The Space Congress® Proceedings

2016 (44th) The Journey: Further Exploration for Universal Opportunities

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OHB Human Space Flight, Exploration, Science Projects

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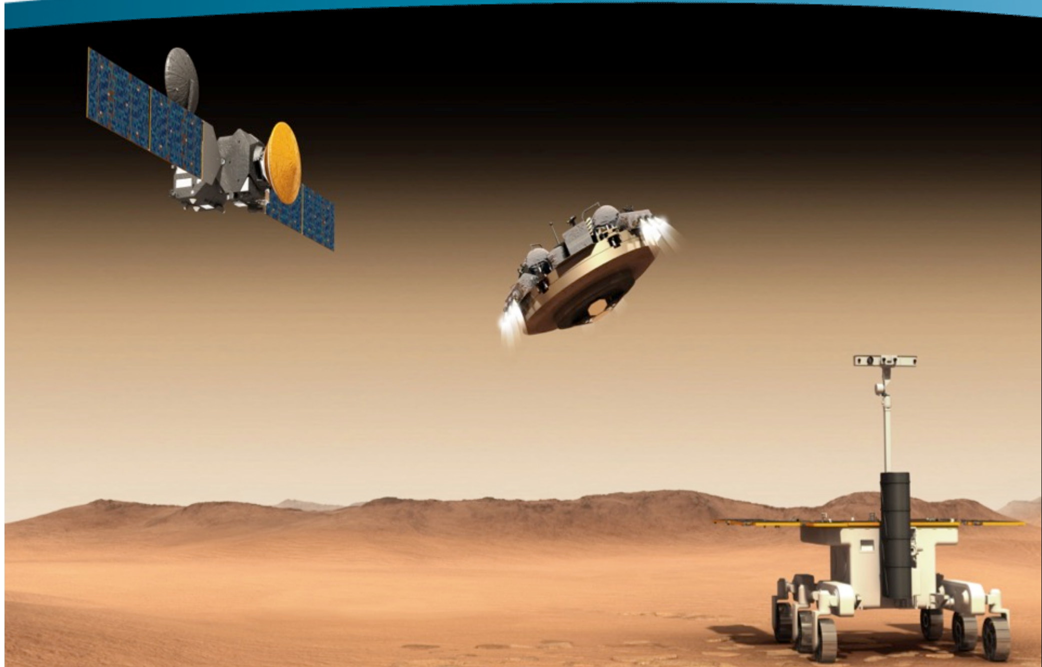
OHB System, Bremen

