

# **Mars Exploration**

## **The ESA Perspective**

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**MEPAG # 25**

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- **Implementing the ExoMars programme is Priority # 1 for ESA**
- **The full ExoMars Programme consists of:**
  - 2016 Trace Gas Orbiter (TGO) with data relay capability
  - 2016 Entry, Descent and Landing Demonstration Module (EDM)
  - 2018 Rover with Drill and Pasteur Payload
- **International cooperation essential for ESA to implement ExoMars**
- **Baseline was ESA – NASA cooperation**

# ExoMars - International cooperation



- **NASA could not provide Launcher for 2016 due to budgetary difficulties**
- **Cooperation was extended to include Russia**
  - Trilateral meeting ESA, NASA and Roscosmos on ExoMars cooperation was held on December 7-8 in Paris.
  - In December, the NASA administrator informed ESA and Roscosmos that NASA would not be in a position to continue discussions
- **On 19 December, the ESA and Roscosmos Heads of Agency agreed to investigate a possible bilateral cooperation for ExoMars**
  - Task joint ESA-Roscosmos WG to provide by February 2012 a feasibility analysis to implement the objectives of ExoMars on a bilateral basis
  - Any bilateral scenario should keep the launch dates of 2016 and 2018
- **WG report was finalized on February 6, showing a technically feasible concept**

- **Implementation scenario for ExoMars with Russian cooperation has been presented to Heads of Delegation meeting on 15 February 2012, in preparation of a decision to be taken by Council in March**
- **Together with its member states, ESA is assessing and elaborating the impacts of this scenario in detail.**
- **A decision is expected to be taken at the ESA Council on 14-15 March 2012**

## **Priority # 2 – Post-ExoMars missions - EREP**



- **During the last 3 years, ESA has been preparing its future Mars Exploration Programme within the MREP Programme**
- **MREP consists of four activity lines:**
  - MSR technology preparation,
  - Definition of intermediate mission to MSR (post-ExoMars missions)
  - Technology preparation of intermediate missions to MSR
  - Long term technology preparation: Nuclear power and propulsion.
- **Building on MREP, a follow-on programme will be presented to the C-MIN in November 2012 – European Robotic Exploration Programme (EREP)**

# **EREP Content: Three main lines of activities**



- 1. Prepare and Implement European robotic exploration missions to Mars, targeting as far as possible every launch opportunity**
  - International cooperation will be an important aspect
- 2. Develop new enabling technologies for future robotic exploration missions (Nuclear Power Systems, Propulsion)**
- 3. Study new robotic exploration mission candidates, which can then be implemented in future programme periods of EREP**

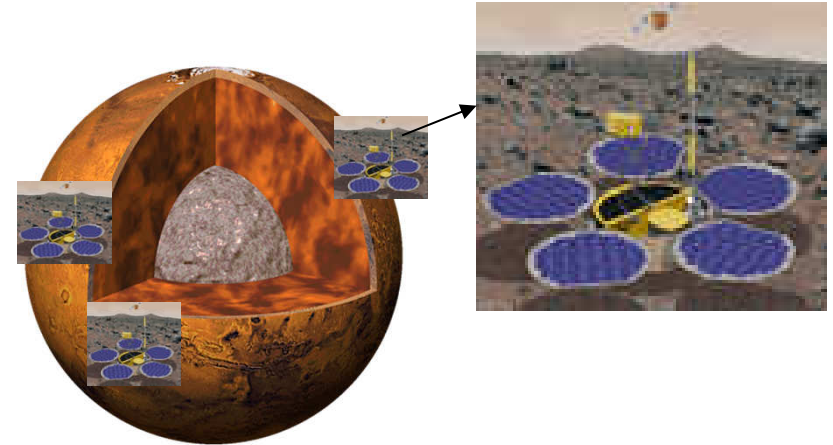
- **Four missions have been studied/prepared through MREP**
  1. Network science mission. Candidate for a launch in 2022
  2. Mars Moon Sample return. Candidate for a launch in 2022
  3. Mars Precision Lander. Candidate for a launch in 2024.
  4. MSR orbiter, as a segment of MSR campaign
- **Mission 4 is subject to international convergence on future MSR campaign**
  - Put on hold for the time being

# Mars Network mission



## Mission objectives & concept:

- Network of 3 surface landers for the study of Mars interior and atmosphere
- Carrier + 3 landers, Direct to Earth communication, or via ExoMars orbiter
- Compatible with Soyuz launch



