Status of ESA's Mars Activities

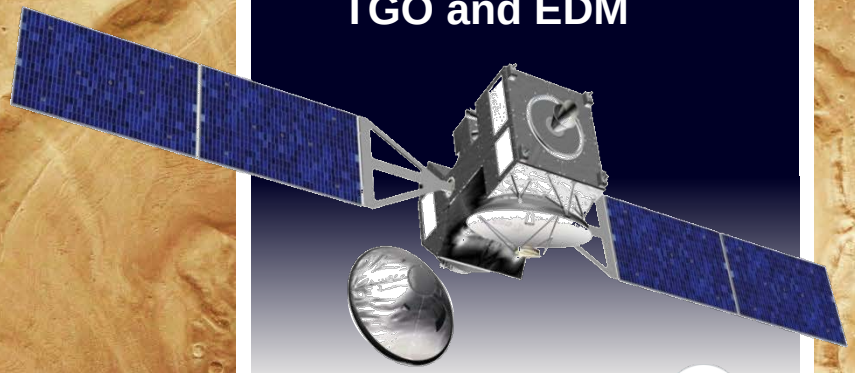
MEPAG meeting

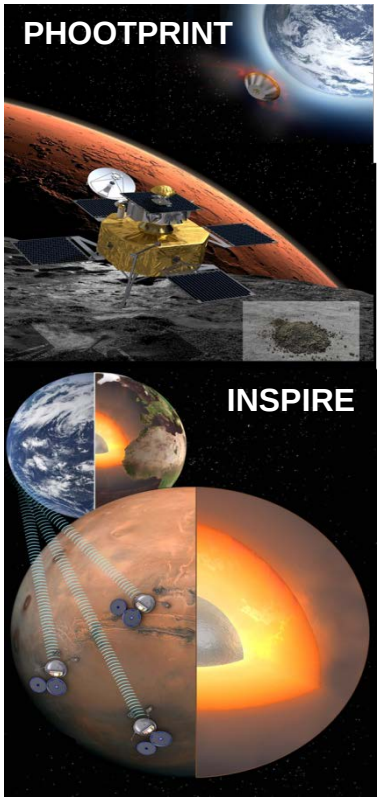
Monrovia CA, 24-25 February 2015

Rolf de Groot
European Space Agency
Head of Robotic Exploration Coordination Office
Science and Robotic Exploration Directorate

NOTE ADDED BY JPL WEBMASTER: This content has not been approved or adopted by, NASA, JPL, or the California Institute of Technology. This document is being made available for information purposes only, and any views and opinions expressed herein do not necessarily state or reflect those of NASA, JPL, or the California Institute of Technology.