OHB System AG
25.05.2016



SPACE SYSTEMS

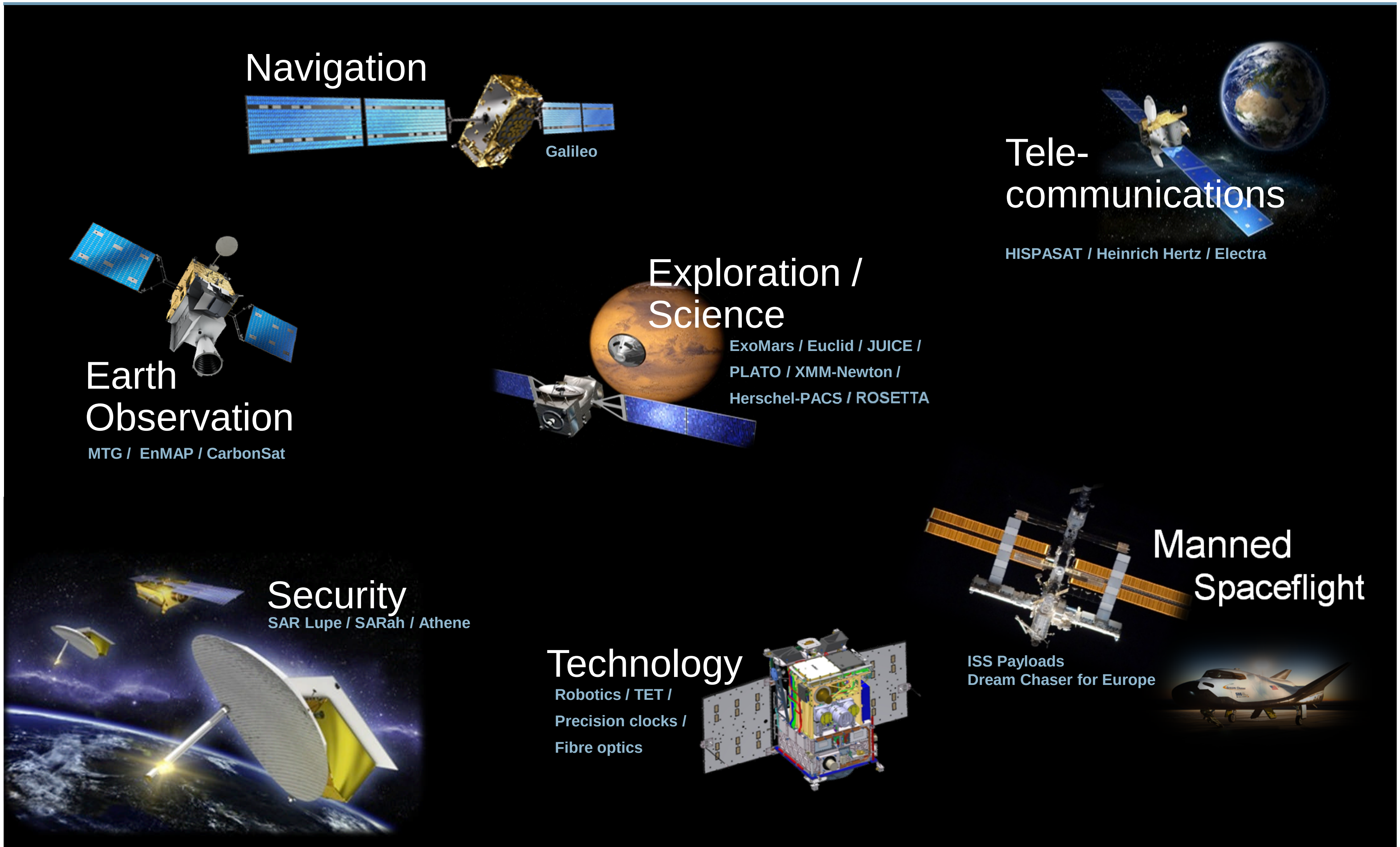
OHB Human Space Flight, Exploration, Science Projects

The 44th Space Congress, Cape Canaveral, Florida

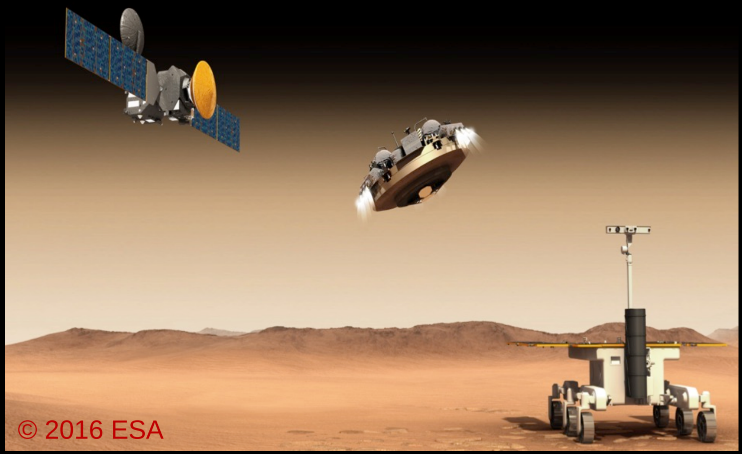
We. Create. Space.

