

Return to the Moon and onwards to Mars

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Head Strategy & Coordination

Human & Robotic exploration

European Space Agency

Exploration: a driving force of humankind ?



Geopolitical identity – soft power



Political inspiration – positive future



Technological leadership – dominance

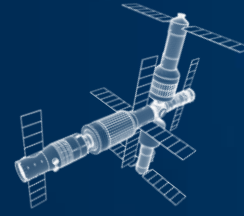
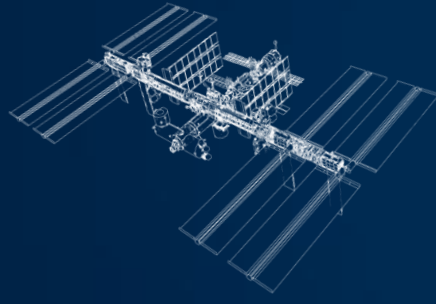
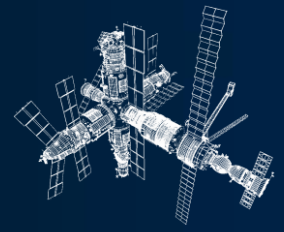
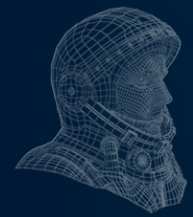


Science – opportunity/ / justification

Sociological – destiny

Individual – instinct

SOFT POWER SYMBOLS IN THE RACE FOR HUMAN SPACE EXPLORATION



1961

1st human in space

1986-2001

Russian Mir Space Station

1998-2030

US-led International Space Station

>2021

Chinese Space Station

>2028

US-led Commercial Space Station(s)

>2028

Russian Orbital Space Station

1st Space Race (US - USSR)

Race on hold

2nd Space Race (US - China)

