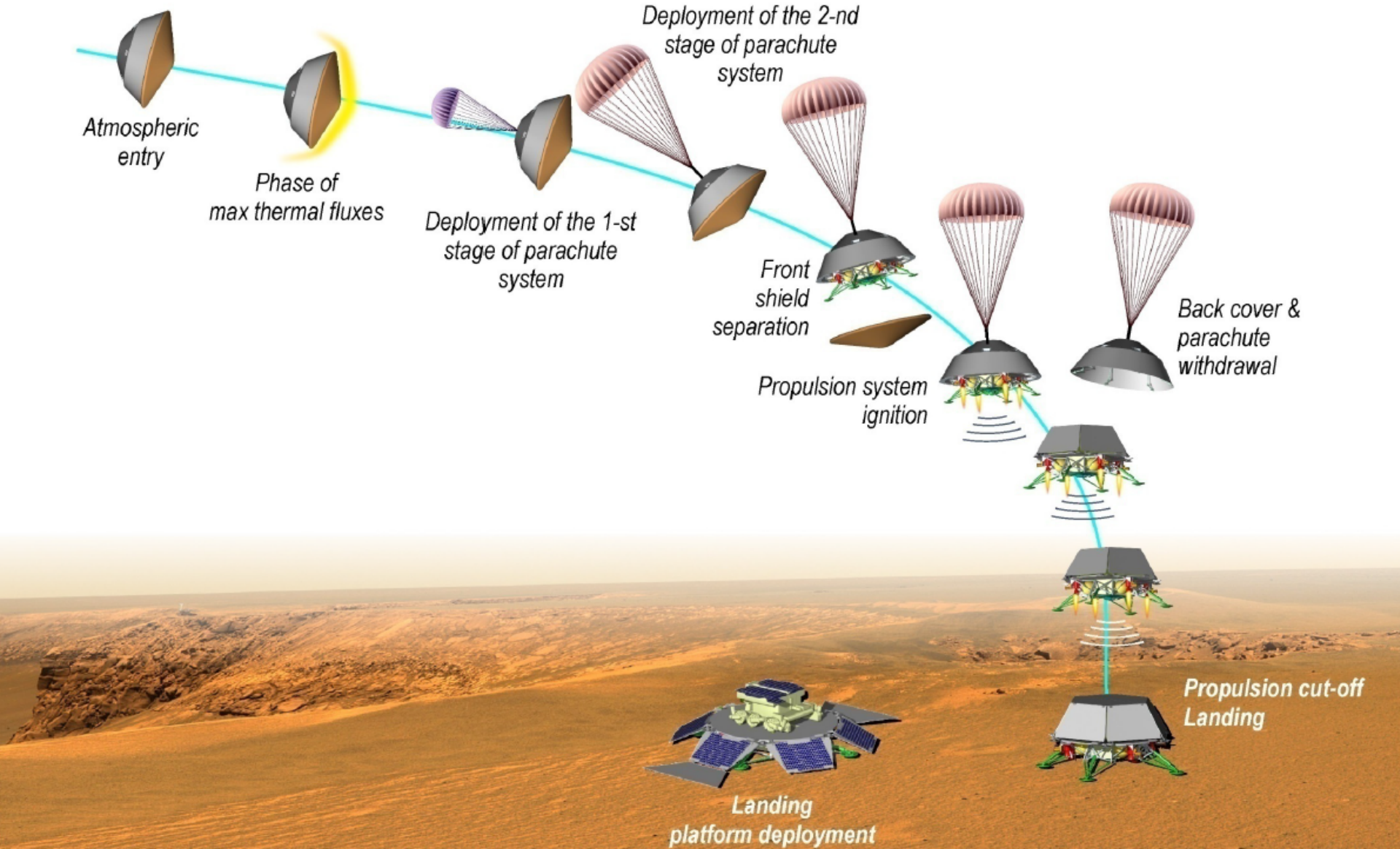
Rover +ROCC + Landed Platform Ops Centre

RUSSIAN-EUROPEAN PROJECT “EXOMARS"