Bremen City of Space – Hometown of OHB System

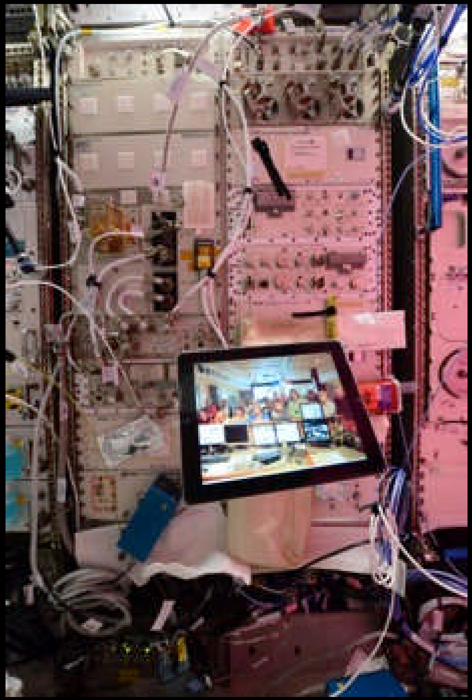
Scope of Activities



Three OHB Activities in the area of Space Exploration, HSF and Science



ExoMars 2016 & 2020



ISS payload development and Utilization

European access to LEO

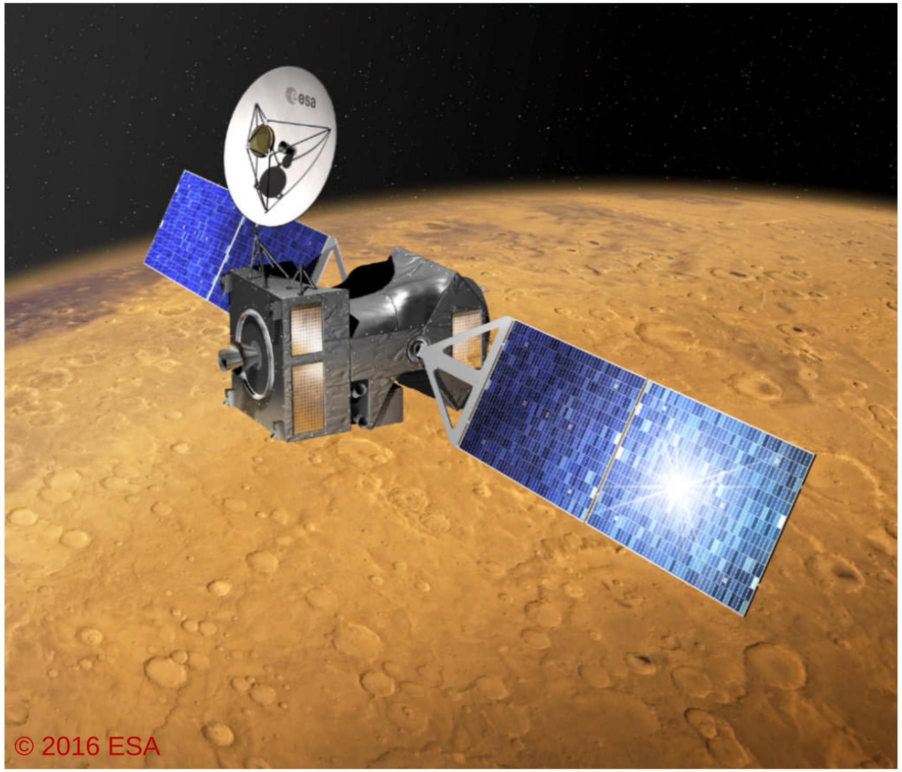
Two missions– one programme

Two missions are foreseen within the ExoMars programme:

- one consisting of the Trace Gas Orbiter (TGO) plus the Entry, Descent and Landing Demonstrator Module (Schiaparelli), successfully launched in March 2016
- one featuring the Rover, transported to Mars by the Carrier Module, with a planned launch is in 2020

Trace Gas Orbiter

- Integral part of the ExoMars programme and the TGO Core Module is the major German contribution to ExoMars 2016.
- The Trace Gas Orbiter performs various tasks in the ExoMars programme:
  - Carrier to Mars for the landing module of the 2016 mission
  - Communication with the landing module of the 2016 mission
  - Search for trace gases, the information on the biological and geological processes
  - Communication with the Rover 2020 Mission