1969

1st human on the Moon

>2025

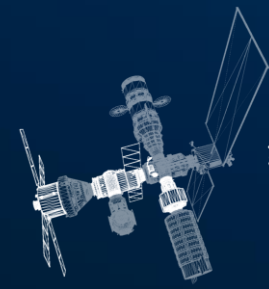
US-lead Lunar Gateway

>2030

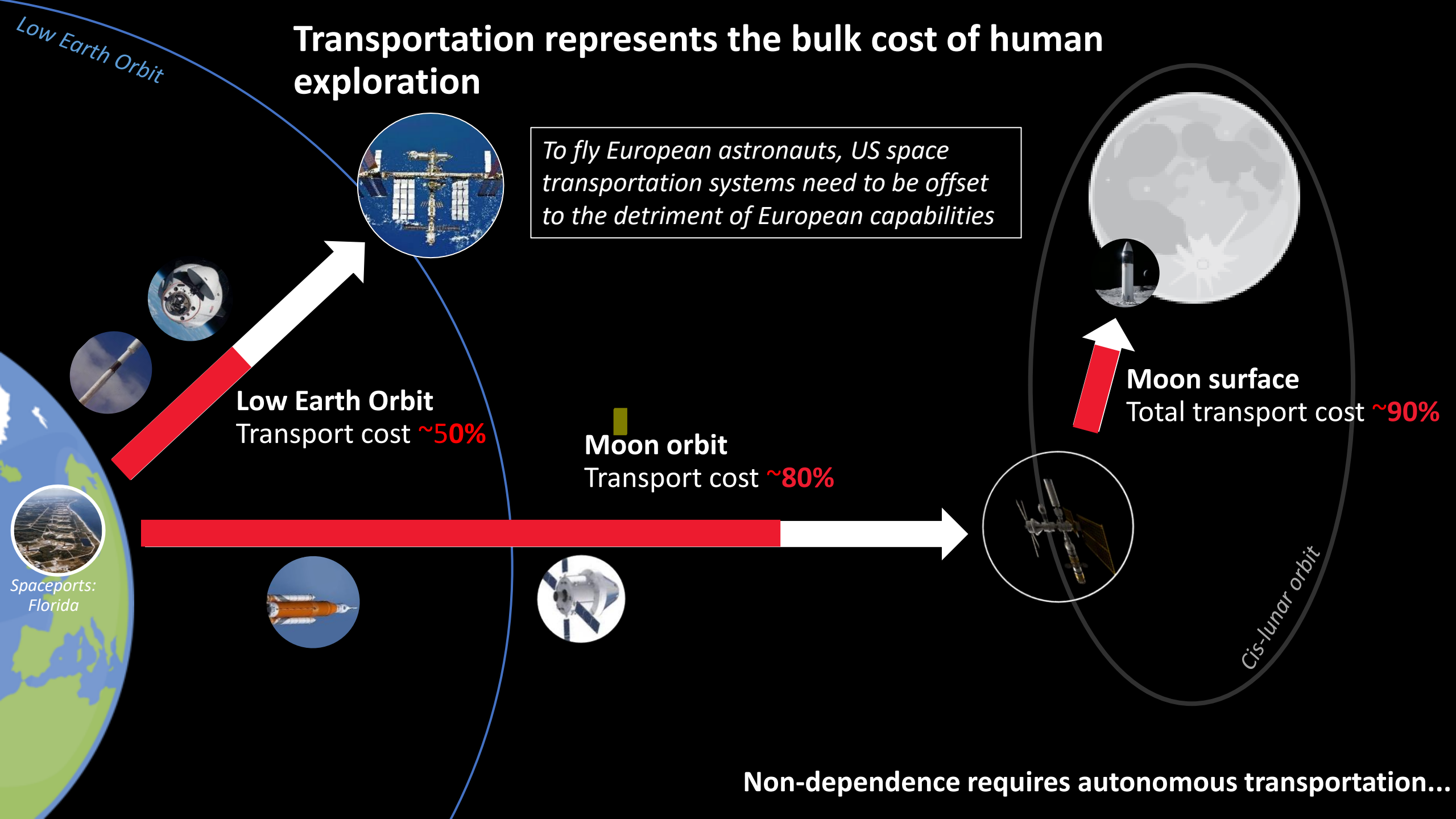
US vs China Moon surface

>2040

US vs China Mars surface



Transportation represents the bulk cost of human exploration



To fly European astronauts, US space transportation systems need to be offset to the detriment of European capabilities

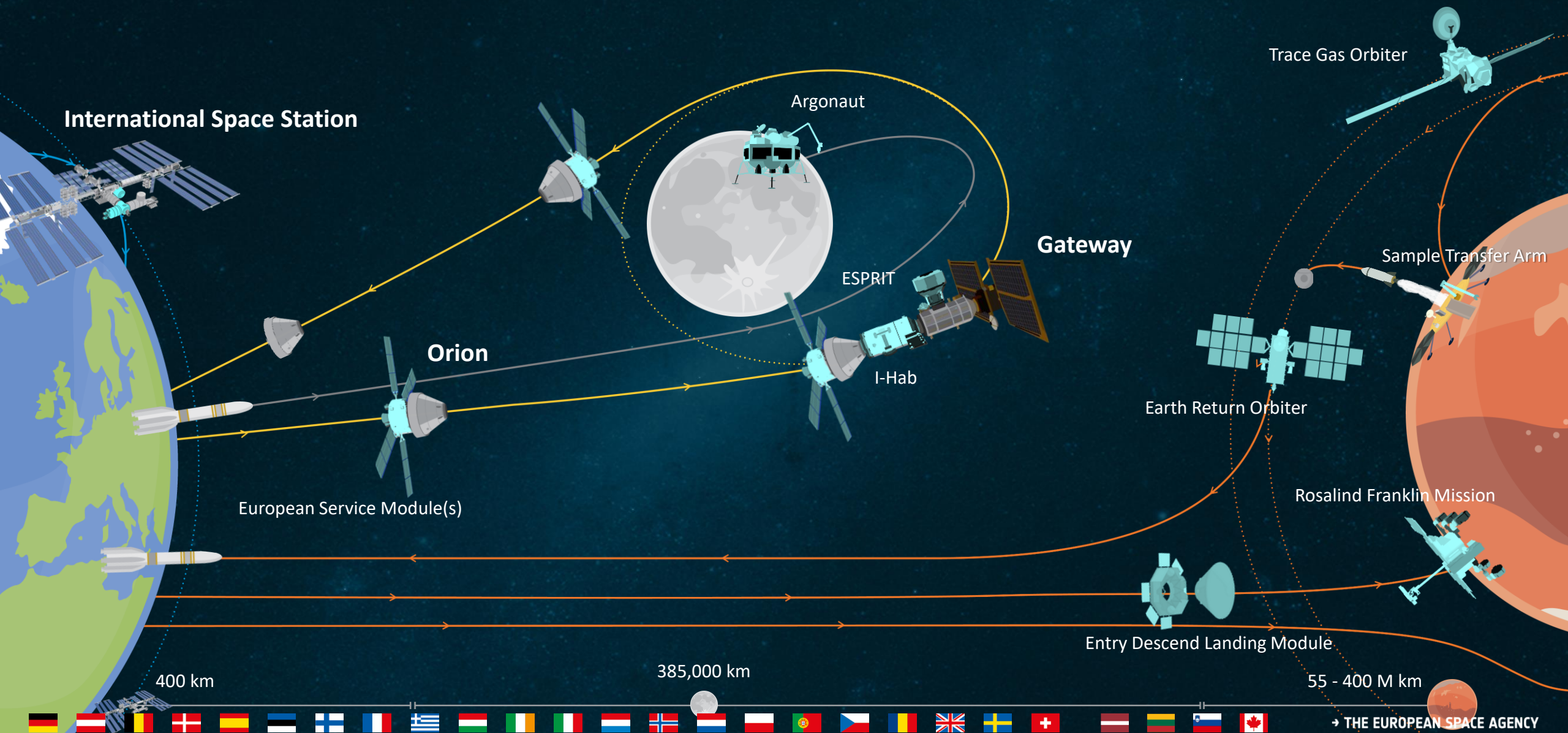
Low Earth Orbit
Transport cost ~50%

Moon orbit
Transport cost ~80%

Moon surface
Total transport cost ~90%

Non-dependence requires autonomous transportation...

