

MetNet Mission for Mars – Mission Status and Payload Precursors

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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 Instituto Nacional de Tecnica Aeroespacial (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. Introduction

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.

The MetNet Lander and mission main parameters including EDL scheme are presented in the Figure 1.

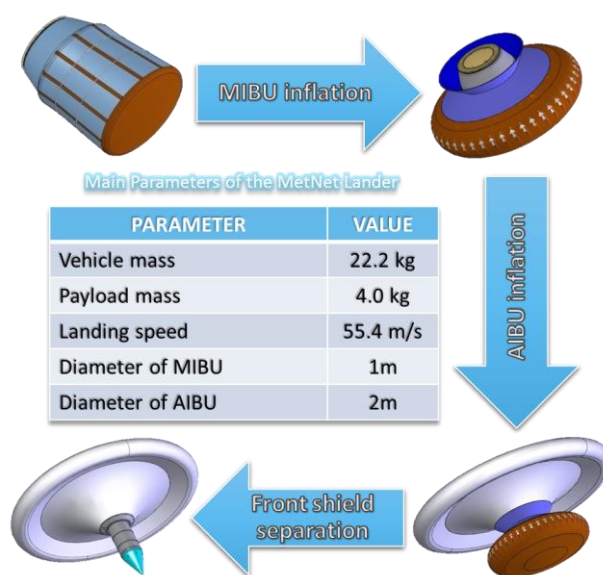


Figure 1: MetNet Precursor Mission main parameters.

2. Strawman Scientific Payload

The strawman payload of the two MNL precursor models includes the following instruments (see Figure 1):

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

Full Qualification Model (QM) of the MetNet landing unit with the Precursor Mission payload is currently under functional tests (Figure 2). In the near future the QM unit will be exposed to environmental tests with qualification levels including vibrations, thermal balance, thermal cycling and mechanical impact shock. One complete flight unit of the entry, descent and landing systems (EDLS) has been manufactured and tested with acceptance levels (See also lowest figure on the left). Another flight-like EDLS has been exposed to most of the qualification tests, and hence it may be used for flight after refurbishments. Accordingly two flight-capable EDLS systems exist.

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 in the MetNet Precursor Mission is the demonstration of the technical robustness and scientific capabilities of the MetNet type of landing vehicle.

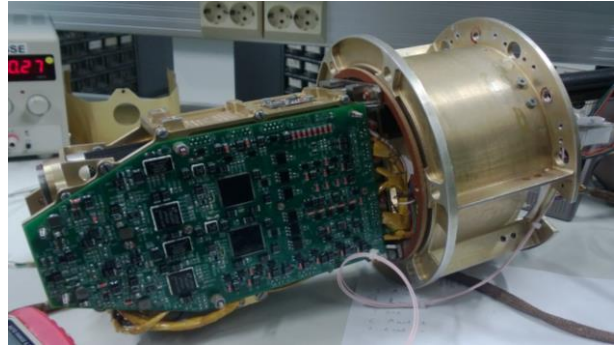


Figure 2: MetNet payload bay electronics in tests.

4. MetNet Payload Precursors

The first MetNet Science Payload Precursors have already been successfully completed, e.g, the REMS/MSL and DREAMS/Exomars-2018. The next MetNet Payload Precursors will be METEO/Exomars-2020 and MEDA/Mars-2020.

Definition of the Precursor Mission and discussions on launch opportunities are currently under way. The baseline program development funding exists for the next five 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] <http://metnet.fmi.fi>