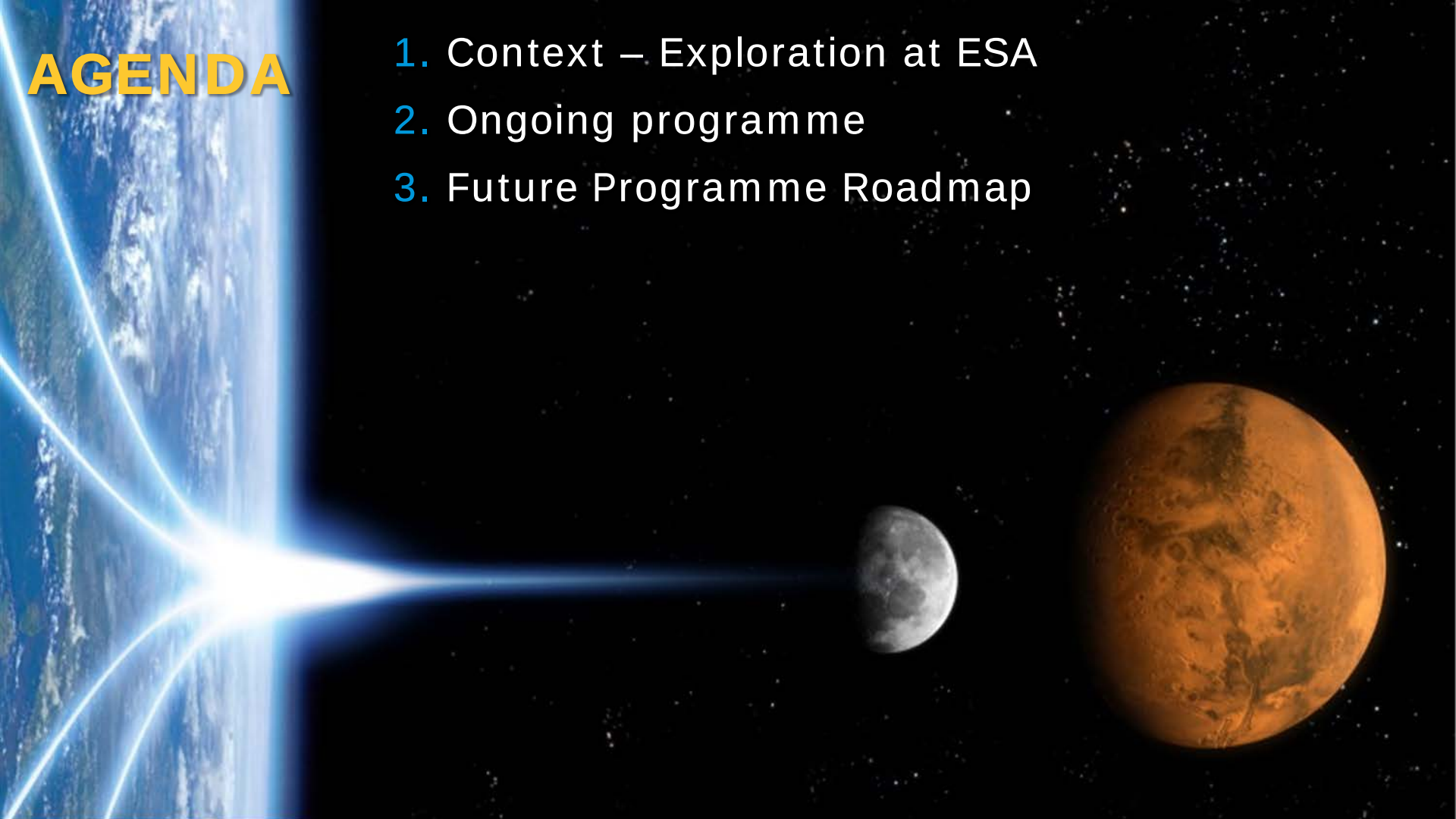
Status and Outlook for the European Exploration Envelope Programme

Dr David Parker – Director of Human and Robotic Exploration

SSB Space Science Week, 27 March 2018

AGENDA

1. Context – Exploration at ESA
2. Ongoing programme
3. Future Programme Roadmap



Exploration is Strategy-Driven

"focused on solar system destinations where humans will someday live and work."