Mars Exploration at ESA





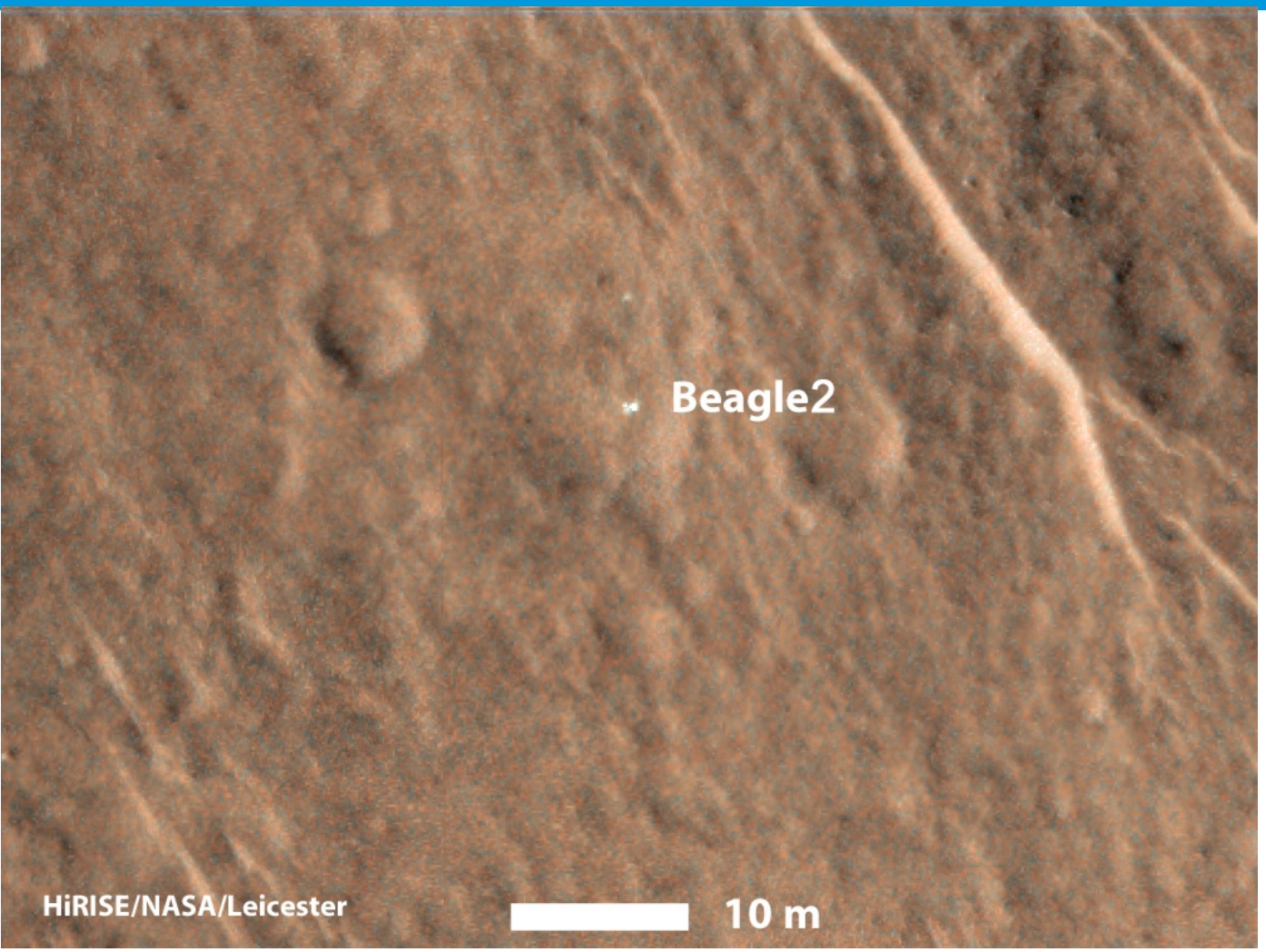
2003 → 2030+

Mars Express Mission: Status and recent activities

- Status:
  - Spacecraft and payload status: very good
  - Fuel estimates enough for several more years.
  - Mission extension: until end of 2016, conditional to end of 2018.
- Recent events and activities
  - 19 October 2014: Siding Spring comet flyby (distance ~ 135,000 km)
    - Very strong enhancement of electron density in the ionosphere at about 100 km altitude observed by MARSIS after the flyby.
  - Good progress in construction of a Digital Terrain Model, DTM, based on HRSC stereo images combined with MOLA laser altimeter data.
  - The Beagle2 lander carried by Mars Express has been identified in HiRise images of Isidis Planitia. Beagle 2 landed on 25th December 2003, but no signal was ever received. The new finding reveals that the entry, descent and landing seems to have worked but that the deployment of the solar panels may not have worked properly and that therefore the radio antenna was blocked.

