

# Exploration@ESA in 2020

A report for Space Science Week

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23 March 2021

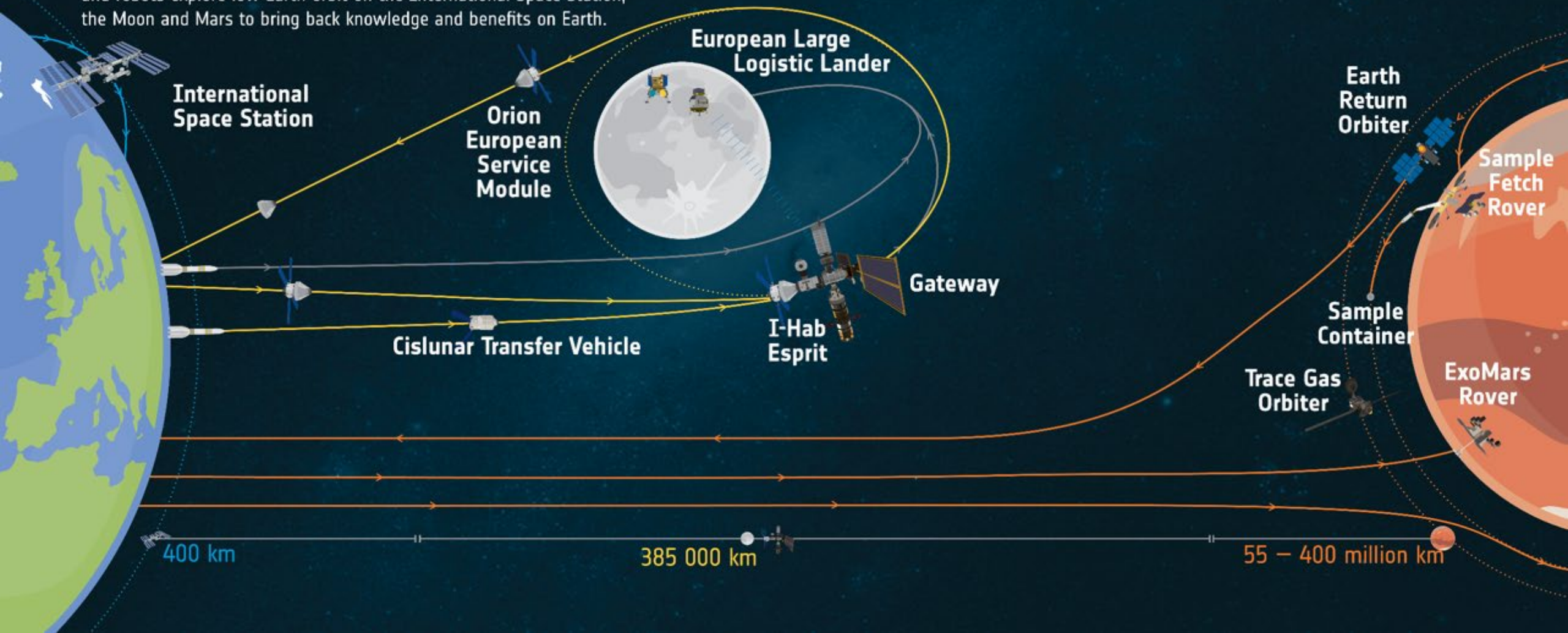
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# ESA'S HUMAN AND ROBOTIC EXPLORATION DESTINATIONS

ESA's Human and Robotic Exploration programme will see astronauts and robots explore low Earth orbit on the International Space Station, the Moon and Mars to bring back knowledge and benefits on Earth.



