Geophysical Research Abstracts
Vol. 13, EGU2011-6054, 2011
EGU General Assembly 2011

Autonomous Operation of the MetNet Precursor Mission

Ari-Matti Harri (1), Walter Schmidt (1), Luis Vázquez (2), Harri Haukka (1), and Vladimir Linkin (3)
(1) Finnish Meteorological Institute, Earth Observation Research, Helsinki, Finland (harri.haukka@fmi.fi), (2) UCM, Madrid, Spain, (3) IKI, Moskow, Russia

In the next years a series of small landing vehicles concentrating on Martian meteorology should be deployed to the surface of our planetary neighbor in preparation of the planned manned missions to Mars. Here we present the Finnish – Russian – Spanish precursor mission of such network landers and its principle of operation.

The Mars MetNet Precursor Mission (MMPM) [1] is the technology demonstration project for the deployment of a larger network of small meteorological stations onto the surface of Mars. The development is done in collaboration between the Finnish Meteorological Institute (FMI), the Russian Lavoshkin Association (LA), the Russian Space Research Institute (IKI) and the Spanish National Institute for Aerospace Technology (INTA).

The purpose of MetNet is to get atmospheric data during the descent phase and information about the meteorology and surface structure at the landing site from the meteorological station during one Martian year or longer. Inside a total payload mass of 4 kg its sensors will characterize the near environment of the landing sites and the variation of atmospheric parameters like temperature, pressure, humidity, dust content and opacity in different wavelength bands.

Autonomous Operation:

As it cannot be assumed for all stations that a commanding possibility exists throughout the mission, the on-board control system has to be designed for autonomous decision making to optimize the science return under different environmental and instrument conditions.

As long as data storage and battery charge allow the instruments will be commanded according to a predefined command sequence stored as so called cyclogram, which is defined before launch or updated during the transfer phase. The operating system of the Lander will select one of several cyclograms depending on selection criteria which can be automatically adjusted during the mission. Implemented selection criteria are

- the absolute time as set before separation from the orbiter. This is used for Phobos eclipse measurements, when the shadow of the Martian moon moves across the landing site.
- Day/night calibration: using the MetSIS instrument around sunrise and sunset, the exact day/night cycle can be established and adjusted.
- Day/night status: optical measurements with the camera or MetSIS are not useful during the night and will be skipped.
- Low battery status not allowing instrument operation with high energy demand like the PANCAM.

Additionally the cyclogram interpreter contains the possibility to skip a command in case certain conditions are not met. This allows to utilize the same cyclogram structure even if an instrument should not be operated at the moment. This is the case if from the time of day and accelerometer-based impact angle measurement it can be deducted that the Dust Sensor is directly illuminated by the Sun, making infraread measurements impossible, or if previous operations indicated a severe failure.

As the unit is battery powered with flexible solar panels for re-charging, only a limited amount of energy is available for operating the instruments. Opposed to the RadioThermalGenerator (RTG)-powered American Viking Landers night operations of the pressure sensors will therefore be drastically limited. For future missions especially to higher altitudes and latitudes other options are under investigation.

Reference:

[1] Home page of the MetNet mission: http://metnet.fmi.fi