

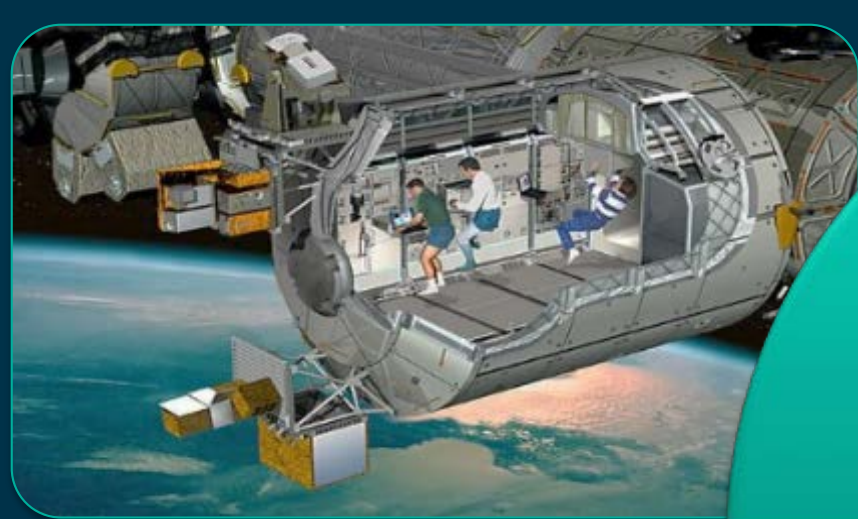


'Terrae Novae'

The European Space Exploration Programme
*Leading Europe's human journey into the Solar System
using robots as precursors and scouts*



Why explore ?