# Research in LEO benefiting Earth

→ CoKa - EDRS terminal launched  
→ Bartolomeo launched and installed

→ New SciSpace research approved

→ Successful *Beyond* mission

→ Preparation of *Alpha* and *Cosmic Kiss* missions

→ Exploration Science Data Centre opened in February 2020

Sounding  
rockets

Parabolic  
flight

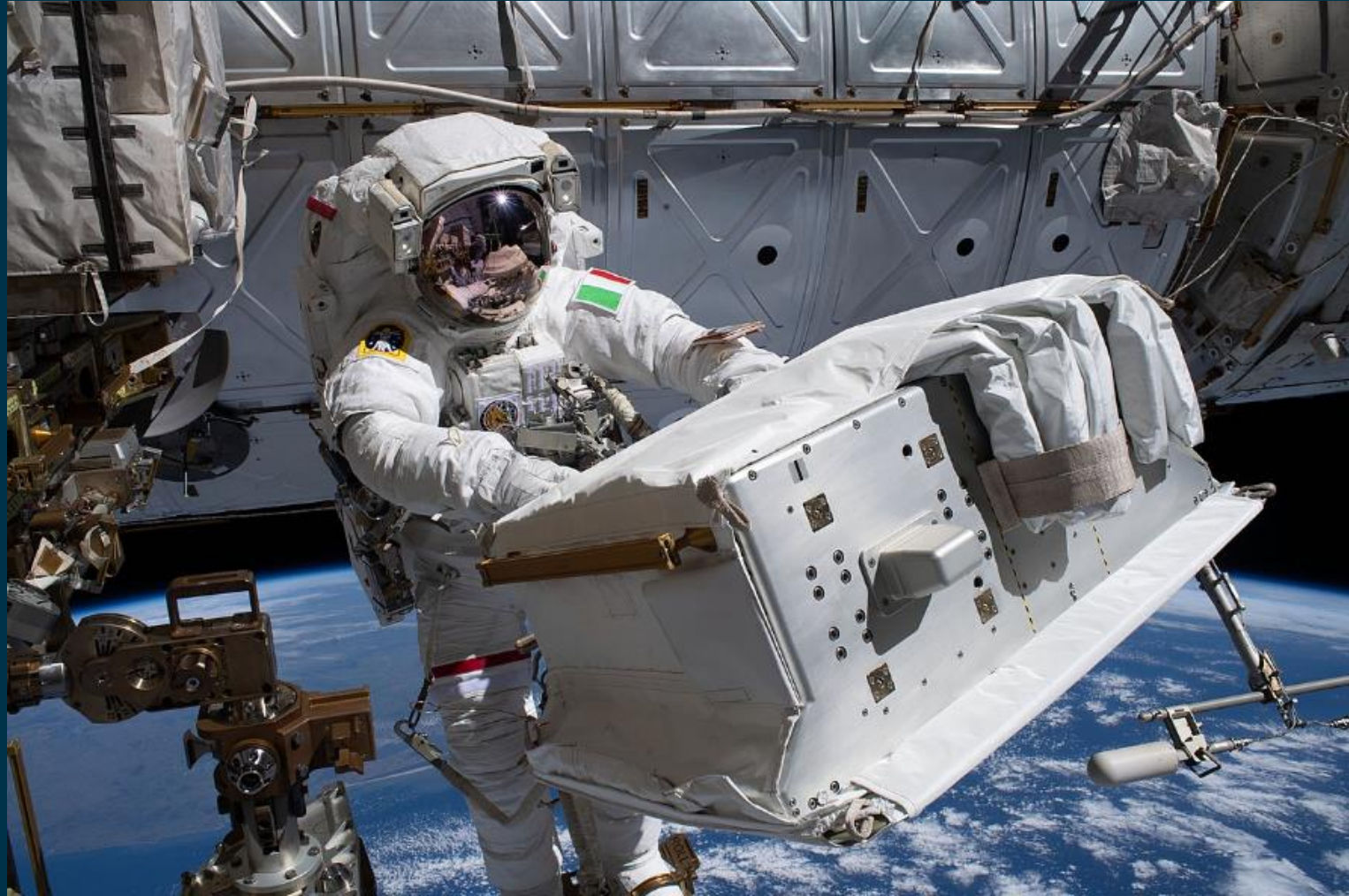
Ground Based  
Facilities

International  
Space Station





# Beyond Mission Successfully Completed in February 2020





# Covid-19 drug research on the ISS

## Cyclodextrin News

A forum for researchers, students and applicants in the field of cyclodextrin technology