## Technology steps & preparation:

- Ballistic entry, small landers
- Preparation covered by MREP
- TRL 5 achievable by 2014

## Timeline:

- Phase B2 can be started Q1 2015
- Compatible with launch in 2022
- Surface operations 1 year+ with solar powered landers





# Mars Moon Sample Return



## Mission objectives & concept

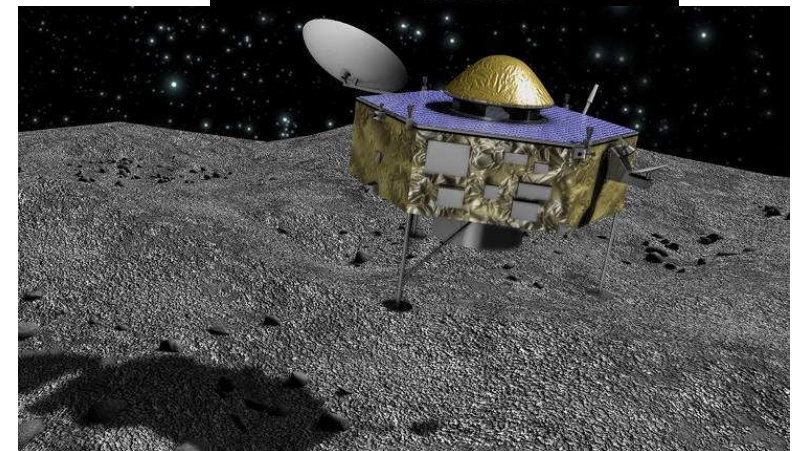
- Sample return from Phobos (back-up Deimos)
- Launcher: Ariane 5 shared launch
- Prepares Mars Sample Return

## Technology steps & preparation

- Sample conditioning, re-entry vehicle, sample receiving facility
- Preparation initiated by MREP
- TRL 5 achievable by 2014

## Mission possible timeline

- Phase B2 can be started Q1 2015
- Compatible with launch in 2022



# Mars Precision Lander



## Mission objectives & concept:

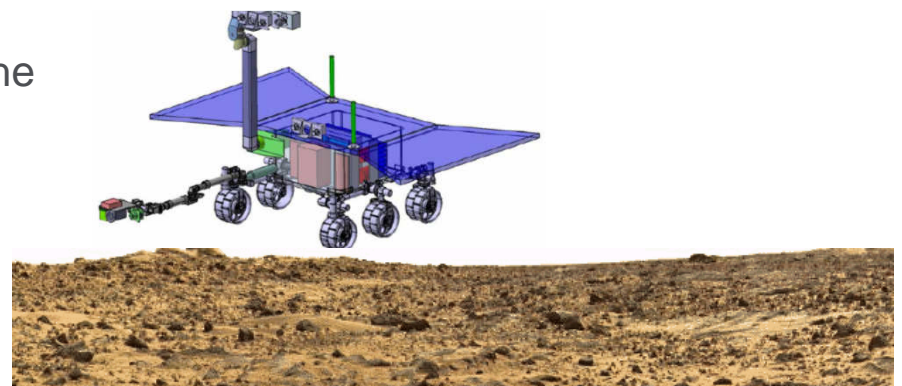
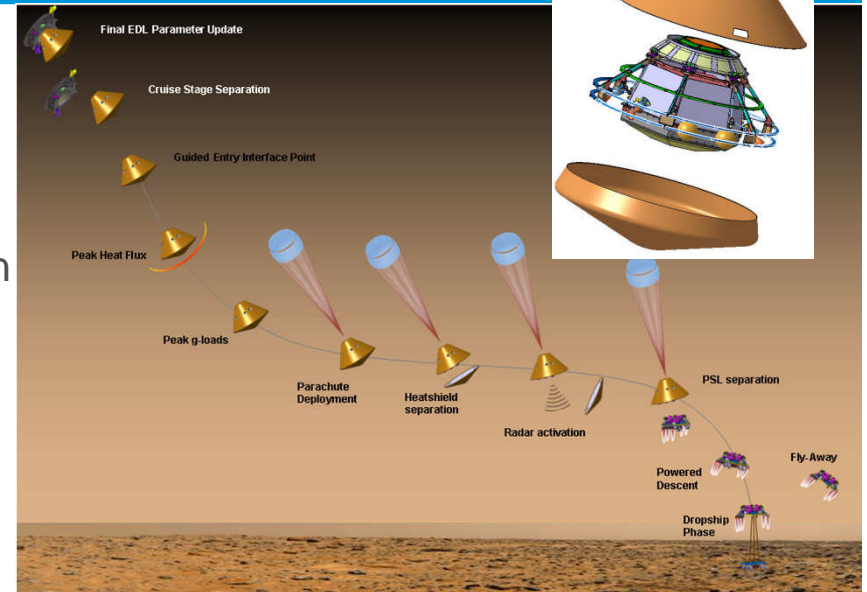
- High landing accuracy, 10 km
- Useful landed mass over < 100 kg
- Carrier could be recurring from Network mission
- Launcher: Soyuz or Ariane 5 shared