Global Exploration Strategy Framework Document, 2007

ESA Scientific Programme

'bottom-up' + mandatory

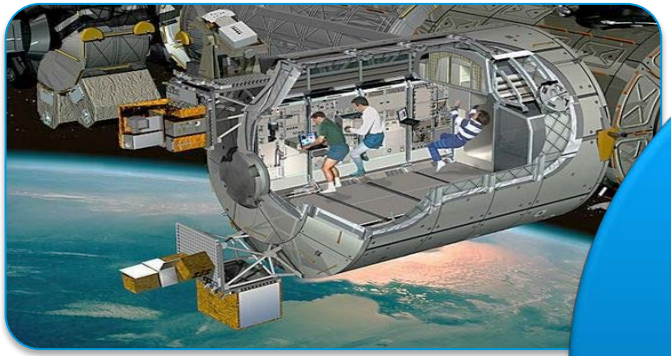
➢**competitive selection** among proposals from the science community in astrophysics, solar physics, planetary science etc.

ESA Exploration Programme

'top-down' + optional

➢**step-wise increase of complexity** to achieve the long-term goal of extending human reach to Mars surface

Why Explore ?

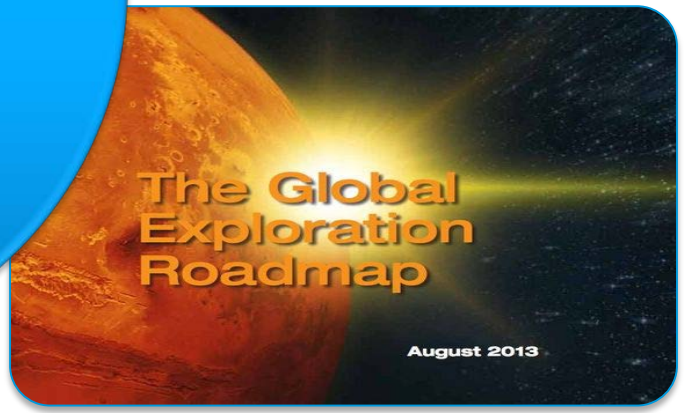


New knowledge

Challenge driven innovation

Inspiration

Global partners



ESA Exploration Envelope Programme (E3P)

Programme approved at ESA's 2016 Council meeting at ministerial level

- **Delivering the 2014 European Exploration Strategy**
- **Open-ended programme, integrating existing and new ESA exploration activities**
- **Humans and robots**
- **LEO, Moon, and Mars**
- **Internationally coordinated (Global Exploration Roadmap)**

2020 2030 2040

Global Exploration Roadmap V3

ON TO MARS

MARS SURFACE

MARS ORBIT

Robotic Mars Sample Return

Goal of Humans on the Martian Surface

Mars Transportation Capabilities

Mars Orbital Mission

TO THE MOON

LUNAR SURFACE

LUNAR ORBIT

Robotic Resource Prospecting Missions

IN LEO

EARTH ORBIT

Deep Space Gateway

Human Lunar Surface Exploration

Gateway Moon and Mars Mission Support Operations

Orion and SLS

Commercial Transportation Systems

Russian Crew Transportation System

International Space Station

China Space Station

Future Platforms

2. E3P PERIOD 1 STATUS

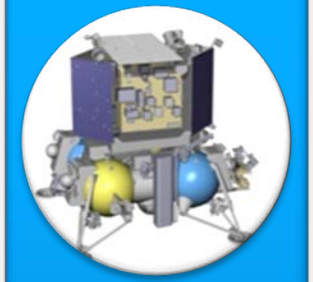
E3P First Period (2017-2019)