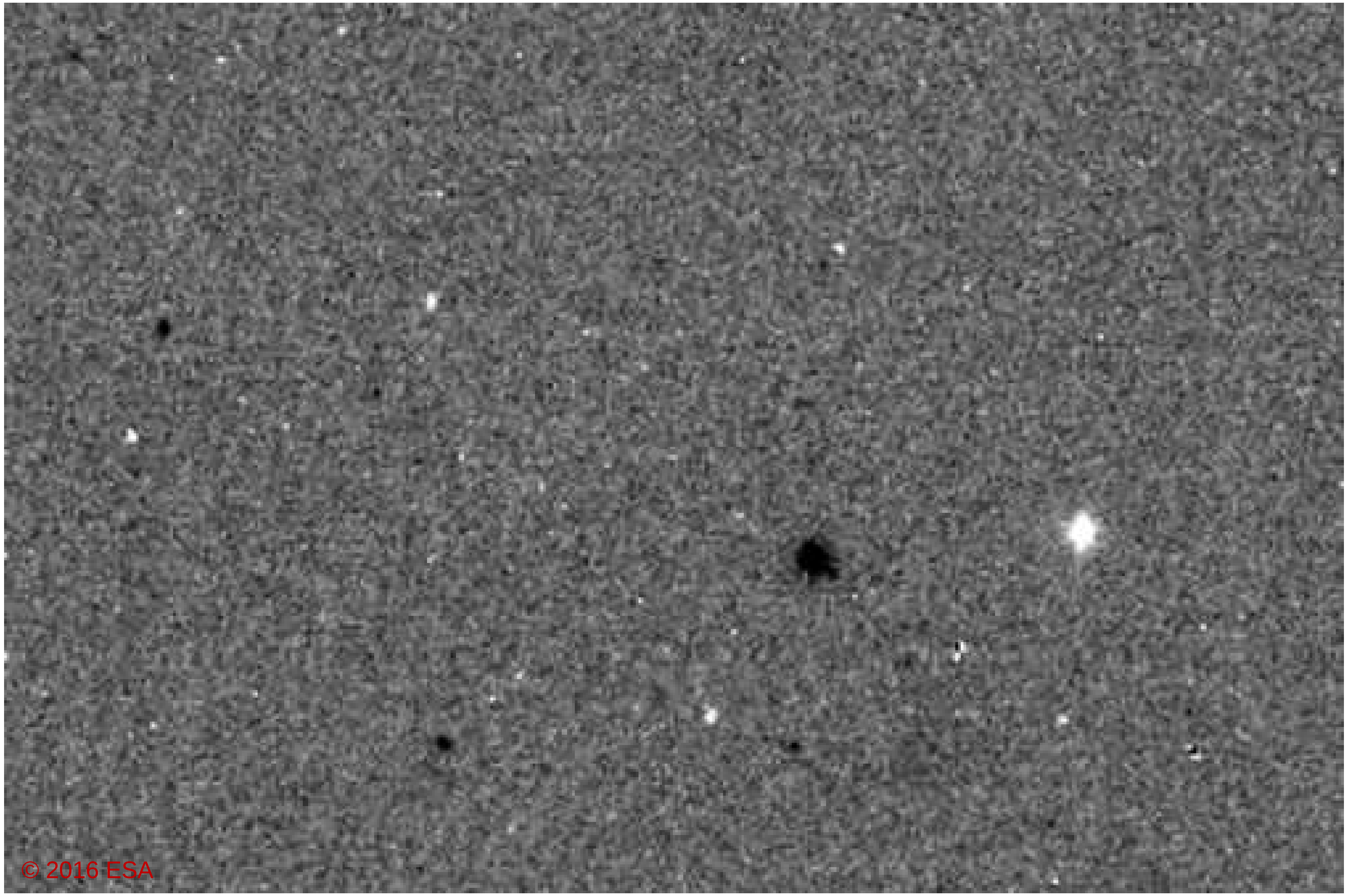
ExoMars Mission 2016 TGO contributions by OHB

- OHB is core team partner to the Prime TAS-F
- Design, procurement and AIT of Mechanical-Thermal-Propulsion System incl. Harness
  - CFRP central tube (Airbus DS Spain)
  - CFRP & Al structure panels (Invent GmbH)
  - Bi-propellant propulsion system (Airbus DS Germany)
  - Multi-Layer-Insulation (RUAG Space Austria)
- Development philosophy for ExoMars:
  - „Design-to-cost“:
    Development of a robust system based on qualified components and processes
  - „Design-to-time“:
    Robust design, tailored model philosophy

ExoMars 2016 Mission Phases Overview

Launch	14 March 2016
Schiaparelli – Trace Gas Orbiter separation	16 October 2016
Trace Gas Orbiter insertion into Mars orbit	19 October 2016
Schiaparelli enters Martian atmosphere and lands on the target site	19 October 2016
Schiaparelli science operations	19 October - 23 October 2016 (to be confirmed)
Trace Gas Orbiter changes inclination to science orbit (74°)	December 2016
Apocentre reduction manoeuvres (from the initial 4-sol orbit to a 1-sol orbit)	December 2016
Aerobraking phase (Trace Gas Orbiter lowers its altitude to 400 km orbit)	January 2017 - December 2017
Trace Gas Orbiter science operations begin. (In parallel, TGO will start data relay operations to support NASA landers on Mars.)	December 2017
Superior solar conjunction (critical operations are paused while the Sun is between Earth and Mars)	11 July - 11 August 2017
Start of the Trace Gas Orbiter data relay operations to support communications for the rover mission and for the surface science platform	2020
End of Trace Gas Orbiter mission	December 2022