Mars Express Mission: Future activities

- Near future activities (2015)
  - Coordinated measurements with the NASA MAVEN mission. Scientific objective: study of the plasma environment and atmospheric escape.
  - 12 March: Close Phobos flyby (61 km from center)
  - 14 June: Mars Solar Conjunction
- Following Year(s) activities
  - October 2016: Mars Express relays data from the ExoMars entry and descent module

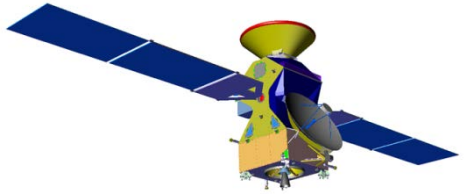

Beagle2
HiRISE/NASA/Leicester
10 m

ExoMars Programme in cooperation with Roscosmos: ESA's flagship mission in Robotic Exploration

2016 Mission

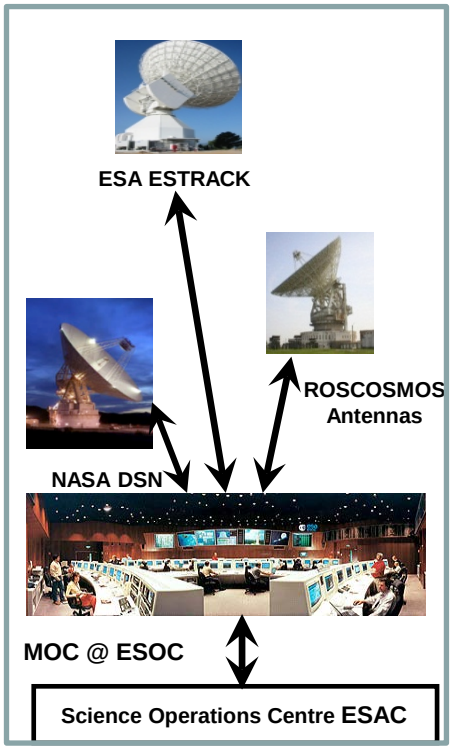
Proton M/Breeze M

Trace Gas Orbiter (TGO)



EDL Demonstrator Module (EDM - Schiaparelli)

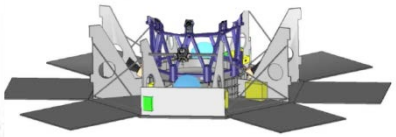
And



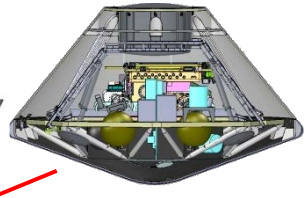
2018 Mission

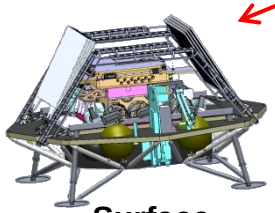
Proton M/Breeze M

Carrier Module (CM)



Descent Module (DM)