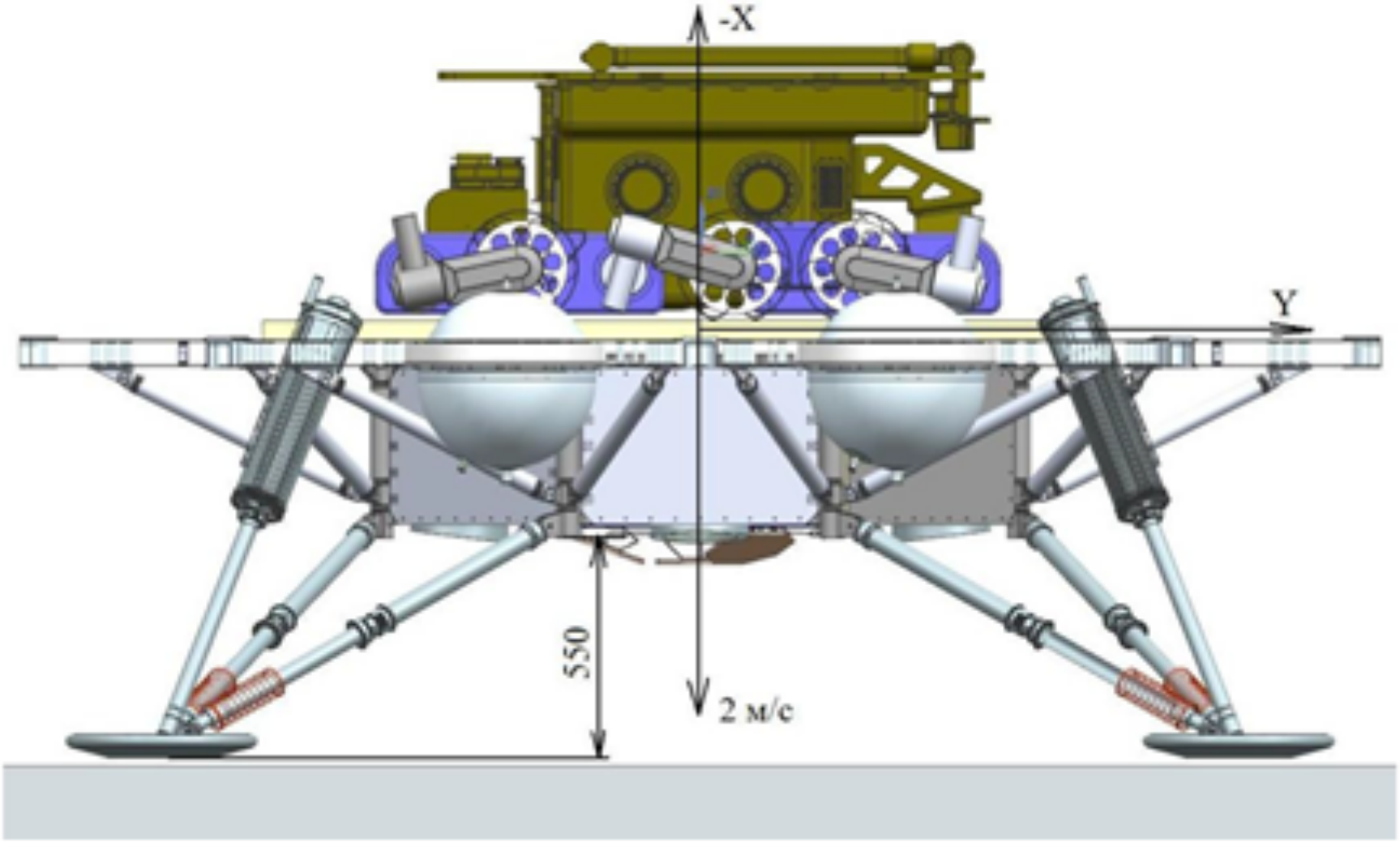



ExoMars 2018 Mission
System Elements Tree
Launcher & Launch Services
Space Segment
Ground Segment & Operations
Spacecraft Composite
ExoMars 2016 Mission TGO
Ground Stations & Communication Subnet (ESTRACK)
Mission Operations Centre (MOC) ESOC
Ground Stations Support Bear Lakes
Carrier Module (CM)
Descent Module (DM)
Lander Ops Centre
Lander Science Data Archiving (TBD)
Propulsion Thrusters and "Tanks
CM-DM Separation System
Landing Module (LM)
Aeroshell
Rover Ops Control Centre (ROCC) ALTEC
Rover Science Data Archiving ESAC
Other CM Elements
Rover Module
Landing Platform (LP)
Parachute System
Rover (Mirror) Science Data Archiving (TBC)
RHUs
OBC #1 (Cruise/EDL)
Other Aeroshell Elements
Science Payload
GNC (IMU & RDA)
Other Rover Elements
UHF Transceiver
Other LP Elements, including OBC #2 (Surf Ops)
Scientific instruments (TBC for ESA)
ESA Contribution
Roscosmos Contribution