Europe aboard the ISS

World-class science in space

Propulsion & power for first 2 Orion missions

First Mars life-search rover



Taking Europe to lunar surface

Tomorrow's missions and tech

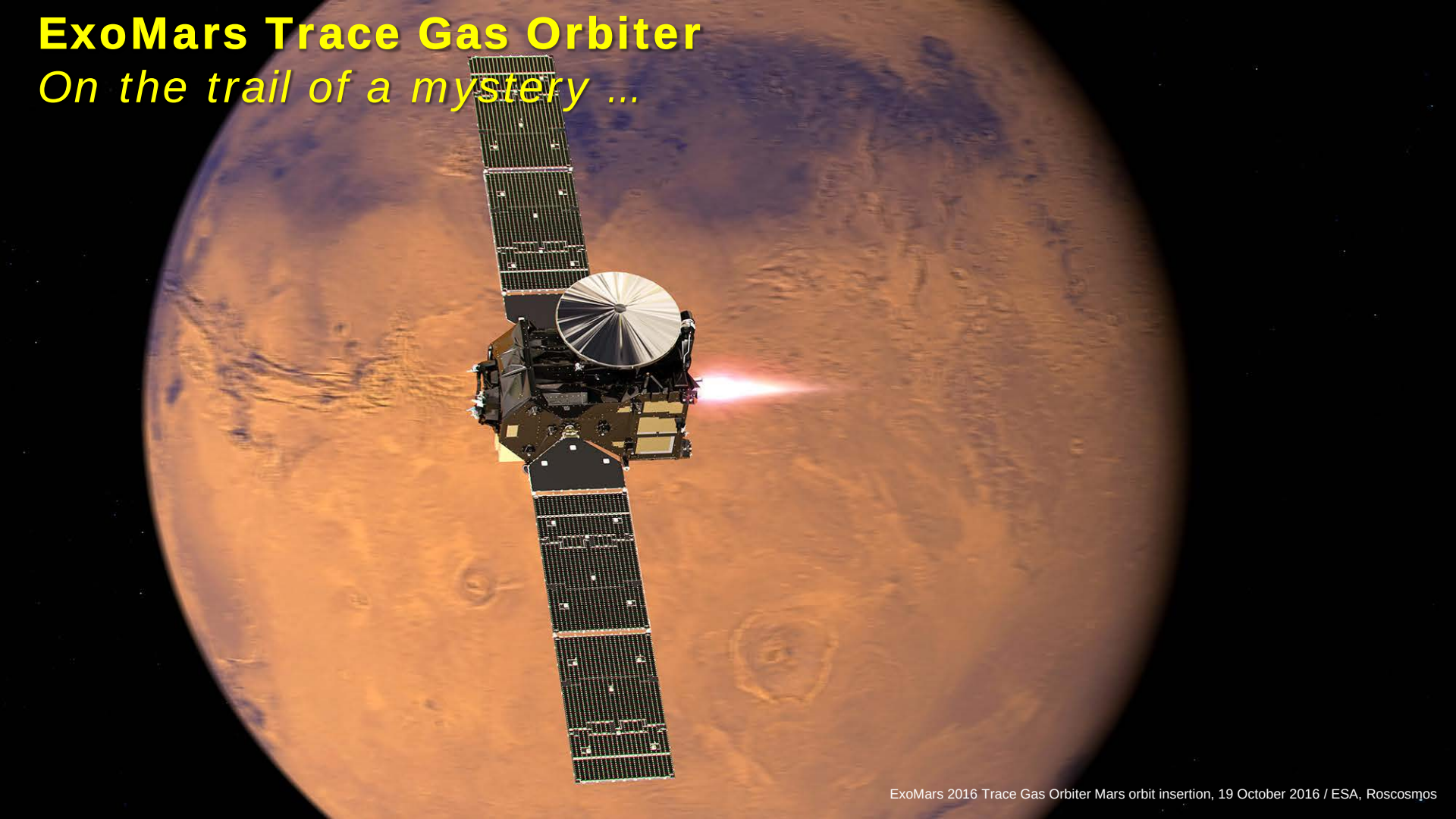
Increased synergy between robotic and human exploration