Surface Platform

Rover

LPOCC

ROCC

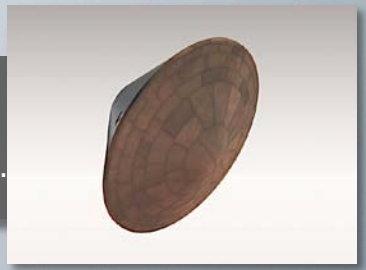
2016 Mission Objectives

EXOMARS

2016

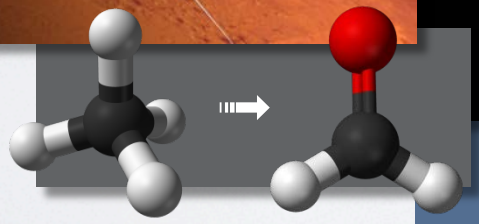
TECHNOLOGY OBJECTIVE

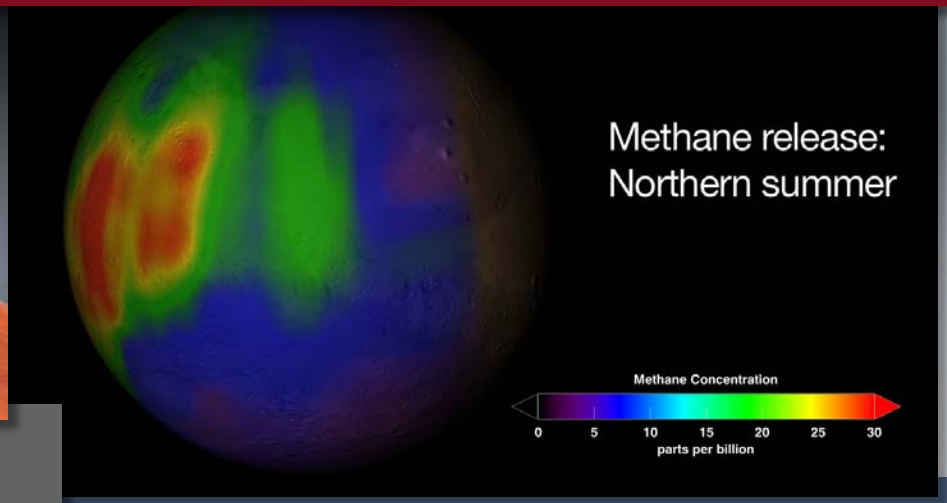
- Entry, Descent, and Landing (EDL) of a payload on the surface of Mars.



SCIENTIFIC OBJECTIVE

- To study Martian atmospheric trace gases and their sources.
- To conduct surface environment measurements.





- Provide data relay services for landed missions until 2022.

2018 Mission Objectives

TECHNOLOGY OBJECTIVES

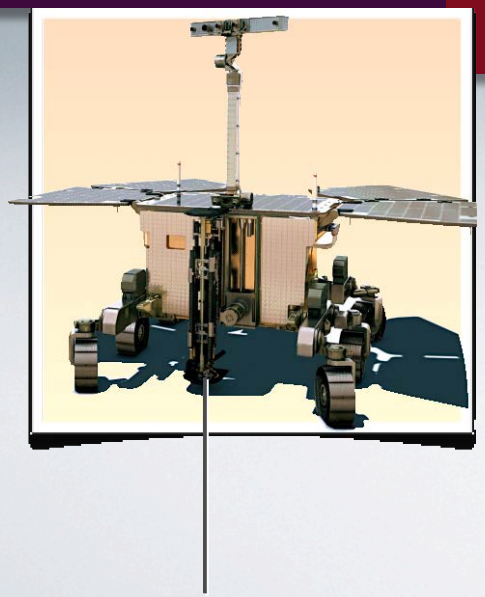
- Surface mobility with a rover (having several kilometres range);
- Access to the subsurface to acquire samples (with a drill, down to 2-m depth);
- Sample acquisition, preparation, distribution, and analysis.

- Qualification of Russian ground-based means for deep-space communication
- Adaptation of Russian on-board computer for deep space missions and ExoMars landed operations
- Development and qualification of throttleable braking engines for prospective planetary landing missions

2018

SCIENTIFIC OBJECTIVES

- To search for signs of past and present life on Mars;
- To characterise the water/subsurface environment as a function of depth in the shallow subsurface.

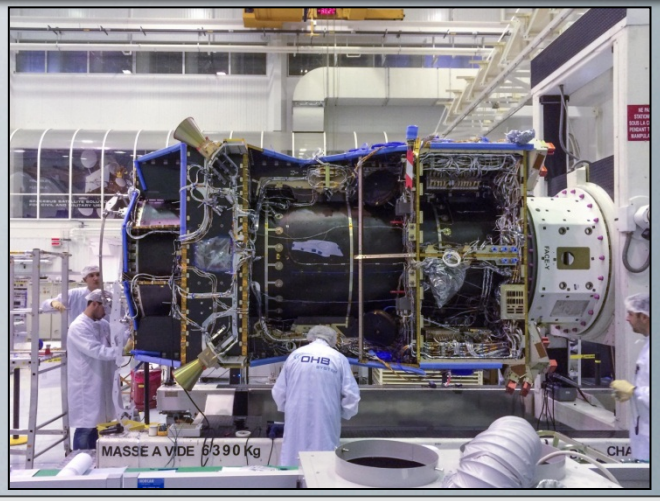


- To characterise the surface environment.