Home Pharma applications Non-pharma applications CD derivatives Events

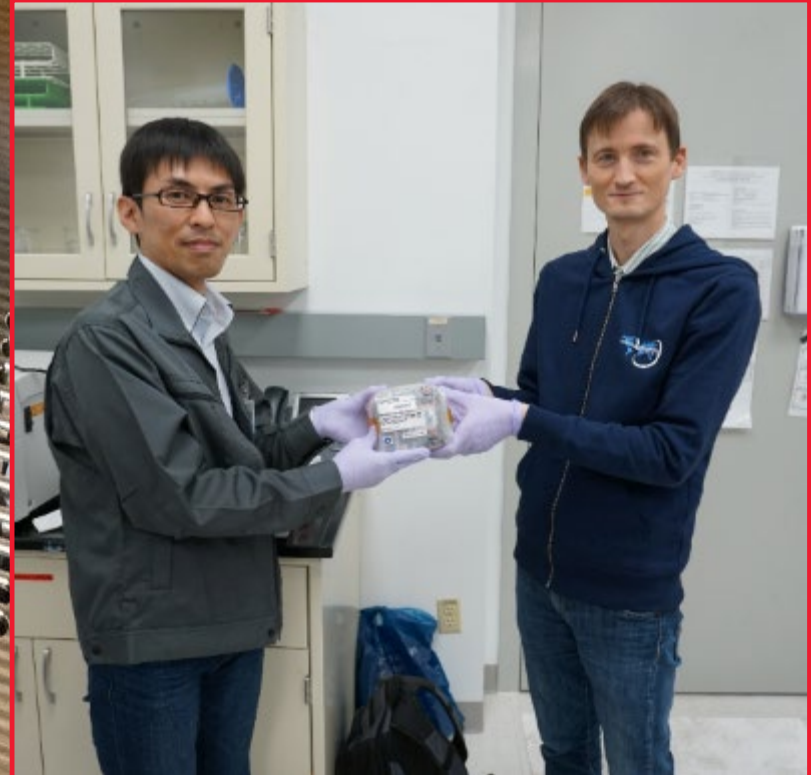


November 11, 2020 • Drug delivery / Non-pharma applications / Other industrial use / Pharma applications / Uncategorized

## FIRST EXPERIMENTS IN SPACE FOR COVID-19 DRUG RESEARCH



6 December 2020  
'Kirara-2' ICE-Cube  
launch







Crew-1's arrival enables many human research experiments

NASA astronaut Victor Glover performs the GRIP experiment in the Columbus laboratory

Credit: NASA



# Time Perception

NASA astronaut Victor Glover performs the Time Perception experiment in the Columbus laboratory