International Space Station / NASA, Roscosmos, ESA, JAXA, CSA

European Service Module for Orion

ExoMars Trace Gas Orbiter

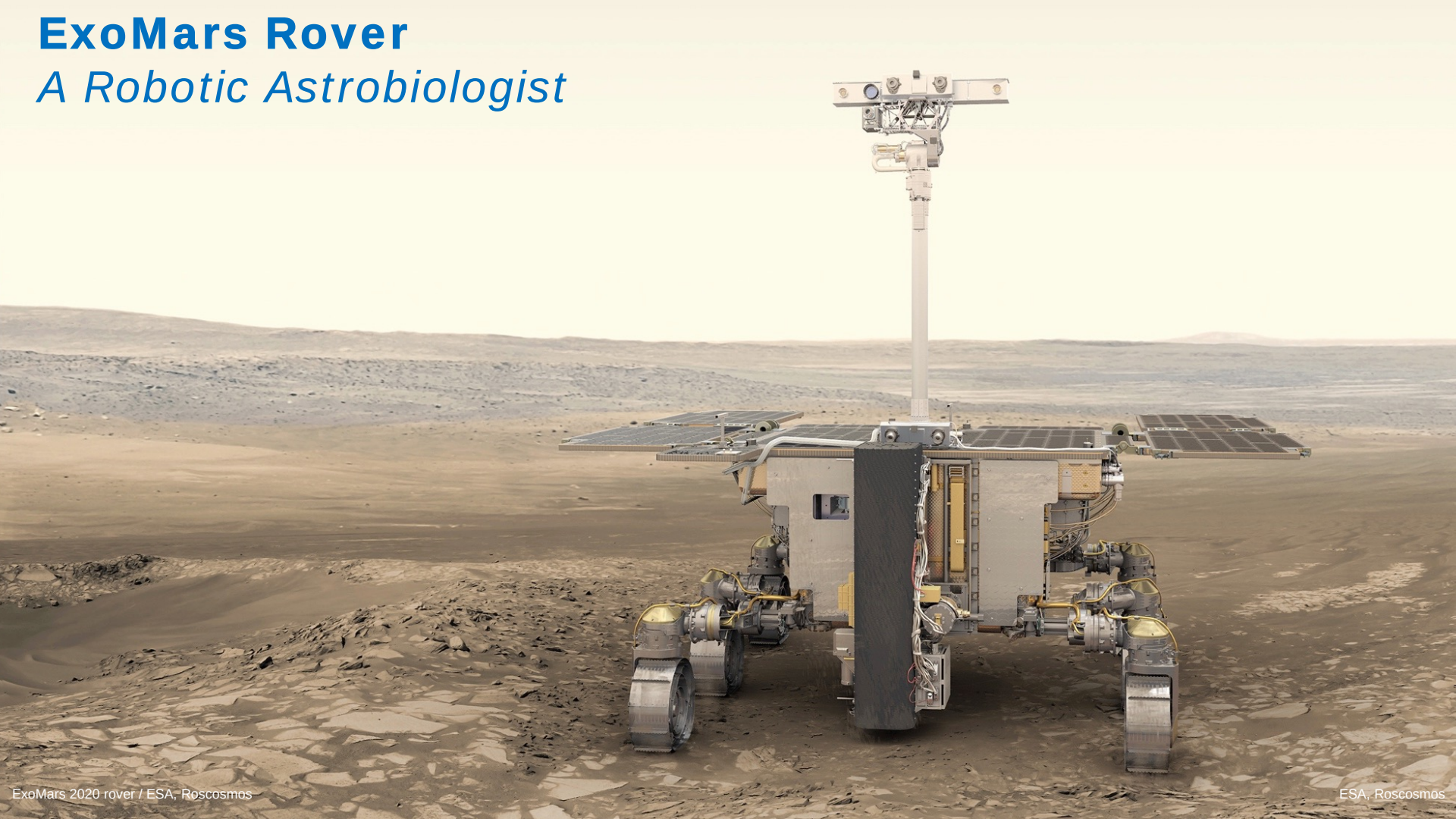
On the trail of a mystery …



ExoMars 2016 Trace Gas Orbiter Mars orbit insertion, 19 October 2016 / ESA, Roscosmos

