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Testing and ground calibration of DREAMS-H relative humidity device

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DREAMS (Dust Characterization, Risk Assessment and Environmental Analyzer on the Martian Surface) instrument suite is to be launched as part of the ESA ExoMars 2016/Schiaparelli lander. DREAMS consists of an environmental package for monitoring temperature, pressure, relative humidity, winds and dust opacity, as well as atmospheric electricity of Martian atmosphere. The DREAMS instruments and scientific goals are described in [1]. Here we describe testing and ground calibration of the relative humidity device, DREAMS-H, provided to the DREAMS payload by the Finnish Meteorological Institute and based on proprietary technology of Vaisala, Inc. The same kind of device is part of the REMS instrument package onboard MSL Curiosity Rover [2][3].

DREAMS-H is based on Vaisala Humicap® technology adapted for use in Martian environment by the Finnish Meteorological Institute. The device is very small and lightweighed, with total mass less than 20 g and consuming only 15 mW of power.

The Humicap® sensor heads contain an active polymer film that changes its capacitance as function of relative humidity, with 0% to 100% RH measurement range. The dynamic range of the device gets smaller with sensor temperature, being in -70°C approximately 30% of the dynamic range in 0°C [3].

Good-quality relative humidity measurements require knowing the temperature of the environment in which relative humidity is measured. An important part of DREAMS-H calibration was temperature calibration of Vaisala Thermocap® temperature sensors used for housekeeping temperature measurements of the DREAMS-H device. For this, several temperature points in the desired operational range were measured with 0.1°C accuracy traceable to national standards.

The main part of humidity calibration of DREAMS-H flight models was done in subzero temperatures in a humidity generator of the Finnish Center of Metrology and Accreditation (MIKES). Several relative humidity points ranging from almost dry to almost wet were measured at several temperature points between 0°C and -70°C. Dry baseline was established in vacuum measurements at the Finnish Meteorological Institute.

In addition to stable relative humidity points, measurements in changing relative humidity and temperature were done in order to get information about the lag of the sensor.

References:

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