ExoMars 2016 Spacecraft works flawlessly until today

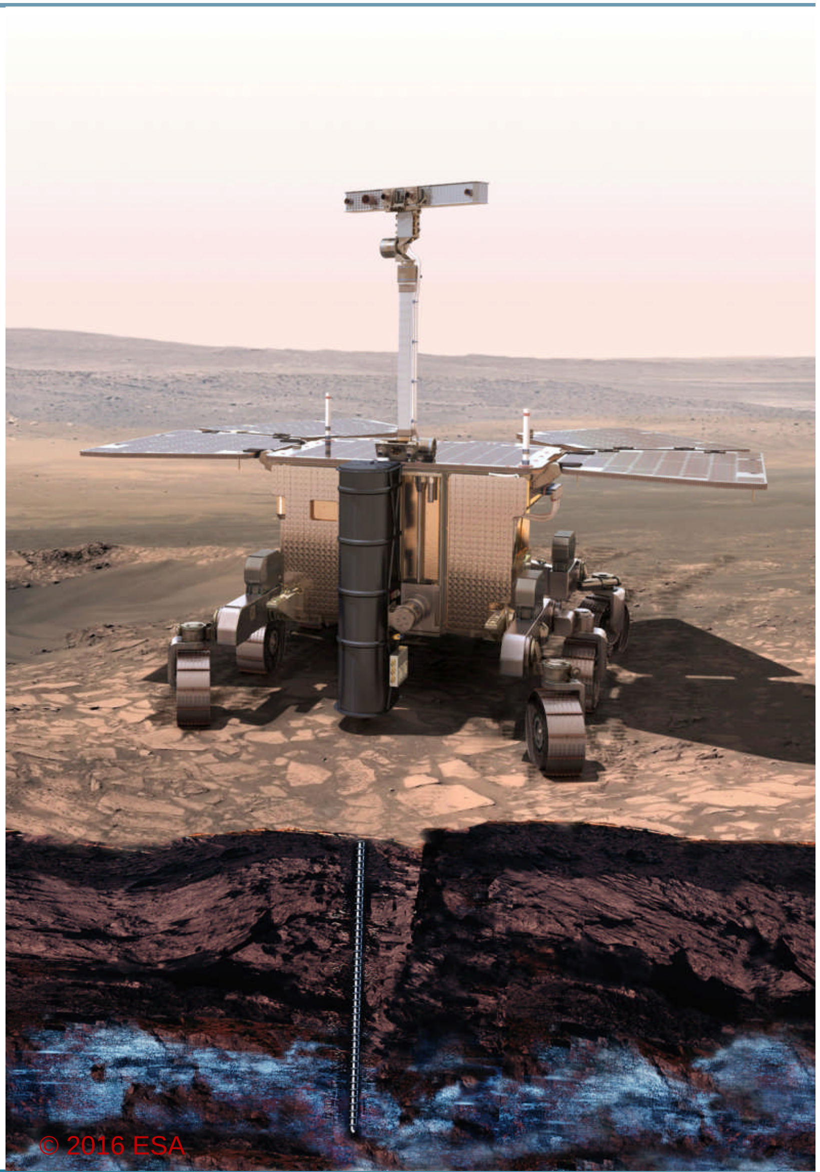


First picture sent by the spacecraft (ESA/Roscosmos/CaSSIS)