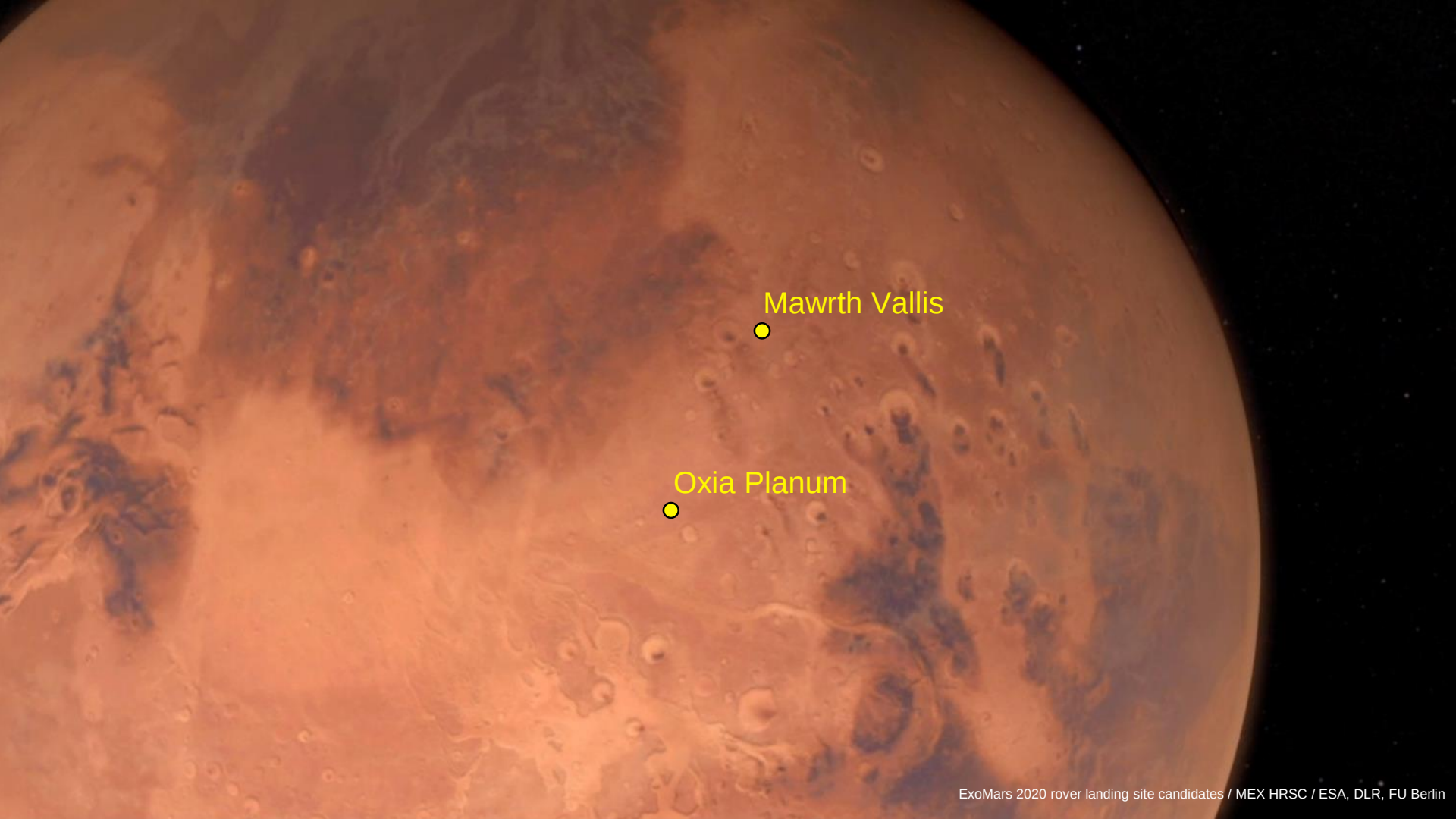
ExoMars Rover

A Robotic Astrobiologist

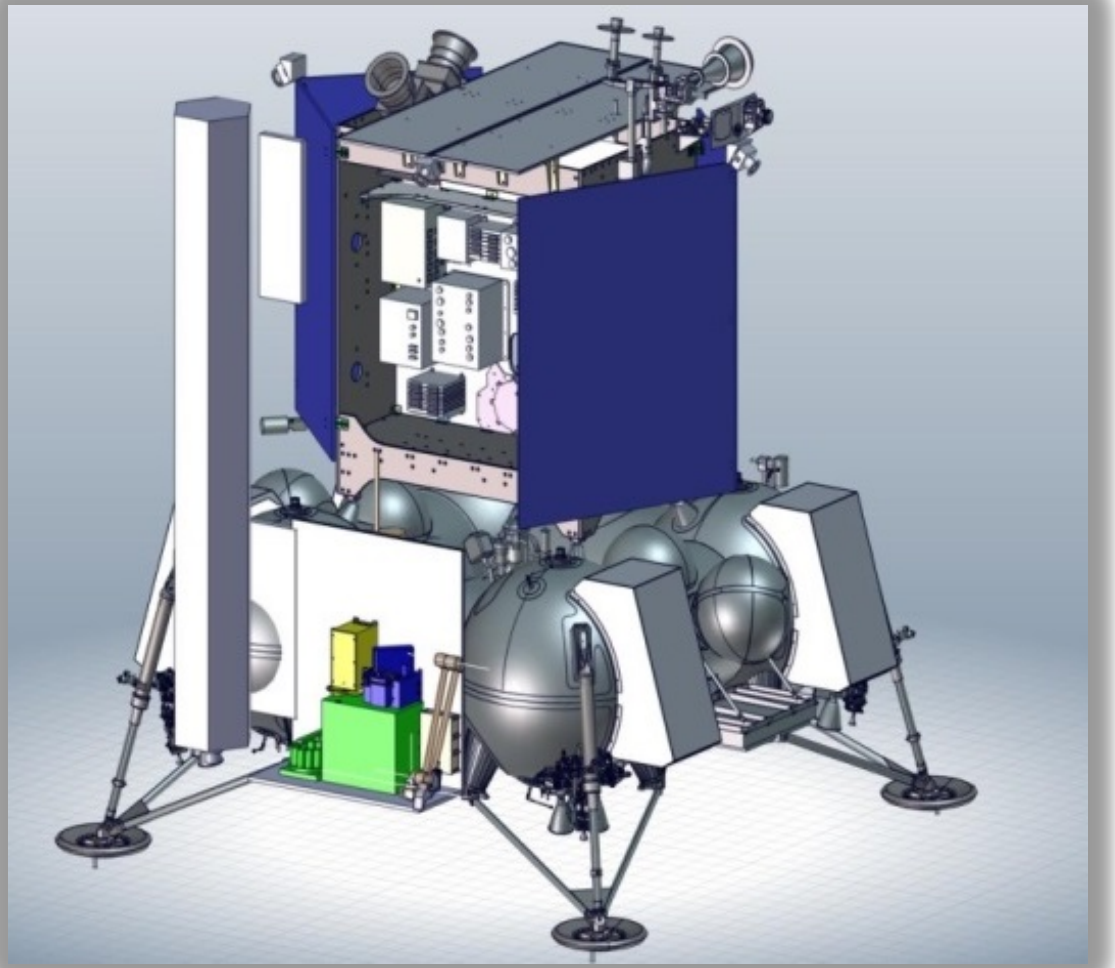


ExoMars 2020 rover / ESA, Roscosmos

ESA, Roscosmos



ExoMars 2020 rover landing site candidates / MEX HRSC / ESA, DLR, FU Berlin



Roscosmos / ESA Luna Resurs Lander

- European PILOT precision landing system
- PROSPECT drill and sample analysis system
- currently at PDR for 2023 launch