THE MASTER PLAN



International Space Station

Orion

European Service Module(s)

400 km

Argonaut

ESPRIT

I-Hab

385,000 km

Gateway

Earth Return Orbiter

Entry Descent Landing Module

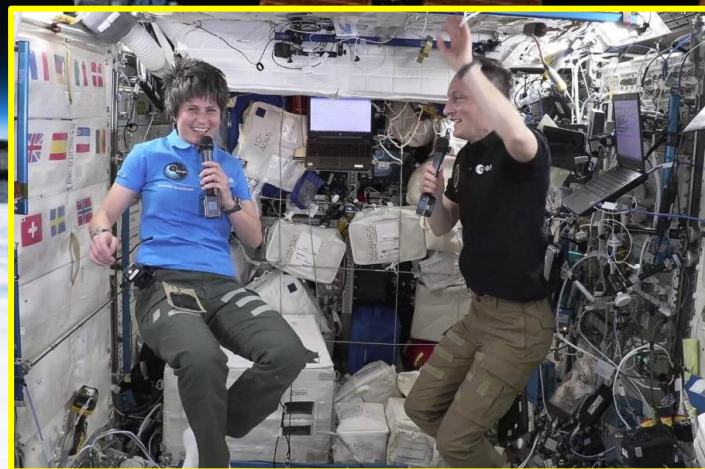
Trace Gas Orbiter

Sample Transfer Arm

Rosalind Franklin Mission

55 - 400 M km



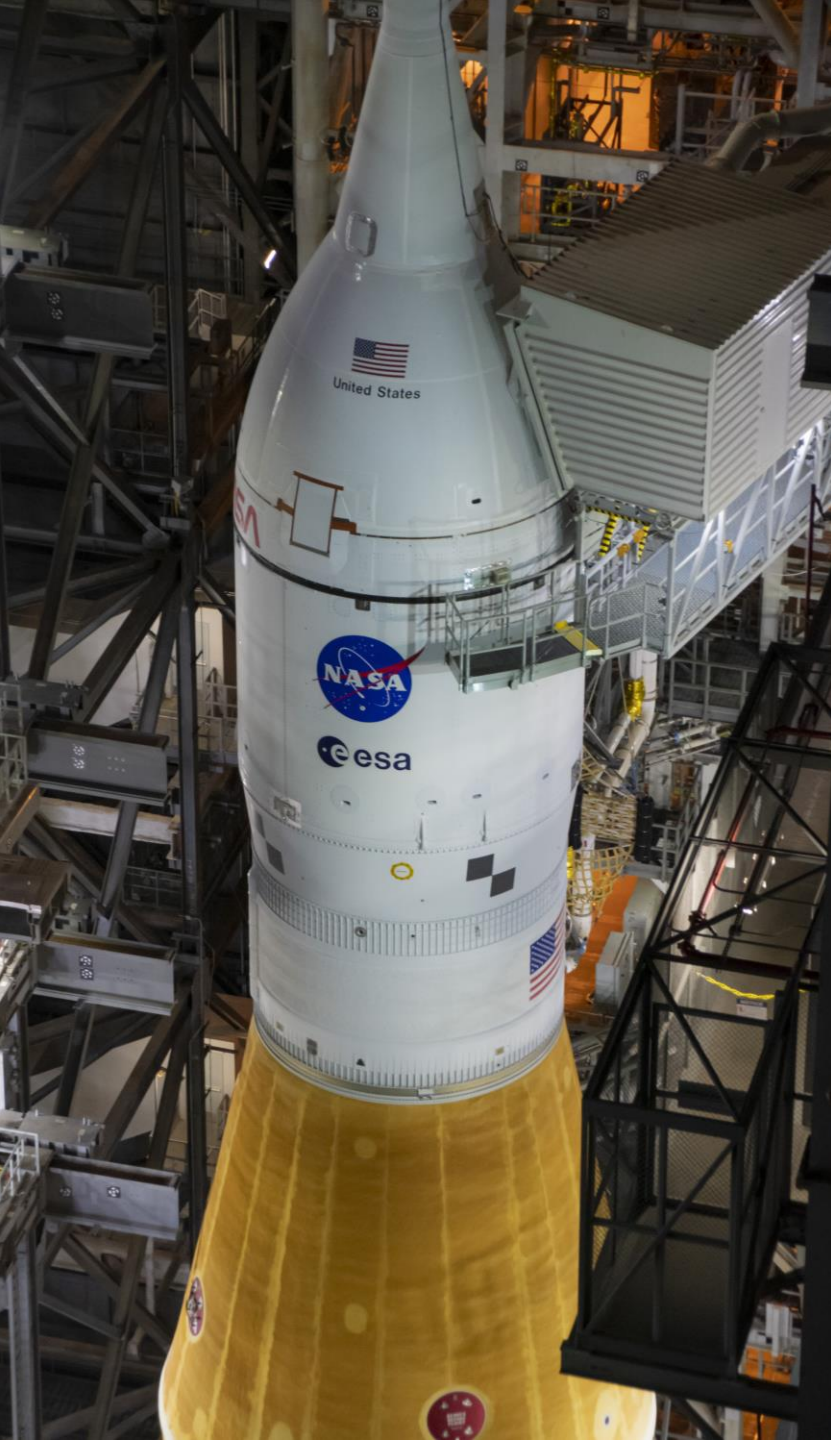


ISS

- Science utilisation and deep space exploration preparation.