Credit: NASA





# Rotifer-B2 launched on SpX-21



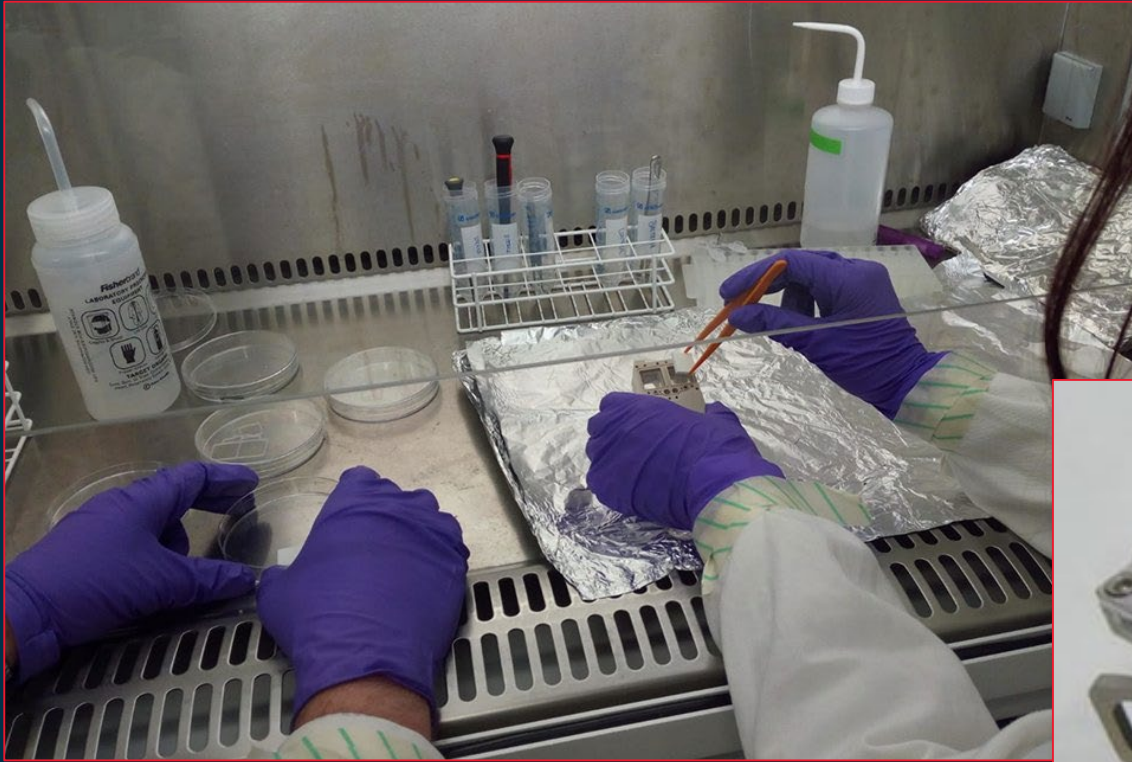
Credit: UNamur

Microscopic invertebrates (*A. Vaga*) are first desiccated then irradiated at the LARN laboratory (UNamur) in preparation for space and ground experiments





# BioAsteroid launched on SpX-21



Credit: Kayser Italia

The first Bioreactor Express Service payload studying how microbes extract materials from rocks in space using the Kubik bioreactor