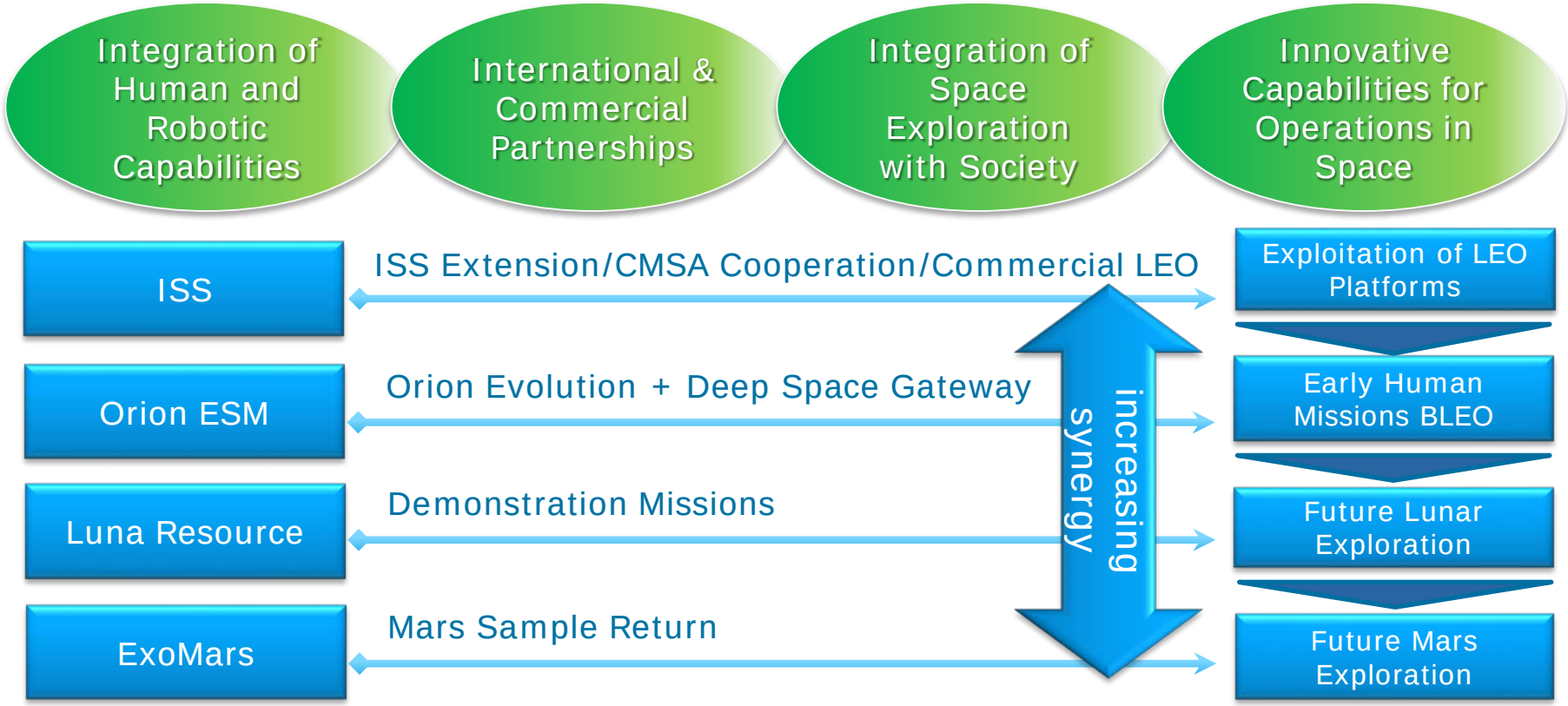
Exploration is changing

ESA's novel exploration business partnerships

- Small, quick payloads aboard ISS – ICECubes (SAS)
- PPP for exploration product – International Berthing and Docking Module (QinetiQ)
- External payload platform for ISS – Bartolomeo (Airbus)
- Transport to lunar orbit & telecoms relay (SSTL/Goonhilly)
- AO for Post-ISS LEO ideas
- Study of lunar ISRU technology demonstrator using commercial transportation services

3.
E3P FUTURE PROGRAMME - OVERVIEW

E3P Future Mission Roadmap Concept



Candidate E3P Elements up to 2030

CORNERSTONES

1. LEO **exploitation >2024** (ISS and transitioning to post-ISS commercial partnerships)
2. Early Human mission beyond LEO (**ESM + Deep Space Gateway**)
3. Sample return (Moon, Phobos, **Mars**)
4. Long term lunar surface exploration, initiated with **robotic precursor mission**