ExoMars Current status (1)

ExoMars programmatic status

- ESA – Roscosmos ExoMars agreement signed (2013)
- ESA – NASA MoU on ExoMars 2016 signed (29 April 2014)
- Additional funding received (~140 M€ at ec 2008) from ESA member states at the Council at Ministerial Level in Luxembourg (2 December 2014) – supports activities until next Council at Ministerial Level (2016)



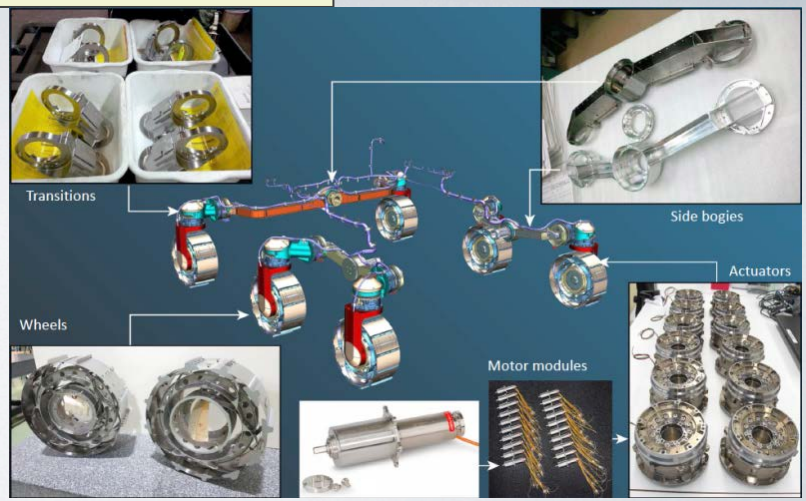
2016 ExoMars Mission (TGO and EDM)

- Contract with Industry for development, launch and phase E1
- Ground Segment Implementation Readiness Review has been successfully completed (October 2014)
- System Critical Design Review (S-CDR) closed-out in November 2014
- TGO and EDM integration are nearing completion
  - NASA provided ELECTRA UHF transponders integrated
- Scientific instruments (SM/QM) integrated on TGO and EDM
  - Will be replaced by FMs in Q1 / Q2 2015 (CaSSIS Q3)
- Mating TGO and EDM in Q2 followed by SCC testing
- Shipping to Baikonour foreseen in October 2015
- 2016 mission on schedule for 7 January 2016 launch albeit with very small margins

ExoMars Current status (2)

