

# Mars MetNet Mission Pressure and Humidity Devices

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## Abstract

A new kind of planetary exploration mission for Mars is being developed 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 [1] is based on a new semi-hard landing vehicle called MetNet Lander (MNL).

MetBaro and MetHumi are part of the scientific payload of the MNL. Main scientific goal of both devices is to measure the meteorological phenomena (pressure and humidity) of the Martian atmosphere and complement the previous Mars mission atmospheric measurements (Viking and Phoenix) for better understanding of the Martian atmospheric conditions.

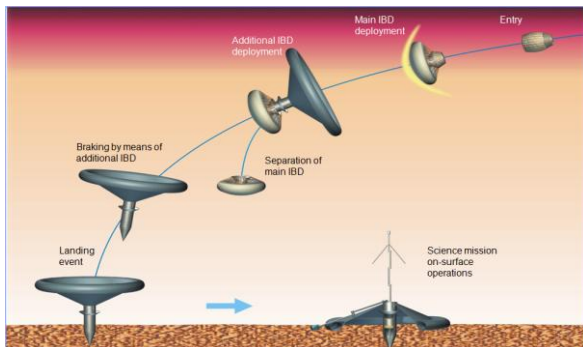


Figure 1: MetNet lander landing scheme.

## 1. MetBaro Pressure Device

MetBaro is the pressure sensor of MetNet Lander designed by Finnish Meteorological Institute to work on Martian surface. It is based on Barocap® technology developed by Vaisala, Inc. MetBaro is a capacitive type of sensing device where capacitor plates are moved by ambient pressure. MetBaro device consists of two pressure transducers including a total of 4 Barocap® sensor heads of high-stability and high-resolution types. The long-term stability of

MetBaro is in order of 5 Pa and resolution  $< 0.5$  Pa. MetBaro is small, lightweighed and has low power consumption. It weighs about 50g without wires and controlling FPGA, and consumes 15 mW of power.



Figure 2: MetBaro pressure device. Photo: Markku Mäkelä, FMI.

## 2. MetHumi Humidity Device

MetHumi is the humidity sensor of MetNet Lander designed by Finnish Meteorological Institute to work on Martian surface. It is based on Humicap® technology developed by Vaisala, Inc. MetHumi is a capacitive type of sensing device where an active polymer film changes capacitance as function of relative humidity. One MetHumi device package consists of one humidity transducer including three Humicap® sensor heads, an accurate temperature sensor head (Thermocap® by Vaisala, Inc.) and constant reference channels. MetHumi is very small, lightweighed and has low power consumption. It weighs only about 15 g without wires, and consumes 15 mW of power. MetHumi can make meaningful relative humidity measurements in range of 0 – 100%RH down to  $-70^{\circ}\text{C}$  ambient temperature, but it survives even  $-135^{\circ}\text{C}$  ambient temperature.



Figure 3: MetHumi humidity device. Photo: Harri Haukka FMI.

### **3. Device Heritage**

The MetBaro type of device has successfully flown in Phoenix mission, where it performed months of measurements on Martian ground. Another pressure device is also part of the Mars Science Laboratory REMS instrument that lands on Mars August 2012. MSL also includes humidity device similar to MetHumi.

### **References**

- [1] <http://metnet.fmi.fi>