Mars Exploration
The ESA Perspective
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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
ExoMars Way Forward

- 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.
• 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
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
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
Mission objectives & concept:
- High landing accuracy, 10 km
- Useful landed mass rover < 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
• 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