New knowledge

Challenge
driven
innovation

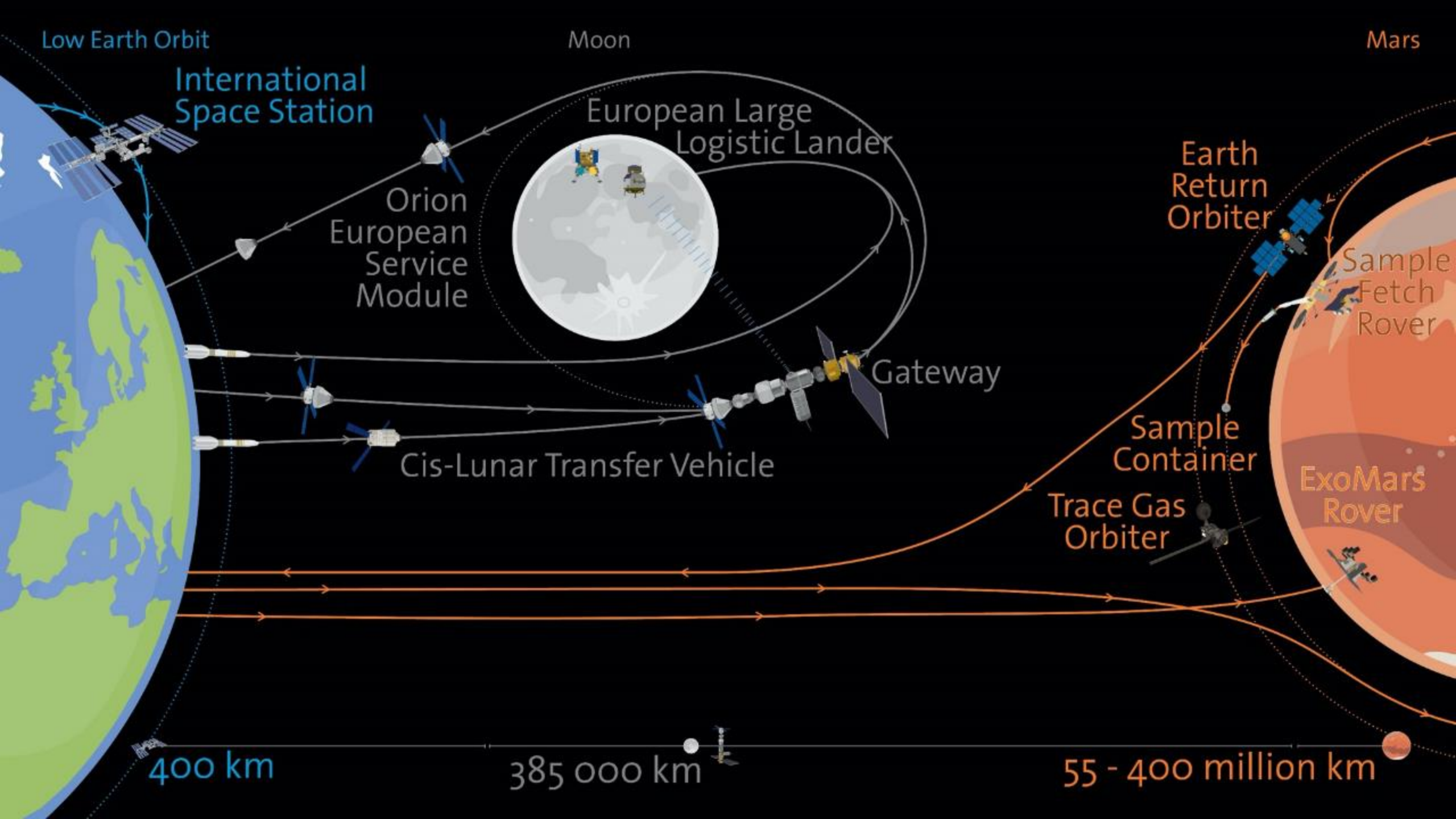


Inspiration
Motivation
Education

Global partners

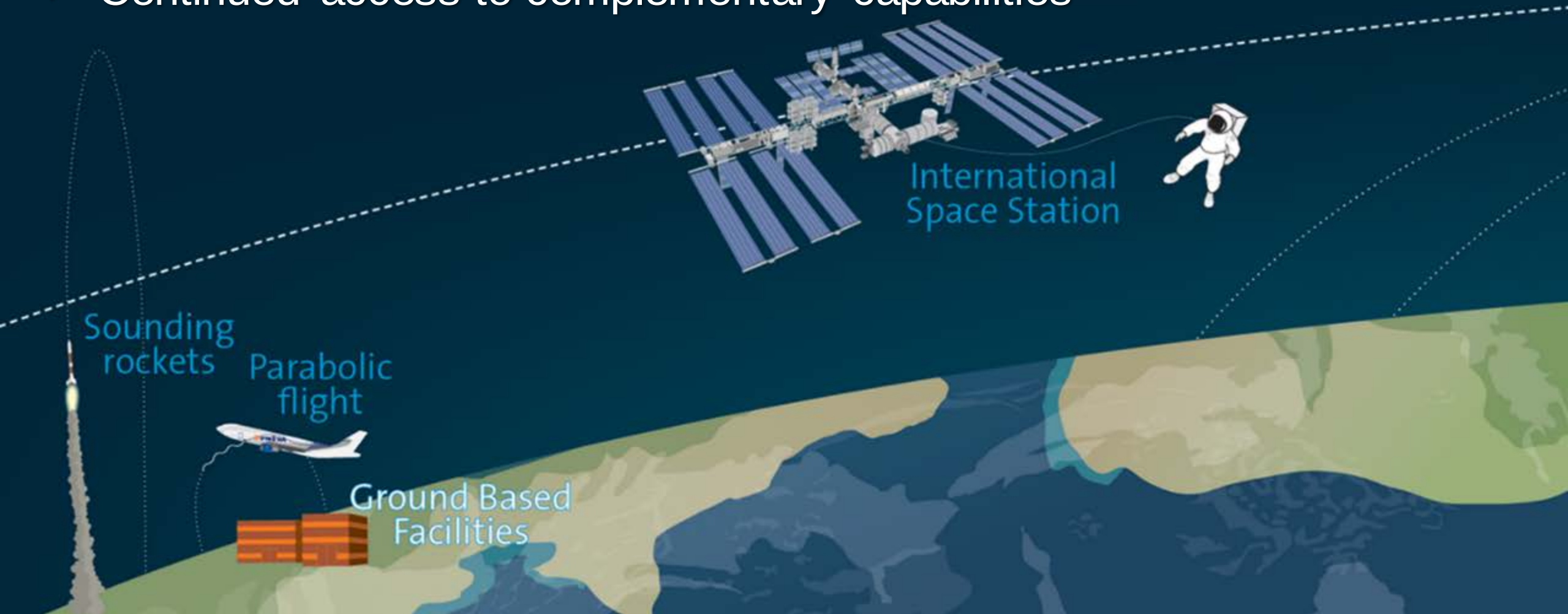


• The Global Exploration
Roadmap, *January 2018*



Destination Low Earth Orbit (LEO)