2018 ExoMars Mission (CM, DM, Rover)

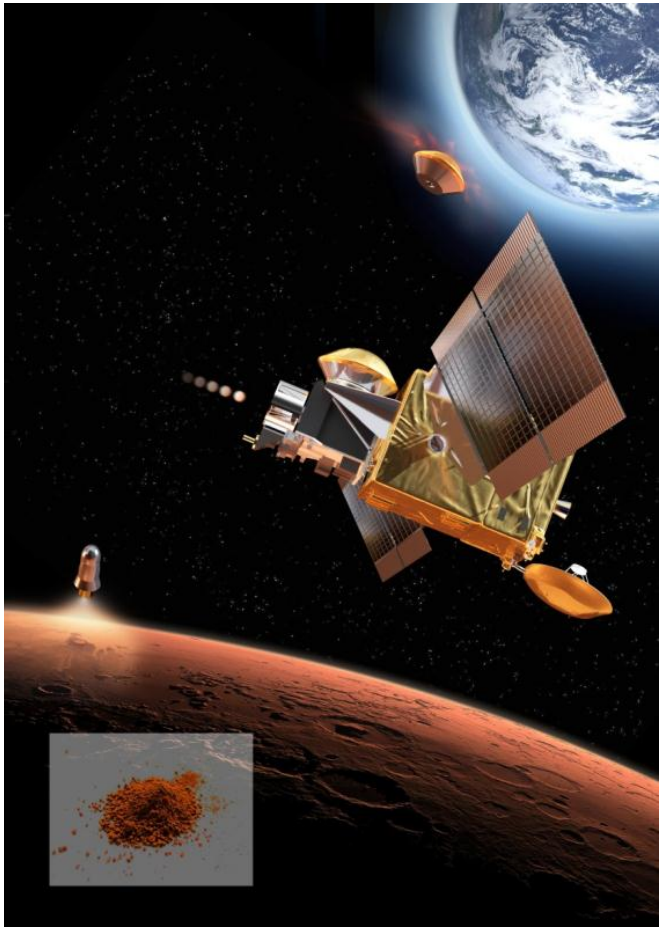
- The 2018 mission is in Phase B (CM, DM), while the Rover is already in Advanced Phase CD
- 2018 System Preliminary Design Review (S-PDR):
  - Kicked-off in September 2014
  - S-PDR board in November 2014 partially successful
  - Action plan in place to close-out S-PDR by 5 May 2015
- Industrial Proposal C/D/E1 received in November 2014
  - Negotiations with industry December – February 2015
  - Revised industrial proposal requested end March 2016
- Rover instruments are progressing although concerns about delivery schedules remain
- AO for Surface Platform instruments in preparation (March 2015)
- Landing Site Selection process on-going (*Jorge Vago presentation*)



ESA activities for future (post-ExoMars) Mars exploration

The Mars Robotic Exploration Preparation Programme (MREP)

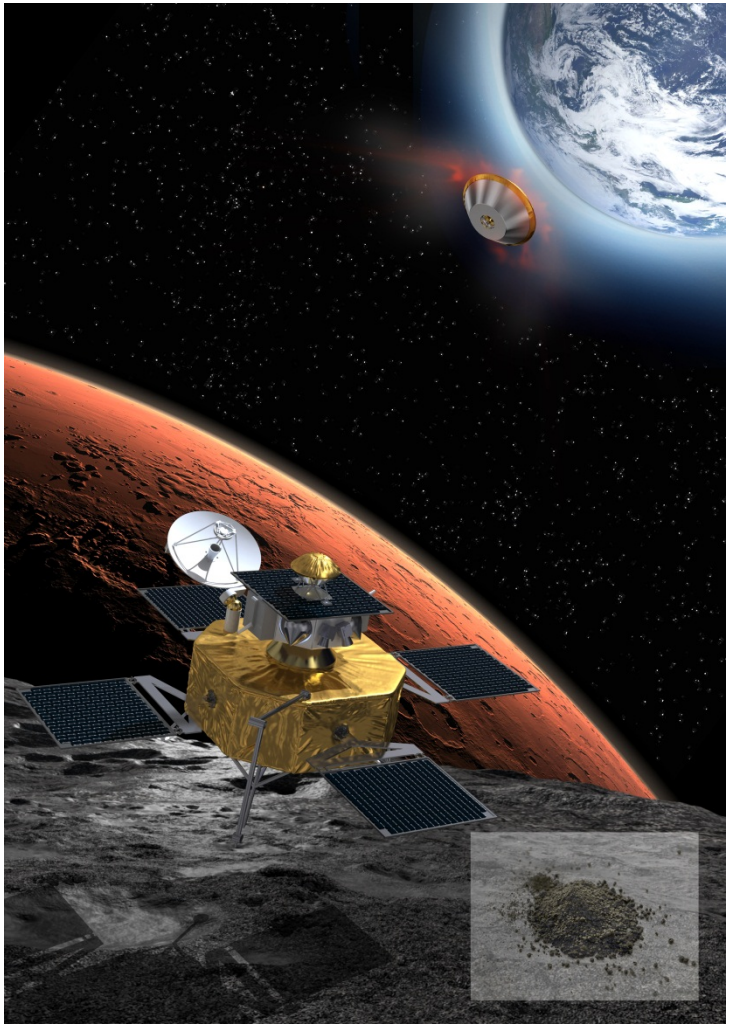
- **Mission studies for post-ExoMars missions**
  - PHOOTPRINT, INSPIRE, MPL-SFR, ..
- **Exploration Technology Development**
  - Mission specific technologies
  - Long-term enabling technologies (Nuclear Power Systems, Advanced Propulsion)
  - General MSR preparatory technology activities (eg. sampling, PP related technologies, sample rendezvous and capture, precision landing, …)
- **MREP phase 2 (2012-2016) ongoing, new subscriptions received at C-MIN 2014**