DM descent diagram

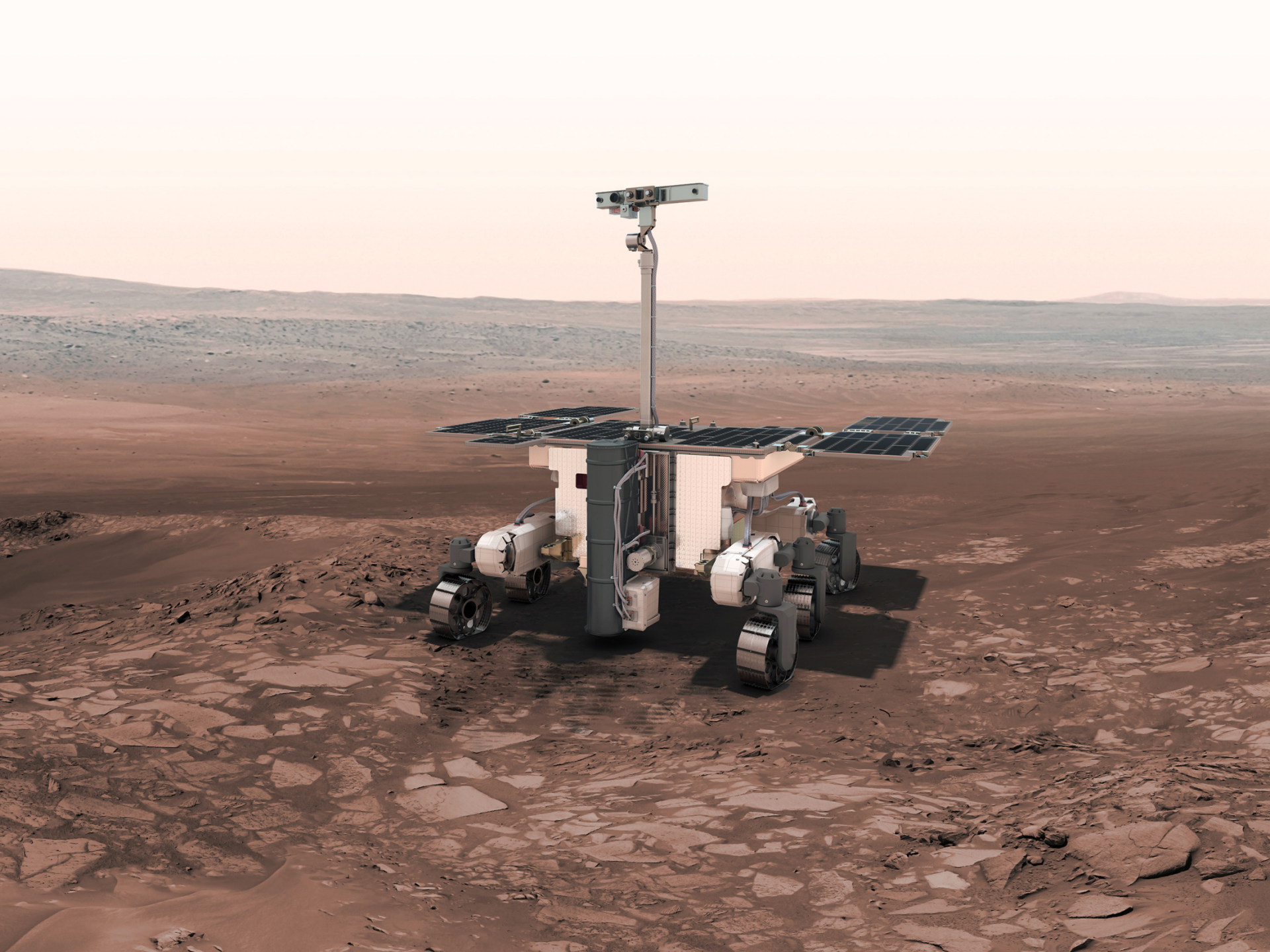


Rover accommodation on the Landing Platform



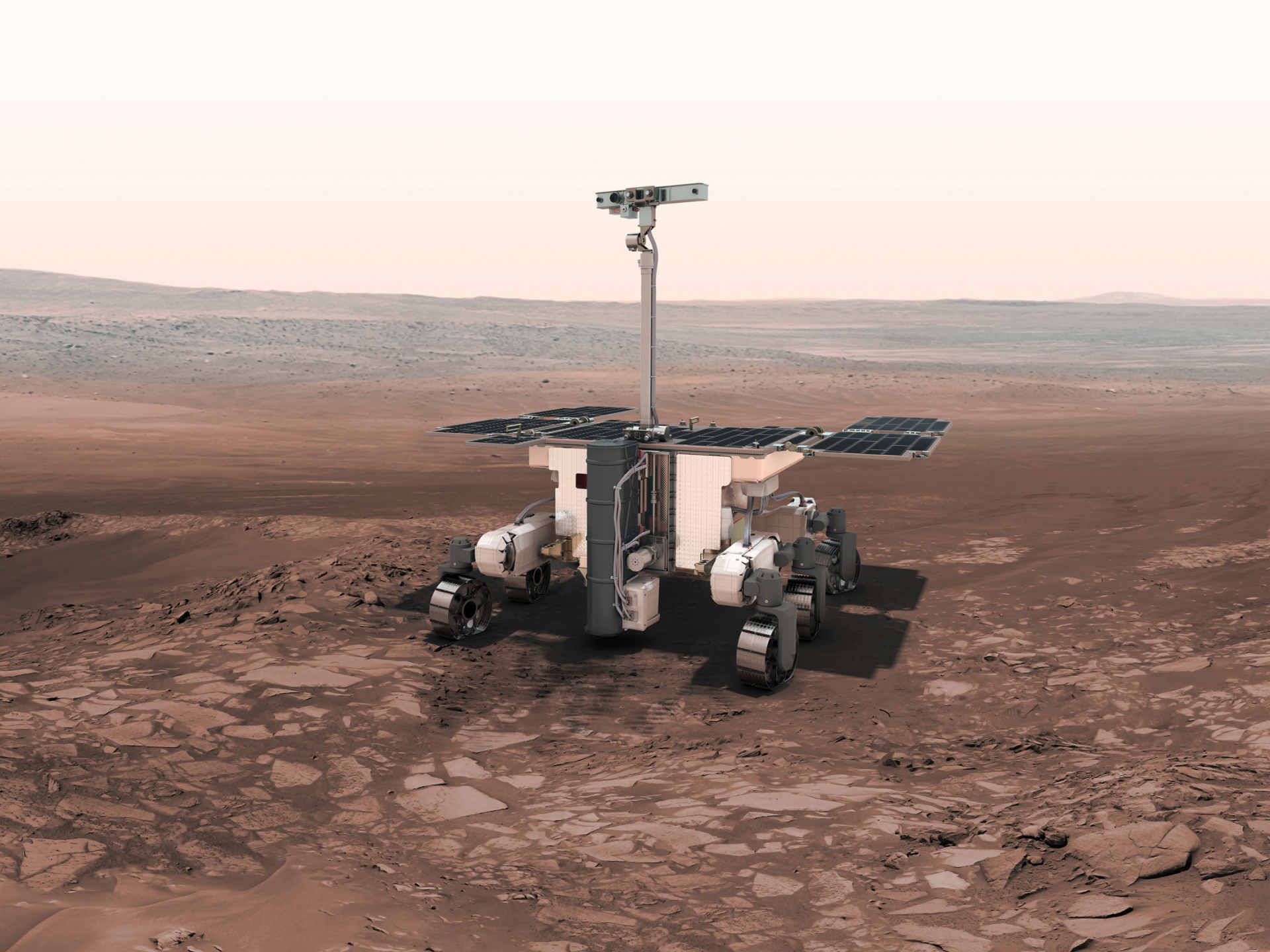
2018

- **Plateforme de surface (Russe)**
  - **Meteo Package** PTW-Hum measurements (EDL phase + surface).
  - **FAST** Fourier spectrometer for atmospheric studies
  - **M-DLS** Multi-channel Diode-Laser Spectrometer for atmospheric studies
  - **RAT-M** Radiometer
  - **Adron-EM** Neutron / Gamma spectrometer. Dosimeter.
  - **SEM** Small seismometer
  - **PK (Dust Suite** Dust studies near surface
  - **MGAK** Gas Chromatographer + Mass Spectrometer
  - **MAIGRET** Magnetometer



2018

- **Véhicule de Surface**
  - **Pan Cam**
  - **ISEM**
  - **Drill**
  - **Wisdom**
  - **Adron**
  - **CLUPI**
  - **Ananalytical Laboratory drawer**