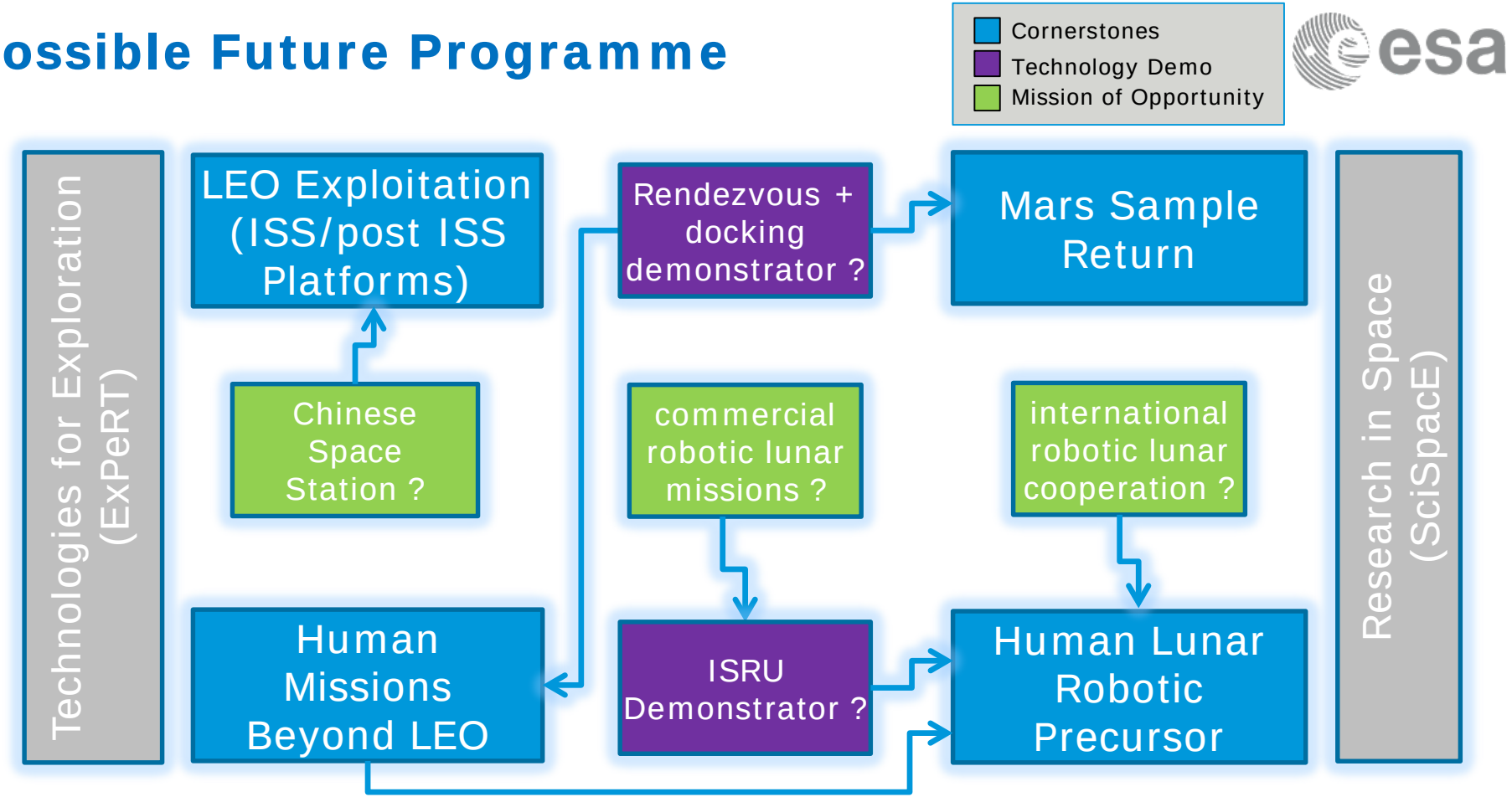
TECHNOLOGY DEMONSTRATORS

1. rendezvous/docking demonstrator
2. ISRU demonstrator

MISSIONS OF OPPORTUNITY

1. Possible Cooperation with CMSA on Chinese Space Station (CSS) ?
2. Commercialised lunar missions (communication, logistic services) ?
3. Cooperation with international partners - robotic lunar exploration ?

Possible Future Programme



Gateway: ESA call for utilisation ideas in 2017

- 100 inputs from European science community
  - Astronomy – 12
  - Earth Sciences – 2
  - Life Sciences - 35
  - Physical Sciences – 11
  - Solar System Sciences - 25
  - Other – 15
- **Workshop at ESA-ESTEC & summary report**
- Integrate with NASA science definition in 2018

MSR Science Definition

International science consultation mandated by IMEWG

- ✓ What science is deliverable
- ✓ Science interests and dependencies
- ✓ Workshop in early 2018

Reports at 2nd International MSR conference:

- Berlin **24-27 April 2018**


Low
Earth
Orbit
Moon
Mars
esa
Thank you
http://youbenefit.spaceflight.esa.int/
we explore. you benefit.
Human Spaceflight and Robotic Exploration