## Technology steps & preparation:

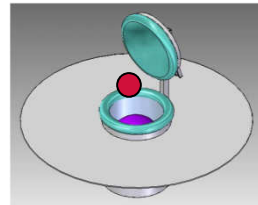
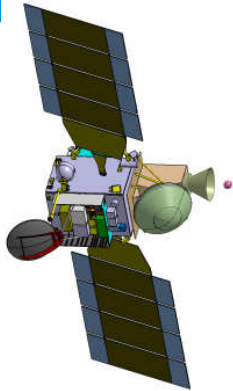
- Guided entry, soft landing
- High mobility rover
- Preparation initiated with MREP
- TRL 5 by 2014 will be difficult to reach for the landing system

## Mission timeline:

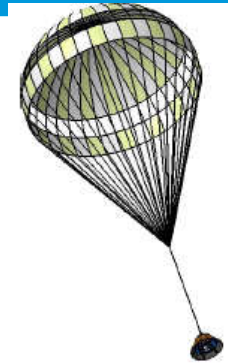
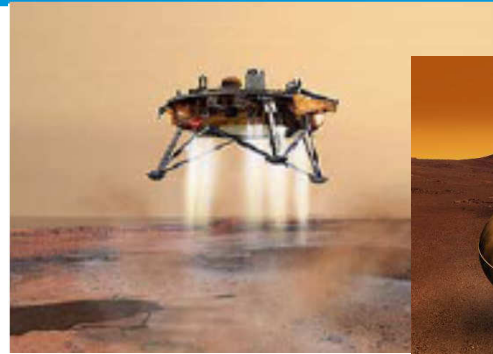
- Compatible with launch in 2024



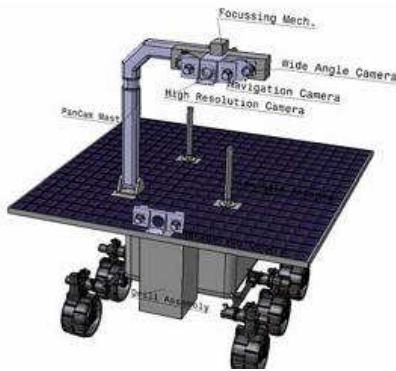
# Technology themes for MSR preparation in EREP (started in MREP)



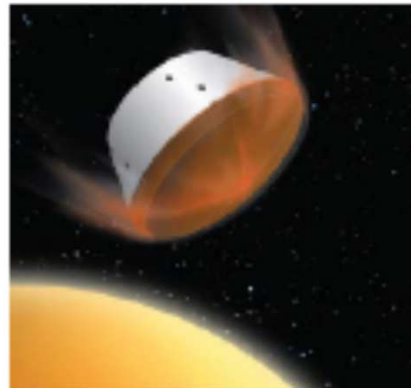
**Sample capture in orbit**, Rendezvous, planetary protection bio-sealing



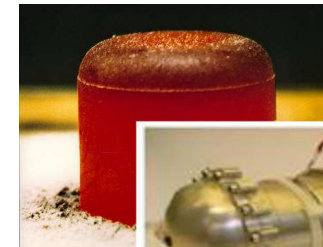
**Descent and landing**  
GNC, Airbags, throttleable retro-rockets



**Robotic technologies**  
Autonomy and navigation,  
Small (< 100 kg) rovers



**Earth re-entry vehicle**  
Heat shield for  $V > 12$  km/s



**Power sources**  
RHUs & RPG

# Mars Exploration – ESA perspective

## Final remarks



- **Finding a solution for ExoMars is the absolute Priority #1 of ESA**
- **Priority # 2 is preparing the future through the EREP Programme**
- *Status update of Mars Express presented by Fred Jansen*