OHB contributions for the Rover

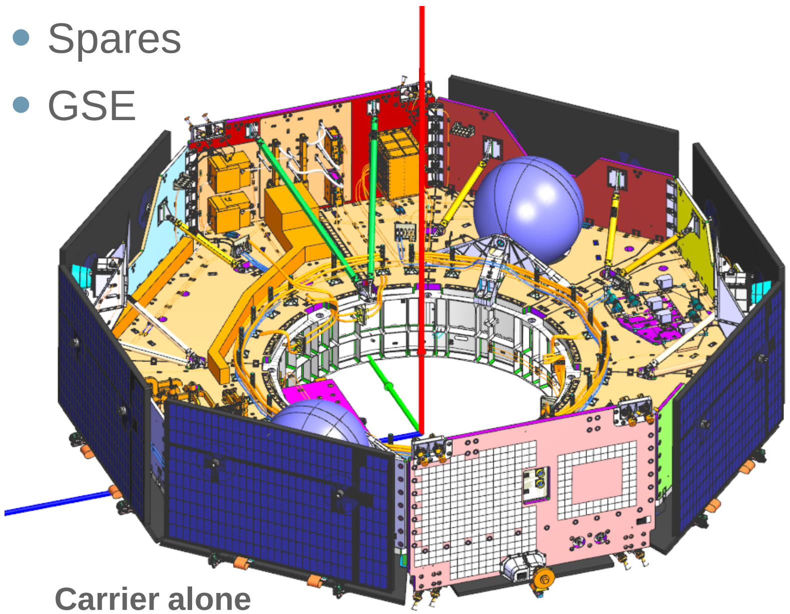
OHB plays a major role in finding, processing, distribution and analysis of Mars samples:

- Search: High-Resolution Camera (HRC) for maneuver on Mars and the search for suitable sites for drilling (DLR project)
- Sample preparation & distribution: Sample Preparation & Distribution System (SPDS) and structure of the Analytical Laboratory Drawer (ESA project)
- Analysis: contributions in the Raman Laser Spectrometer (Pasteur payload) with Optical Fiber Harness and Support for Internal Optical Head (DLR project)

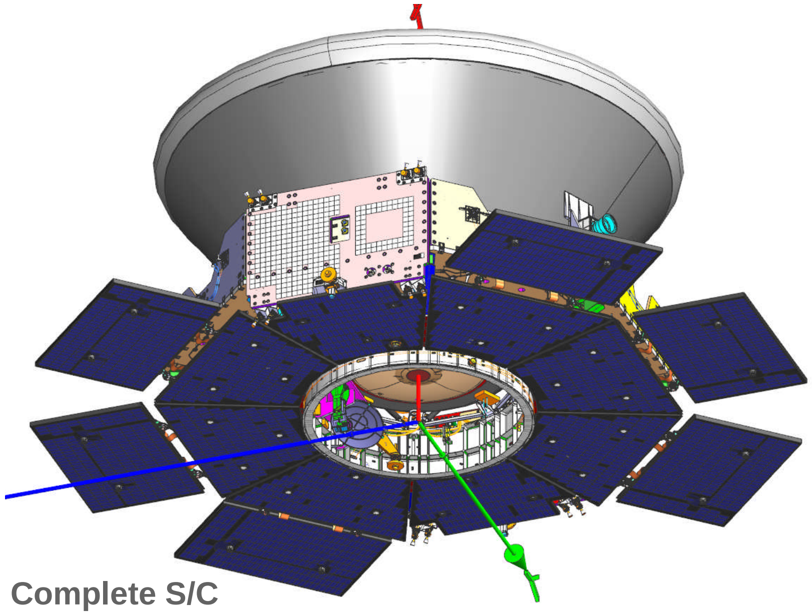


Carrier for the 2020 Mission

- OHB is core team partner to the Prime TAS-I
- Antwerp Space delivers the communication system for the Carrier
- OHB deliveries:
  - Structure Model
  - Avionics Test Bench
  - Proto-Flight Model
  - Spares
  - GSE



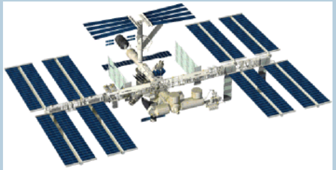
Carrier alone



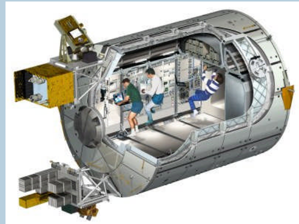
Complete S/C

Human Spaceflight Activities

ISS: Infrastructure, Facility and Experiment Development

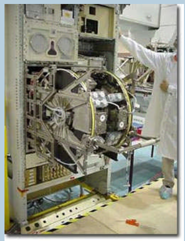


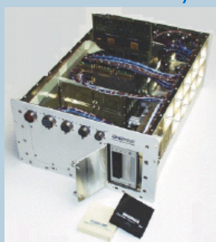
The OHB ISS Team
provides
engineering, integration & operations support
for the
Columbus payloads developed by OHB