Bartolomeo in the parking position during the robotic installation

Credits: NASA



# Europe's new era of lunar exploration



✓ ESM4/5/6 contract agreed

Orion European Service Module

Cis-Lunar Transfer Vehicle

✓ Design work underway

Gateway

✓ I-HAB and ESPRIT in development

Lunar Comm/Nav Services

✓ Design work in 2021

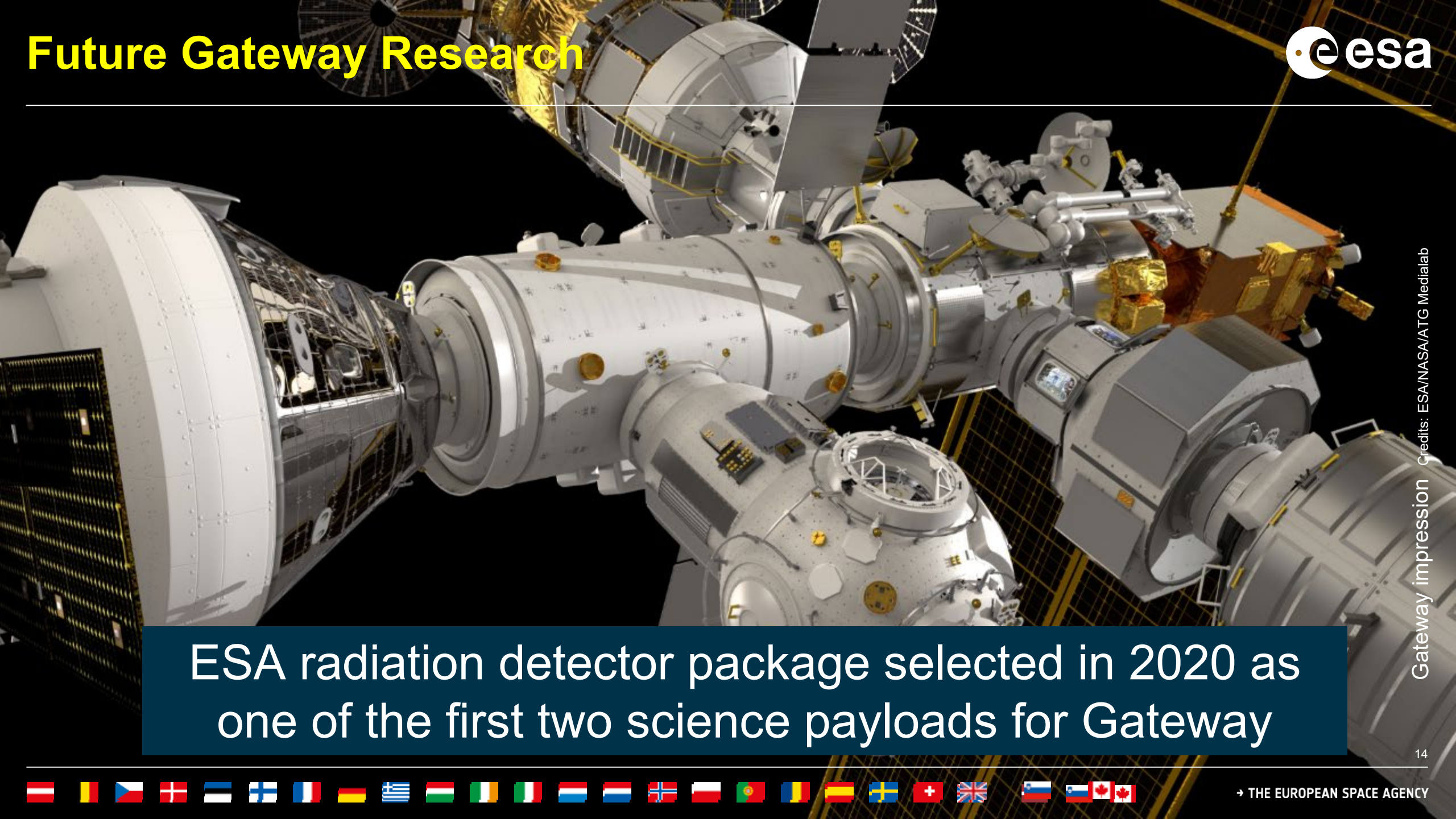
✓ PILOT precision landing system

✓ PROSPECT ice-drill

Luna-27

European Large Logistic Lander

✓ Design work underway



ESA radiation detector package selected in 2020 as one of the first two science payloads for Gateway

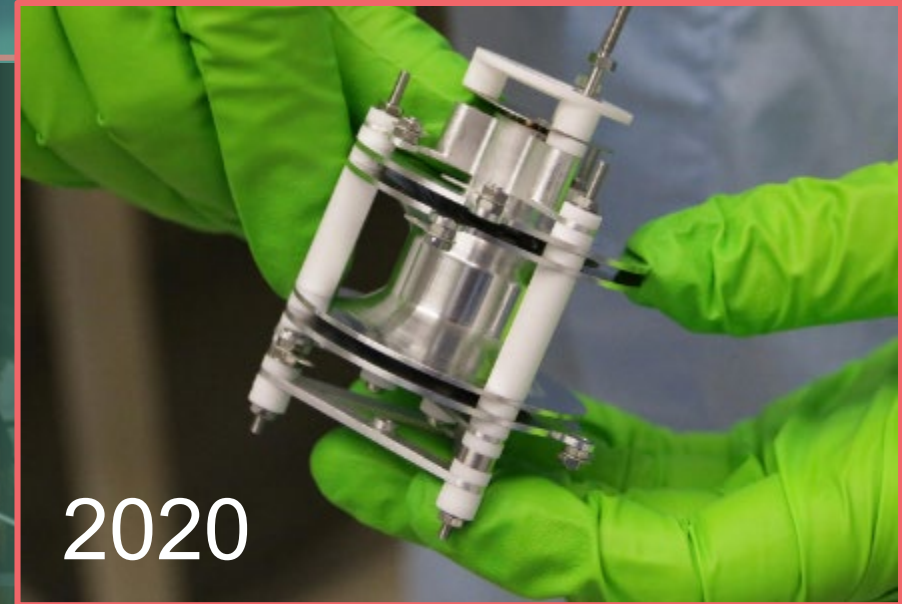
Gateway impression Credits: ESA/NASA/ATG Medialab



# First ESA Science to Moon surface in 2021



ESA can be quick !



