Mars Express Science Ground Segment overview: the mission’s evolution, new challenges and future perspectives


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Abstract

We present an overview of more than 13 years of mission operations from the perspective of the Science Ground Segment (SGS), including the evolution of the mission planning system and summarizing the new challenges ahead for the years remaining until the end of the mission. In addition, we emphasize the planning for the eclipse and solar conjunction season during the Summer of 2017. In comparison with the SGS planning for other missions, we present some observation statistics and conclude with the planned system improvements and future mission perspectives.

Mars Express (MEX) Operational Highlights

- 2004: Science operations started after 4 days of LEOP, Observations of Earth and Moon
- 2005: First Photos flyby, identification of water ice and CO2 on South-Pole. Methane and recent volcanic activity observation support.
- 2009: Photos and Deimos together: detection of the boundary between Mars upper atmosphere and space.
- 2010: 77 km Photos flyby, subsurface water ice mapped across Mars.
- 2011: Curiosity rover landing site studied. Discovery of superheated of water vapour in the atmosphere.
- 2012: Solar conjunction special operations.
- 2012: Molecular O3 in the right side atmosphere, gravity analysis of magnes dunes under volcanoes.
- 2013: Global meteorological maps produced. Photos flyby at 58 km.
- 2014: SiteX Spring avoidance and observations, Oort cloud comet observations.
- 2015: 10 years of auroral data. UV auroras detected. VMC educational campaign.
- 2016: 40 km Bibra crater discovery to create a collapsed centre of an enormous volcanic. VMC goes grea.

Downlink statistics

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Conclusions

Flexibility is key for science missions in comparison with other missions’ planning tools for which automation is vital for their development. Unfortunately, this implies manual processes and requires qualified operators, both engineers and scientists, to achieve the Principal Investigators goals. In order to improve SGS systems across planetary missions, it is vital to maintain accurate reporting and documentation for long-term missions such as MEX and for an optimized transfer of know-how to future, potentially more complex planetary missions.

References


Future activities

- Preparing TGO joint science phase, providing contextual information to the new observations.
- Preparing the support to Photos & Deimos science with new pointing designs and system tools.
- Optimizing planning for high-resolution stereo coverage of the surface.
- Characterizing landing sites for future robotic and manned missions.
- Monitoring observation trends tends to secure the homogeneity in observations for climatology, ionosphere, plasma environment and dynamical processes on ground and in the atmosphere.

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