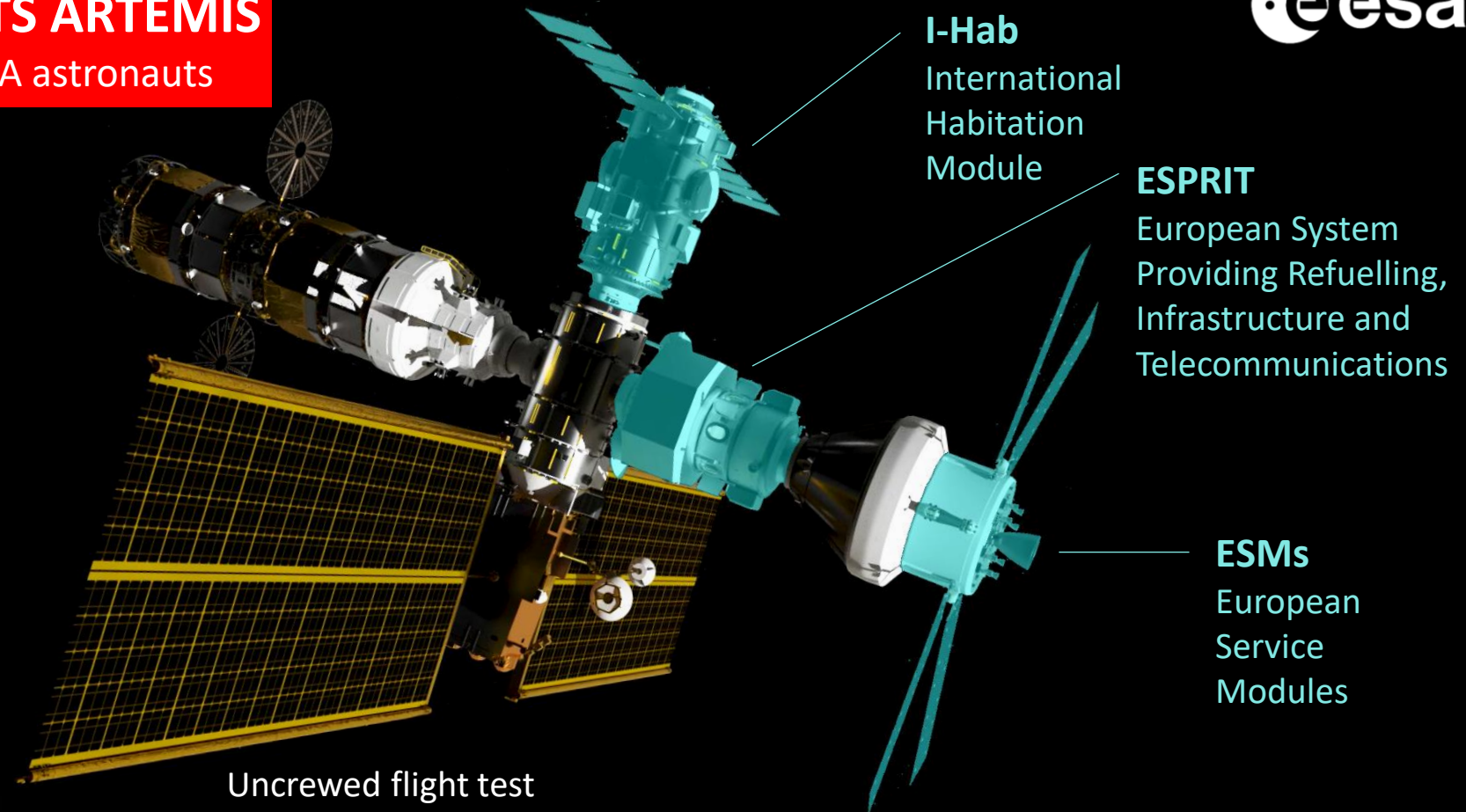
Post-ISS

- A role for European industry as service providers in US-lead commercial space station(s).
- ESA buying services instead of Agency owned assets.
- Transportation model is fundamental – cargo & crew.