Engineering

- EPM FM, GM1, GM2, Training model
- Sustaining Eng. for S/Ss in other facilities (Biolab, EMCS, FSL, EDR)



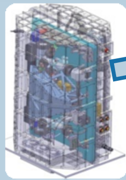


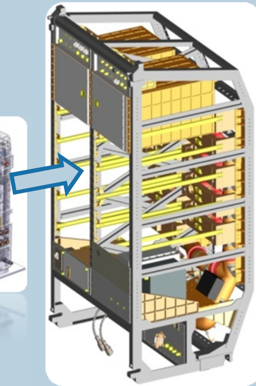
Operations

- Support of Ops preparation & In-crement integration
- on-orbit operations
- Inputs for Crew procedure development

Integration

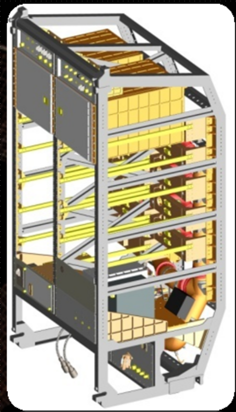
- Integration of new experiments in EPM
- Analytical /physical integration, test & verification





European Physiology Model (EPM) ops support

The EPM has been widely used since its commissioning in Columbus. It has supported more than 100 sessions of 14 different experiments and is planned to be extensively used in future.
Due its high modularity & flexibility EPM could be adapted to many different experiment needs, expansion of EPM research fields to physics as well and integration of extra-large containers.



Human Physiology Experiments:
CARD (8 subjects btw 2009 and 2012)
NEUROSPAT (5 subjects btw 2009 and 2013)
PASSAGES (10 subjects btw 2009 and 2012)
SOLO (8 subjects btw 2009 and 2012)
ICV (12 subjects btw 2009 and 2013)
BISE (4 subjects btw 2009 and 2010)
ENERGY (9 subjects btw 2011 and 2013)
CIRCADIAN RHYTHMS (8 sbjcts. btw 2013 and 2017)*
VASCULAR ECHO (8 subjects btw 2016 and 2018)*
Fundamental research and exercise systems
FLYWHEEL (October 2009)
MARES (January 2013 unit present)
DOSIS (22 data D/Ls between 2009 and 2011)
DOSIS 3D: (46 data D/Ls from 2012 until today)
PK4 (2015 to 2018, 3 sessions per year) *tbc

Images credits: NASA

Dream Chaser® for ISS Cargo Missions

NASA Program for Cargo missions to ISS 2019-2024 – CRS2

- Contract Award: Jan 2016
- 3 Awards: SNC, SpaceX, Orbital ATK
- Flight Rate: 4-5 missions per year
- Minimum Award: 6 Missions/company

ESA Strategic Partnership Idea: Dream Chaser® for European Utilization

→ PARTNERS FOR SPACE EXPLORATION

- March 2015: ESA Call For Ideas (CFI) for strategic partnerships with the private sector in the field of Space Exploration
- Mai 2015: DC4EU Partnership Proposal
- Feb 2016: DC4EU selected as one of eight 8 Partnership Topics
- May 2016 – February 2017: DC4EU Pilot Phase

SIERRA NEVADA CORPORATION Space Systems

Telespazio A Finmeccanica/Thales Company

Dream Chaser® for European Utilization

Objectives of the partnership idea

The primary objective is to provide affordable, reliable, and flexible space services for autonomous European access to low Earth orbit (LEO). DC4EU delivers best value for Europe providing a full end-to-end mission concept using the unique capabilities of the Dream Chaser® Space Utility Vehicle, compatibility with European Ariane Launcher System, and landing on suitable runways in Europe for a prompt payload access.

What is this enabling and innovative partnership idea about?

- Independent European access to LEO space using Dream Chaser®
- Uncrewed autonomous European LEO service missions using European assets and infrastructure (e.g. launcher system, ground infrastructure, communication system)
- Use of the Dream Chaser® free flight platform for multiple missions: Scientific research, technology and operational demos (e.g. on-orbit assembly, repair, active debris removal)

THANK YOU FOR YOUR ATTENTION