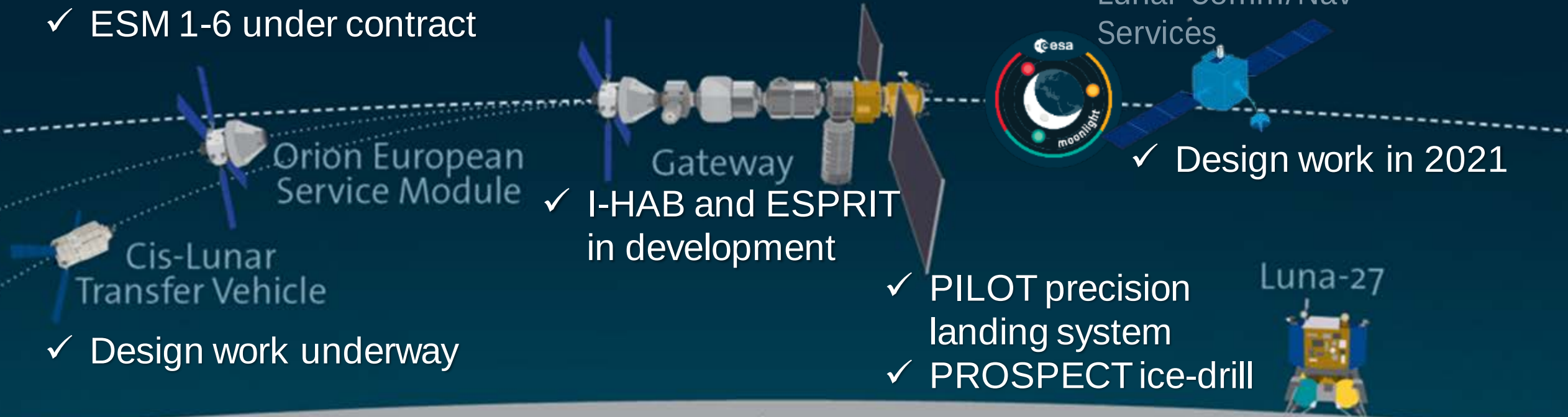
- ✓ Continued utilisation of ISS until 2030
- ✓ Continued access to complementary capabilities