WHERE TERRAE NOVAE MEETS ARTEMIS

Orion moonship, lunar Gateway, and ESA astronauts



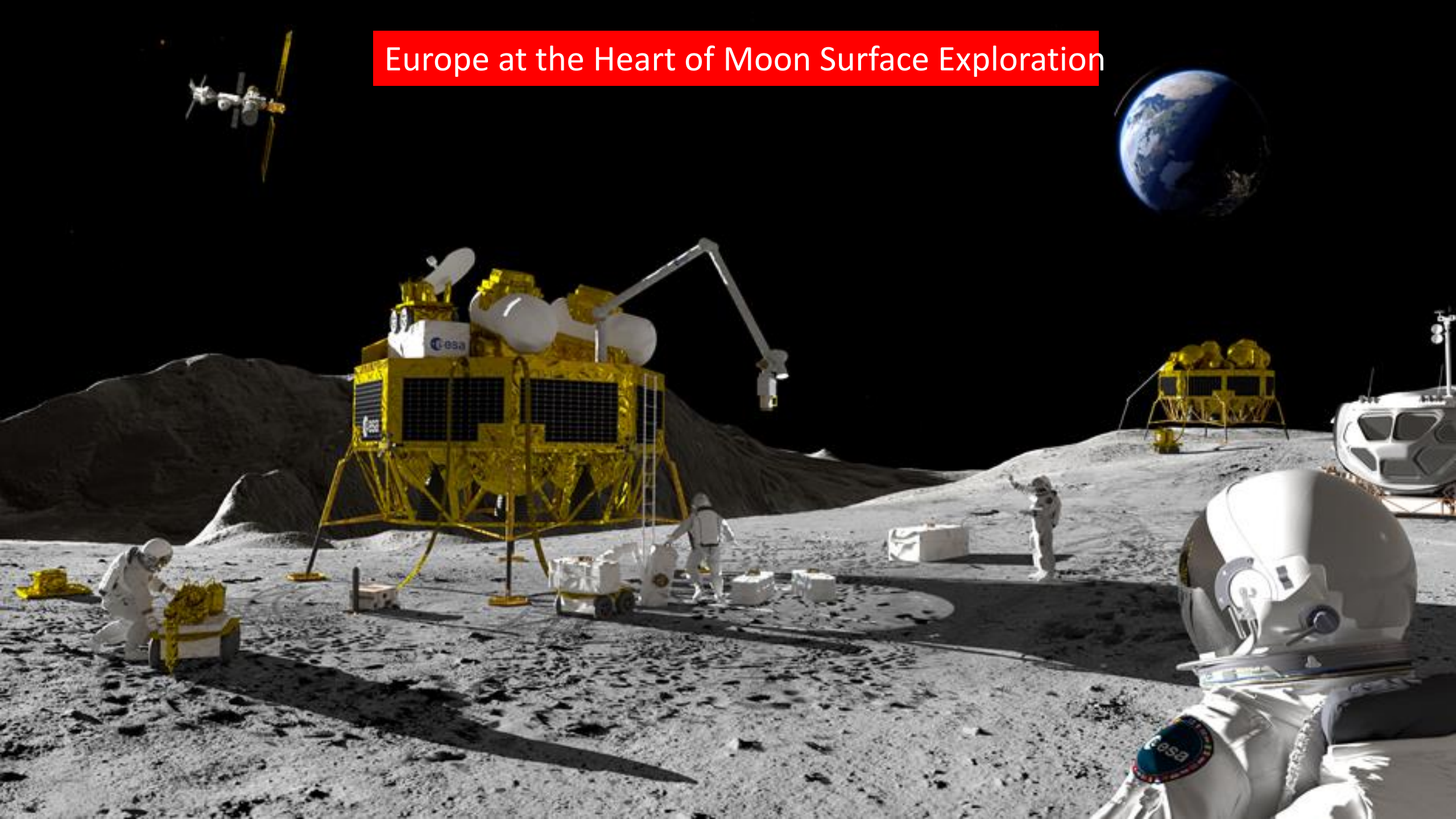
Artemis I	2022	ESM-1	Uncrewed flight test
Artemis II	2024	ESM-2	Crewed flight test
Gateway HALO	2025	ESPRIT HLCS	First Gateway launch
Artemis III	NET 2025	ESM-3	Moon landing
Artemis IV	2027	ESM-4 + I-HAB	ESA astronaut
Artemis V	2028	ESM-5 + ESPRIT ERM	ESA astronaut
Artemis VI	2029	ESM-6	...
...