2018

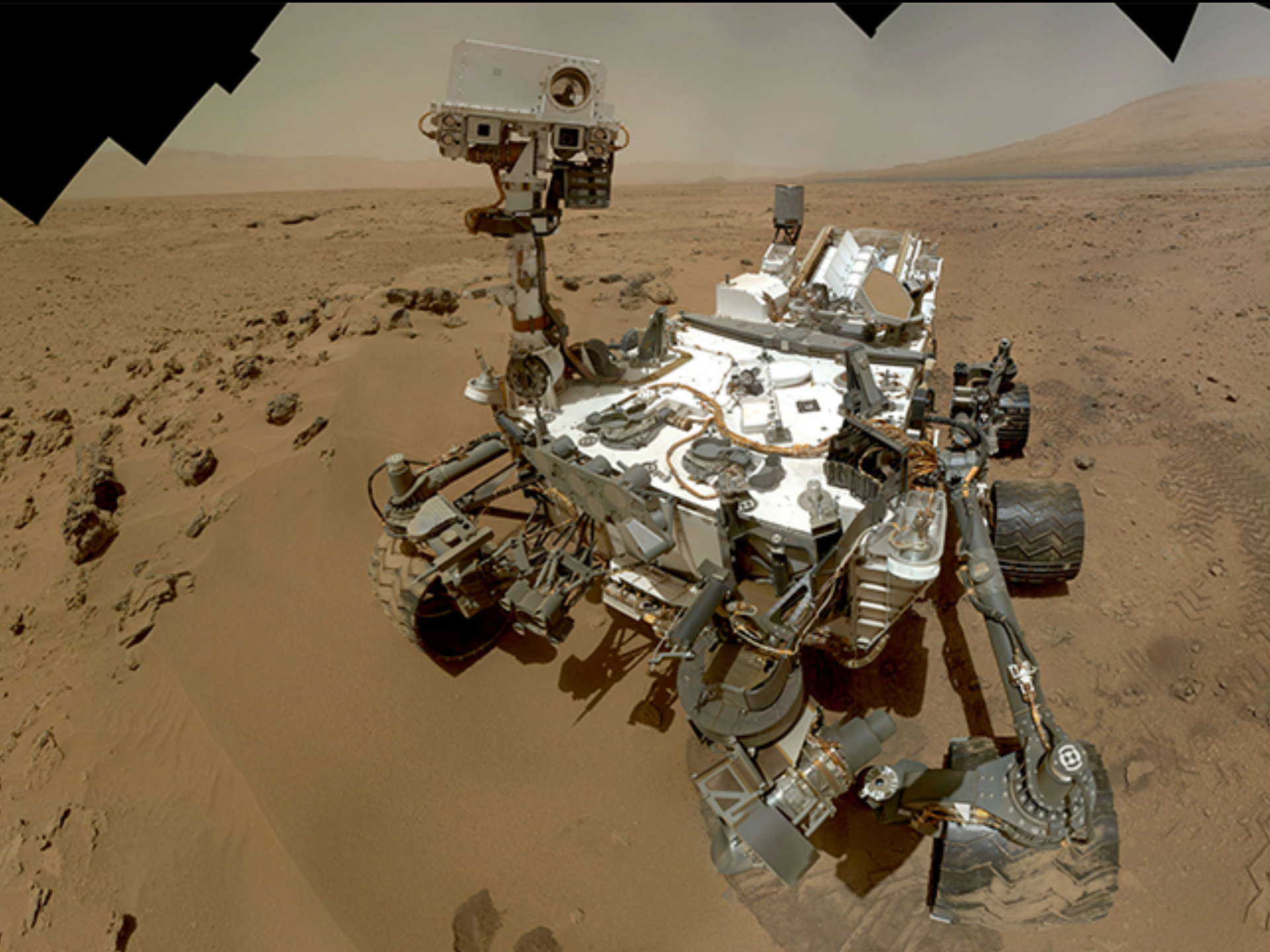
- Analytical Laboratory Drawer
  - Micromega
  - Raman laser spectrometer
  - MOMA

Interdisciplinarité

- Environ 200 scientifiques européens, une dizaine américains et 50 russes
- Une interprétation coordonnée délicate des données (test organisé par l'ISAR)
- Tous les problèmes d'un projet spatial
  - Prenant
  - Incertain
  - Long…Très Long….

D’autres Missions à l’assaut de Mars

- Opportunity
- Curiosity
- Maven
- Mission Indienne
- Mars 2020
- NeMO
- Et plus….



MEUH!
G.LE SUEUR