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Mars MetNet Mission - Martian Atmospheric Observational Post Network

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Abstract

A new kind of planetary exploration mission for Mars is under development in collaboration between the Finnish Meteorological Institute (FMI), Lavochkin Association (LA), Space Research Institute (IKI) and Institutio Nacional de Tecnica Aerospacial (INTA). The Mars MetNet mission is based on a new semi-hard landing vehicle called MetNet Lander (MNL).

The scientific payload of the Mars MetNet Precursor [1] mission is divided into three categories: Atmospheric instruments, Optical devices and Composition and structure devices. Each of the payload instruments will provide significant insights in to the Martian atmospheric behavior. The key technologies of the MetNet Lander have been qualified and the electrical qualification model (EQM) of the payload bay has been built and successfully tested.

1. MetNet Lander

The MetNet landing vehicles are using an inflatable entry and descent system instead of rigid heat shields and parachutes as earlier semi-hard landing devices have used. This way the ratio of the payload mass to the overall mass is optimized. The landing impact will burrow the payload container into the Martian soil providing a more favorable thermal environment for the electronics and a suitable orientation of the telescopic boom with external sensors and the radio link antenna. It is planned to deploy several tens of MNLs on the Martian surface operating at least partly at the same time to allow meteorological network science.

2. Strawman Scientific Payload

The strawman payload of the two MNL precursor models includes the following instruments:

Atmospheric instruments:

- MetBaro Pressure device
- MetHumi Humidity device
- MetTemp Temperature sensors

Optical devices:

- PanCam Panoramic
- MetSIS Solar irradiance sensor with OWLS optical wireless system for data transfer
- DS Dust sensor

Composition and Structure Devices:

- Tri-axial magnetometer MOURA
- Tri-axial System Accelerometer

The descent processes dynamic properties are monitored by a special 3-axis accelerometer combined with a 3-axis gyrometer. The data will be sent via auxiliary beacon antenna throughout the descent phase starting shortly after separation from the spacecraft. MetNet Mission payload instruments are specially designed to operate under very low power conditions. MNL flexible solar panels provides a total of approximately 0.7-0.8 W of electric power during the daylight time. As the provided power output is insufficient to operate all instruments simultaneously they are activated sequentially according to a specially designed cyclogram table which adapts itself to the different environmental constraints.

3. Mission Status

The eventual goal is to create a network of atmospheric observational posts around the Martian surface. Even if the MetNet mission is focused on the atmospheric science, the mission payload will also include additional kinds of geophysical instrumentation. The next step is the MetNet Precursor

Mission that will demonstrate the technical robustness and scientific capabilities of the MetNet type of landing vehicle. Definition of the Precursor Mission and discussions on launch opportunities are currently under way.

4. MetNet Payload Precursors

The first MetNet Science Payload Precursors have already been successfully completed, e,g, the REMS/MSL and DREAMS/Exomars-2016. The next MetNet Payload Precursors will be METEO/Exomars-2020 and MEDA/Mars-2020. The baseline program development funding exists for the next seven years. Flight unit manufacture of the payload bay takes about 18 months, and it will be commenced after the Precursor Mission has been defined.

References

[1] Mars MetNet Mission webpage http://metnet.fmi.fi