Mission for 3rd ESA astronaut
TBD

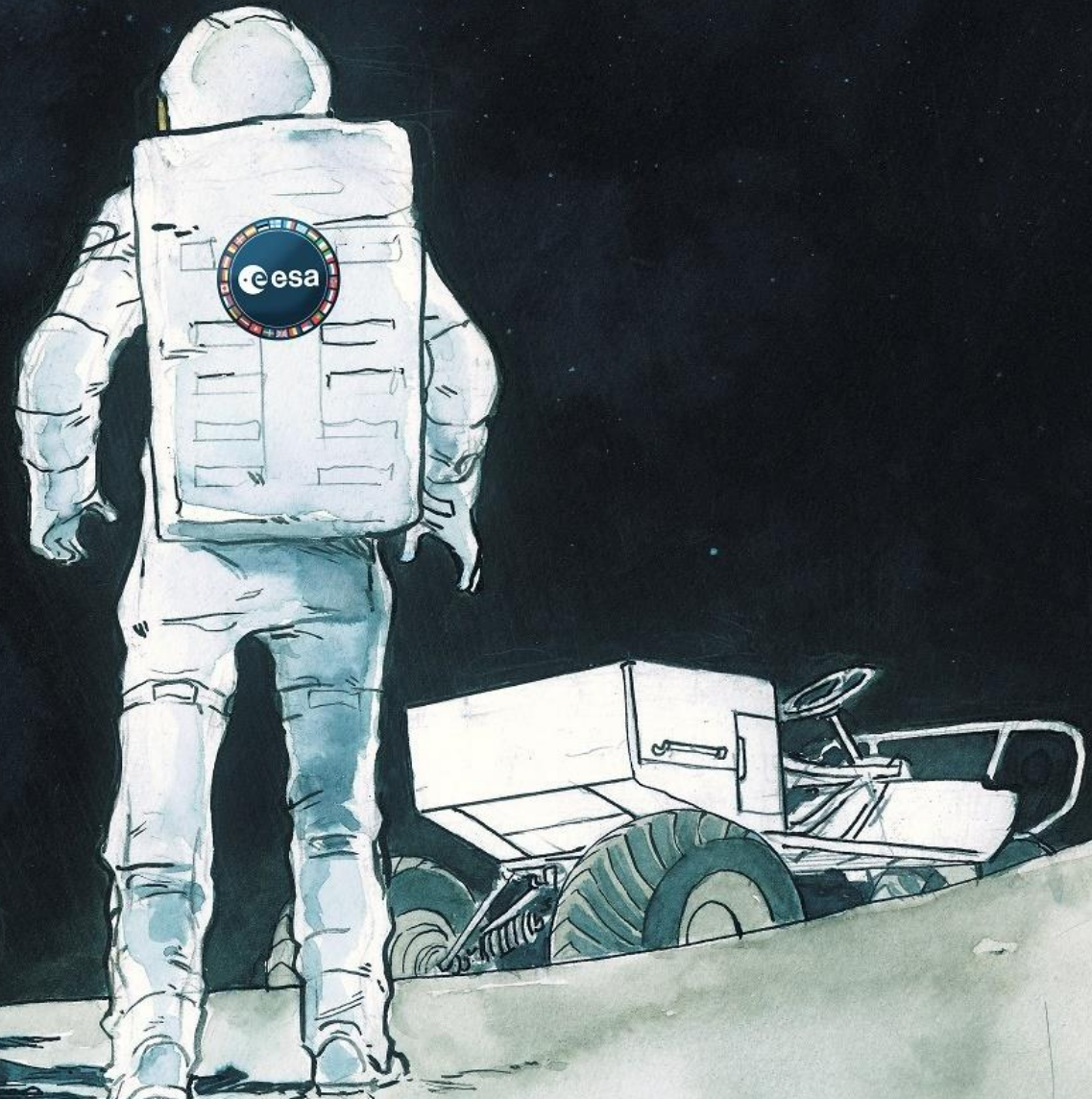


Europe at the Heart of Moon Surface Exploration

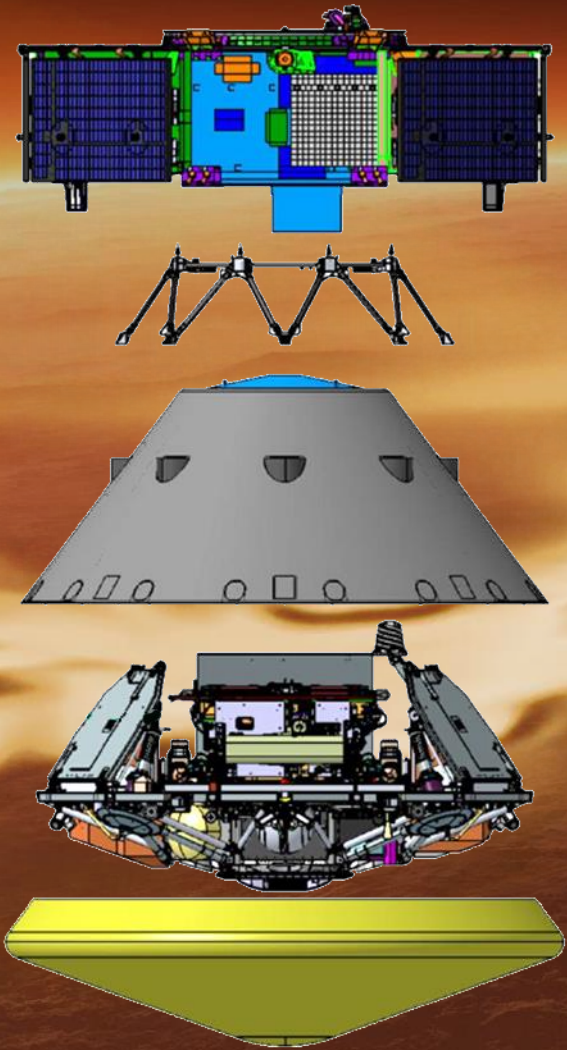


THE MOON

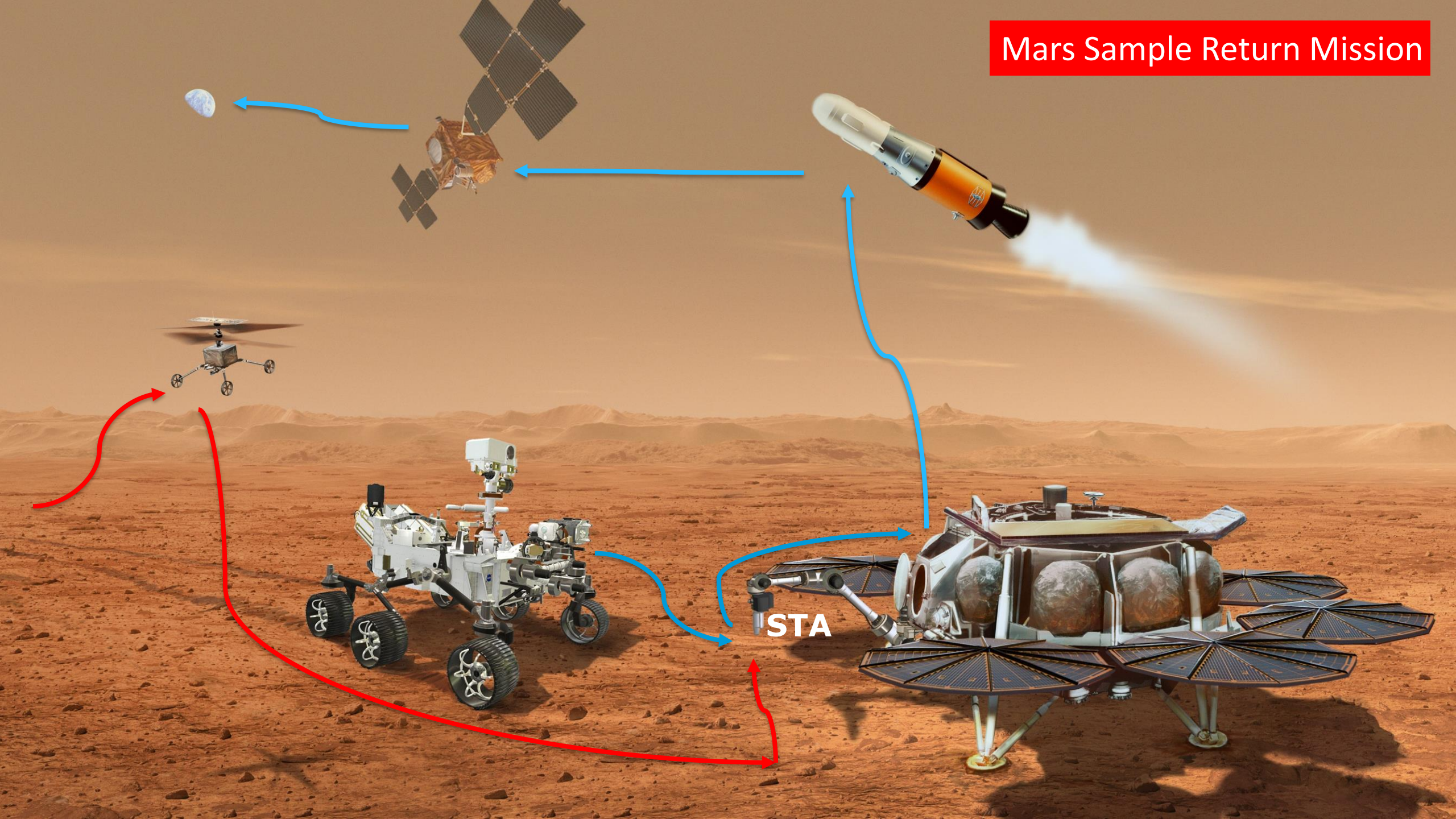
- Regular and substantial robotic access during the 2030s enabling European-led scientific and logistic activities.
- Reliable and visible partner for sustainable exploration of the Moon.
- First European on the surface before 2030 in the framework of Artemis.