Phobos Sample Return (PHOOTPRINT): Mars-2024 candidate

- **Return a sample of ~100 g from Phobos**
- **High and recognised intrinsic science value**
  - Origin and formation of Phobos; Solar System evolution
- **Prepares critical building blocks for MSR**
  - Sampling, transfer and sealing
  - Short range Rendezvous
  - Earth Return Capsule
  - Sample receiving facility

- **Possible scenarios for cooperation with Roscomos identified**
  - Successful CDF study in May / June 2014 showing technical feasibility as well as enhanced science value



Phobos Sample Return Phase-A studies

- Two parallel studies of 12 month duration
- ITT released, planned Kick-Off May 2015, finish May 2016
- Implementation proposal ESA C-MIN 2016

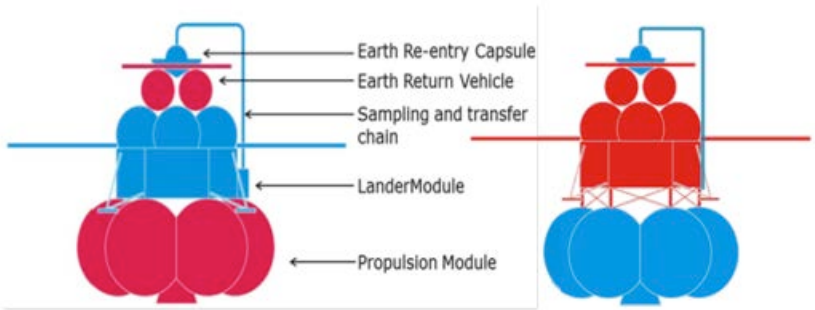


Figure 1: Joint mission baseline architecture (left) joint backup architecture (right)

	Joint baseline	Joint back-up	Stand-alone
PM		X	X
LM	X		X
ERV			X
ERC	X	X	X
SATCS	X	X	X

Figure 3: elements to be studied

	Baseline		Backup	
	ESA	ROSCOSMOS	ESA	ROSCOSMOS
Launcher				
Propulsion Module (PM)				
Lander Module (LM)				
Sampling and Transfer Equipment		With ROSCOSMOS Participation (*)		With ROSCOSMOS Participation
Earth Return Vehicle (ERV)				
Earth Re-Entry Capsule (ERC)				
Science Instruments				
Launch Ops				
SC Cruise + Landing Ops				
ERV SC Operations				
Science Operations				
Ground support				
Sample Receiving facility				
Science exploitation				

Figure 2: Joint mission sharing preliminary ESA / Roscosmos agreement for the baseline and backup mission architectures

MREP: other activities in preparation for MSR

- **MarsFAST: ESA/NASA joint mission study based on the NASA Skycrane and ESA rover technologies**
  - NASA: EDL System and static platform
  - ESA: Fast mobility rover as demonstration for MSR Fetching Rover

- **The International Mars Exploration Working Group (IMEWG) has resumed discussions on MSR (iMARS phase II) in March 2014**
- **The 2 iMARS-II working teams have presented their intermediate report to IMEWG on 23 October 2014 (ESA HQ):**
  - Engineering team presented the current views on the MSR architecture(s) and on technology development needed for MSR
  - Science team presented its preliminary views on the management aspects of sample curation and sample scientific investigations
- **Final iMARS-II report planned for April - May 2015**