Destination Moon



✓ ESM 1-6 under contract



✓ Design work underway

✓ I-HAB and ESPRIT in development

✓ PILOT precision landing system

✓ PROSPECT ice-drill

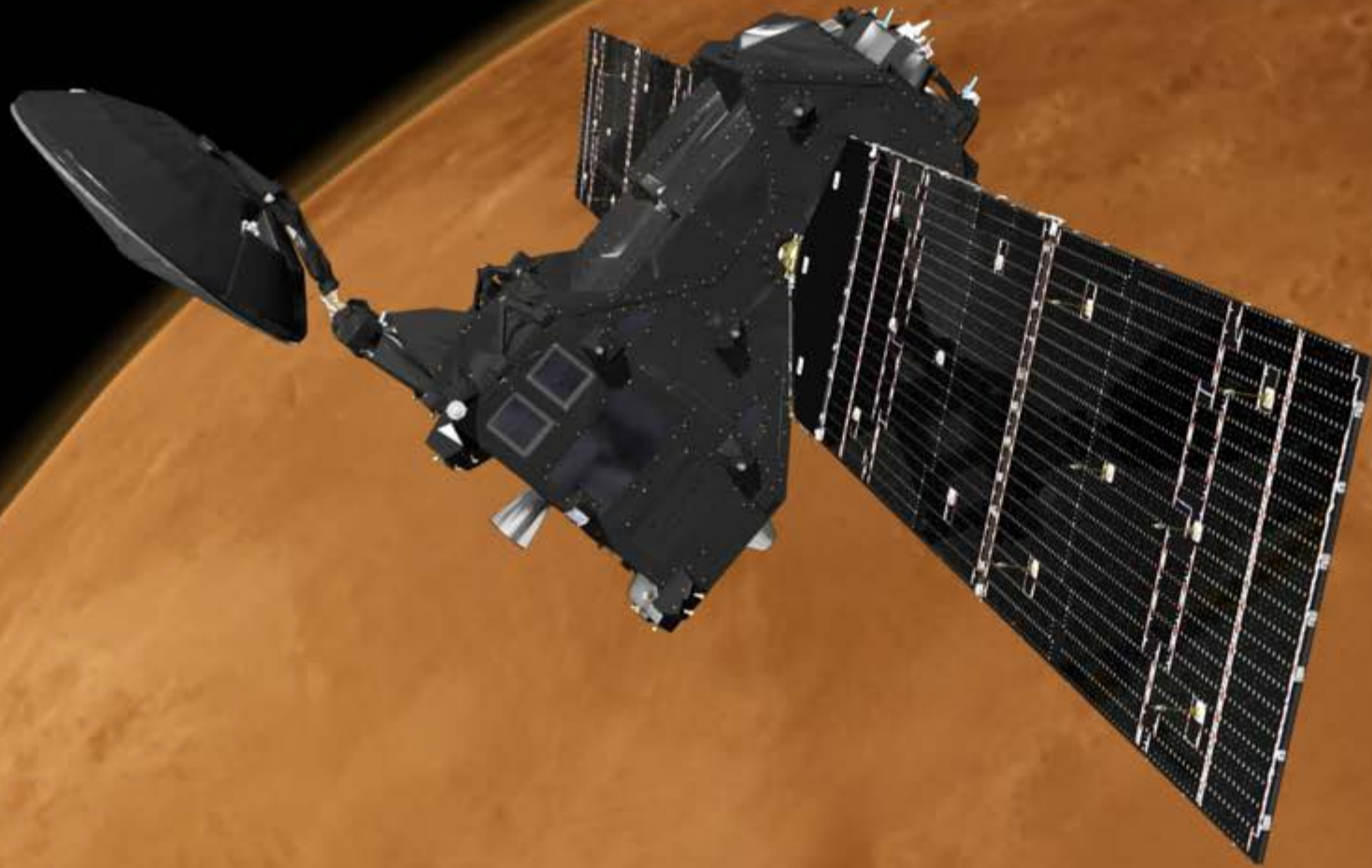
✓ Design work in 2021

- ✓ First ESA science for Gateway in development
- ✓ ESA received 300+ ideas for applications of EL3
- ✓ ESRIC operational in 2021- Europe's home for space resources research

European Large Logistic Lander

✓ Design work underway

Destination Mars



Core theme for ESA's Mars exploration efforts has been the Search for Life



Mars Express (2003) - Search for water and life through studying atmosphere and climate, and the mineralogy and geology of the surface and subsurface.

Major discoveries include hydrated minerals, recent glacial landforms and possible evidence of a subsurface lake.

Trace Gas Orbiter (2016) - Search for life through investigation of methane and other trace gases.

Major discoveries include refined measurements of atmospheric chemistry and structure and global mapping of near-surface hydrogen (likely water).





In Nature Geoscience this week, we publish a paper on TGO results with profiles of CO in the Martian atmosphere

The front page of the issue carries an image from the CaSSIS camera - 20 000 images so far

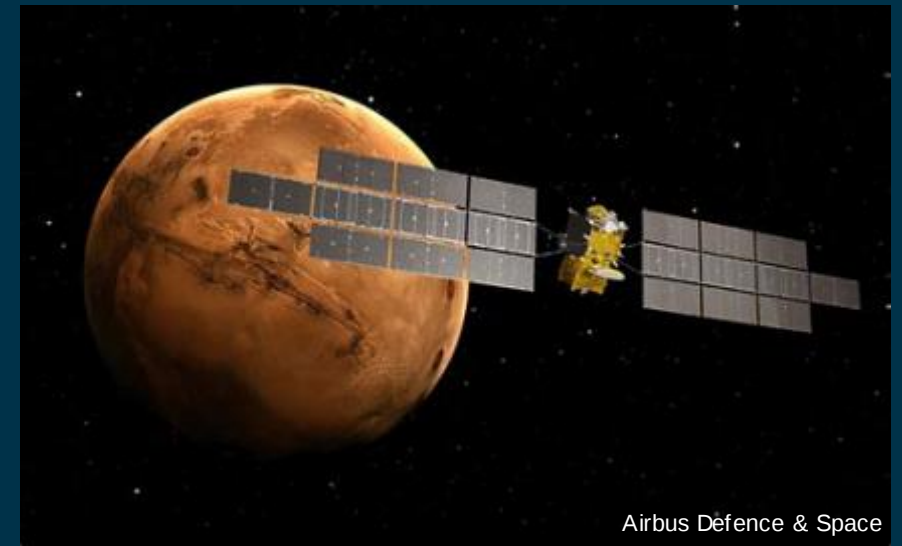
Tomorrow (on the third day of Mars Year 36), we publish two papers in Science Advances, on the discovery of HCl and on seasonal dependence of the D/H ratio



Rosalind Franklin Rover (2022)- Search for past life through reaching deep into the subsurface for the first time

Launch planned in 2022, arrival 2023

Mars Sample Return (2026) - Search for life and preparation for human exploration through investigation of returned samples from Mars



Ambitious decade of robotic Mars exploration



Trace
Gas
Orbiter

- ✓ TGO science and data relay continuing
- ✓ Supporting NASA Mars 2020 landing in February

- ✓ ERO in full development

ExoMars
Rover

- ✓ First astrobiology rover with drill and radar
- ✓ On track for 2022 launch

- ✓ Sample Fetch Rover and robotic arm entering full development

Earth
Return
Orbiter

Sample
Fetch Rover

Sample
Transfer Arm

ESA UNCLASSIFIED - For Official Use



→ THE EUROPEAN SPACE AGENCY



Horizon Goal

Humans on Mars

- A new Mars exploration strategy is in development at ESA to address planning beyond launch of MSR up to 2040
- The Search for Life will continue to be central to the science strategy
- Exploration science, i.e. science that *enables* future human exploration, will become increasingly important

Potential areas of priority:

- ✓ Long-term weather monitoring, storm prediction
- ✓ Astrobiological investigations of special regions
- Accessing, investigating, and utilizing subsurface ice
- ✓ Geophysics
- ✓ Communications & Navigation





By 2040 ? The human Mars explorers