ExoMars Rosalind Franklin rover mission



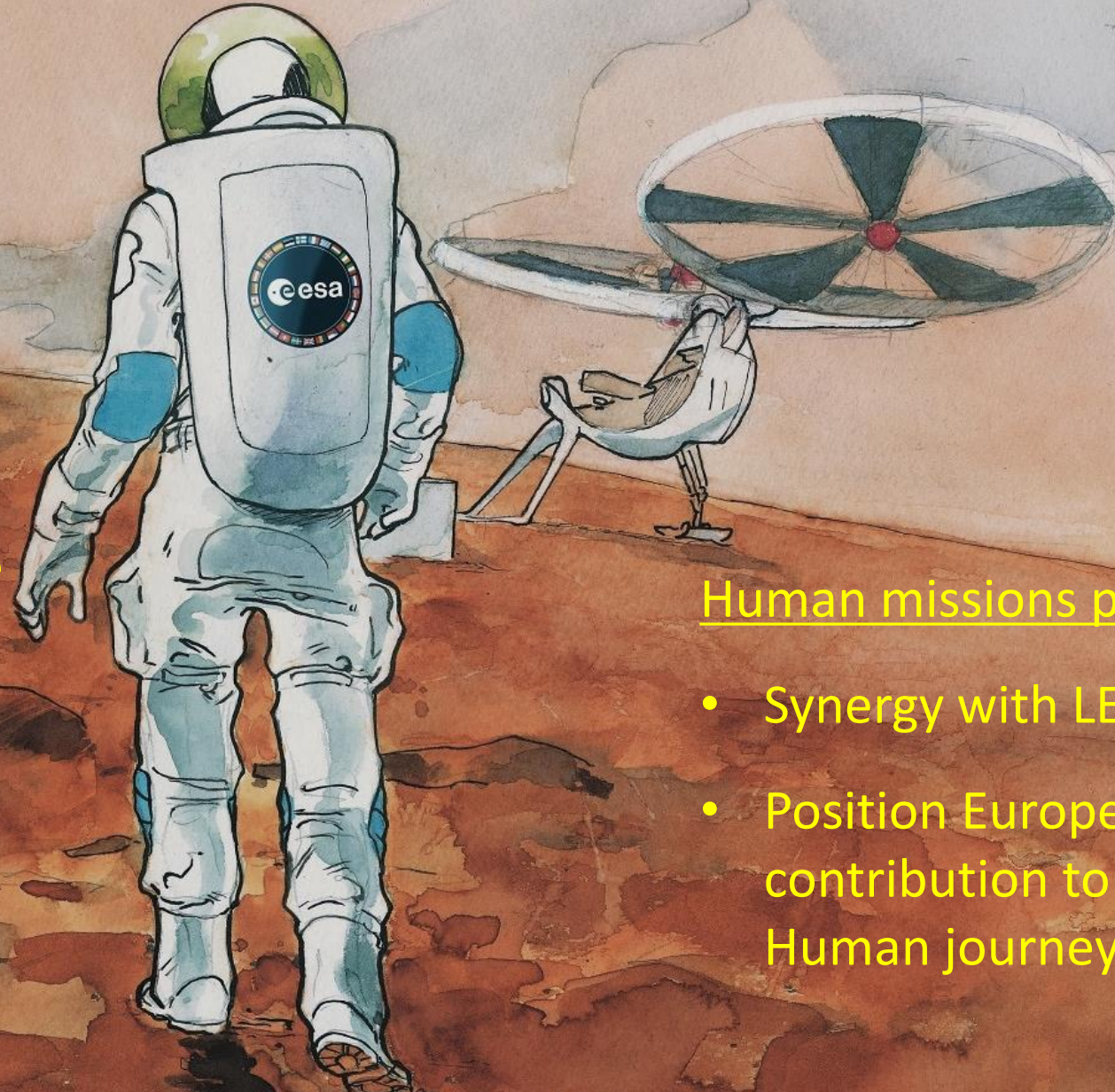
Mars Sample Return Mission



STA

Robotic missions

- Consolidate key capabilities to continue the search for life, and secure non-dependence of action at Mars.
- Option for campaign of small fast-track ESA-led missions.



Human missions preparation

- Synergy with LEO and Moon
- Position Europe for a strong contribution to the first Human journey in the 2040s.

2045...

Staying alive on another planet...



WITH CLEAR GOALS IN VIEW
European autonomy and strategic
resilience



Continuity

Continuous presence in **Low Earth Orbit**



Ambition

First European on the Moon by 2030

Vision

Europeans on **Mars** by the early 2040s

Inspiration

Autonomous crew transportation



Space public spending in US and Europe (2021)

US civil & military 55 B€

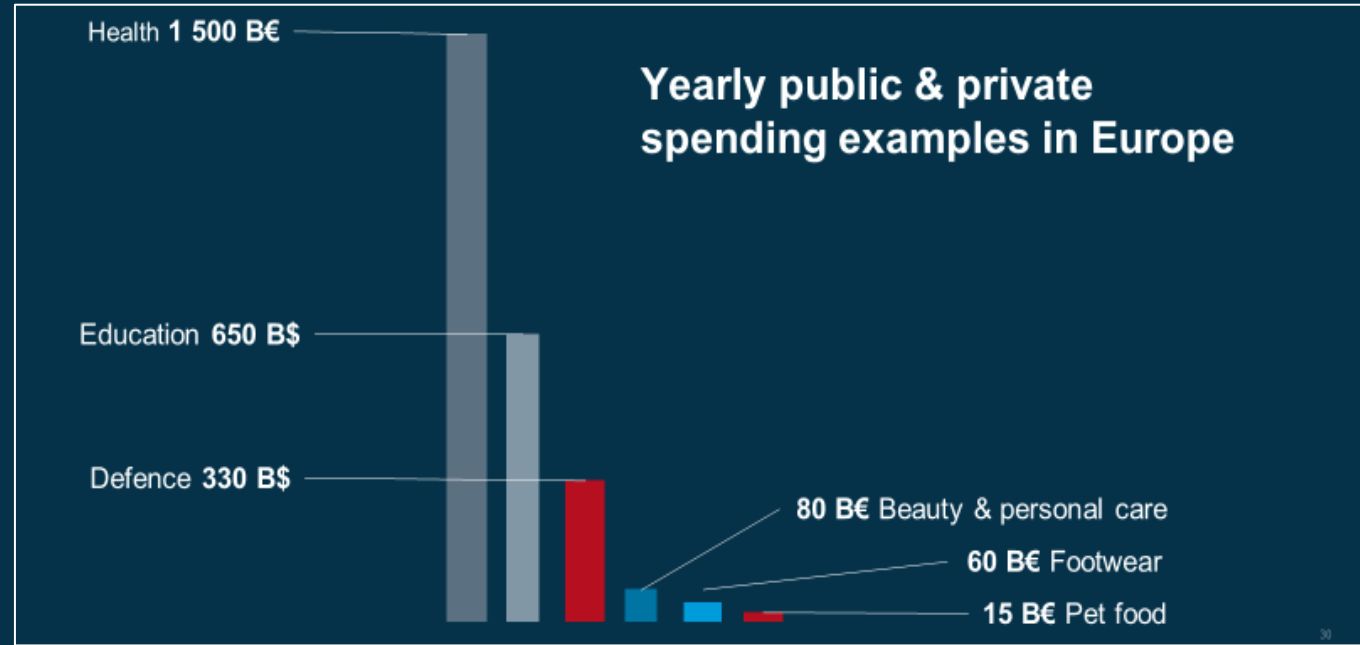
NASA 24 B\$

NASA exploration 13 B\$

12 B€ Europe civil & military

6.5 B€ ESA

0.7 B€ ESA exploration



1.0 \$ = 1.0 € (Oct 2022)



human and robotic exploration

TERRAE NOVAE PROGRAMME



Science & exploration



Europe's exploration vision