# Ambitious decade of robotic Mars exploration



Trace  
Gas  
Orbiter

- ✓ TGO science and data relay continuing
- ✓ Support to NASA Mars 2020 landing in February 2021

ExoMars  
Rover

Earth  
Return  
Orbiter

## Mars Sample Return contributions

Sample  
Fetch Rover

Sample  
Transfer Arm

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→ THE EUROPEAN SPACE AGENCY

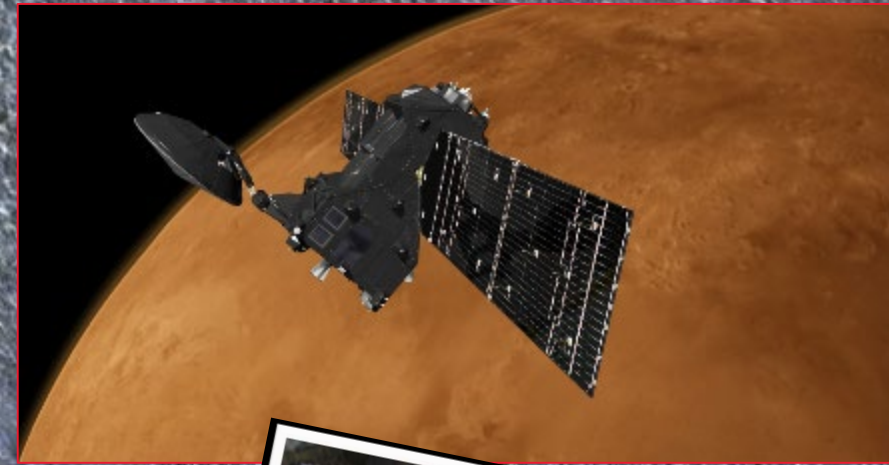


# ExoMars Trace Gas Orbiter is five years old !

14 March  
2016



20 000<sup>th</sup> image of Mars by the  
CaSSIS stereo camera



# ExoMars and Mars Sample Return (MSR)

- **ExoMars 2022:** Serious covid 19 disruption
- Top 3 risks:
  1. Completion of parachute qualification
  2. Correction of the propulsion command electronics by Lavochkin
  3. Contractual coverage by ROSCOSMOS of the AIT work at TAS in 2021/2022
- Full development of ESA elements of **MSR** started in 2020

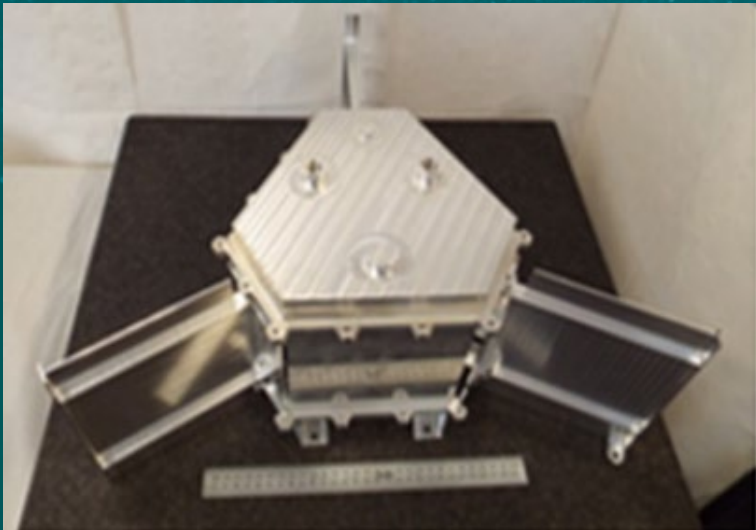


*characterisation in  
TAS-F Cannes*





- ▶ 'before and after' demonstration of oxygen and titanium extraction from lunar regolith simulant
- ▶ Electronic Field Book supporting smart EVA science and operations



- ▶ LESA equipment transport system enabling an incapacitated crew rescue
- ▶ European radioisotope technology based on americium-241:  
*Radioisotope Heater Unit, European Large Heat Source, Radioisotope Thermoelectric Generator*





Low  
Earth  
Orbit

Moon

Mars

**THANK YOU**

<http://youbenefit.spaceflight.esa.int>

**we explore. you benefit.**

Human Spaceflight and Robotic Exploration

