SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Part 2 (3B)

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THE MISSUS PROJECT: AN OVERVIEW OF A BALLOON EXPERIMENT IN PREPARATION FOR DREAMS ONBOARD EXOMARS 2016 MISSION

Abstract

MISSUS (Meteorological Integrated Sensor SUite for Stratospheric analysis) is an innovative multi-sensor scientific package designed for the analysis of several environmental parameters (such as temperature, pressure, and humidity) of thin atmospheres and for the attitude and trajectory reconstruction. The instrument suite was designed and developed at CISAS premises, University of Padova (Italy), and flew on board the BEXUS15 ESA/SSC/DLR balloon in the October 2012. The package consists of several sensors, both commercial along with custom and innovative sensors. Two different parts compose the system: a thermally insulated internal part, fixed on the gondola's body, and an external part, exposed

to the atmosphere. The inner part includes the batteries, a custom acquisition and conditioning electronics, an industrial CPU and an ADC system, house-keeping sensors, some meteorological sensors and some instruments for the attitude reconstruction (differential and absolute pressure sensors, a triaxial accelerometer, an IMU). The external module (a fluxgate magnetometer, a custom Pitot tube and an innovative temperature sensor) is installed on an aluminum protruding boom. The balloon flight offered the unique opportunity for testing the onboard innovative instrumentation; in particular, the new temperature sensor is the prototype of the MarsTem (DREAMS temperature sensor onboard ESA Exomars 2016 Mission) and is constituted of a sensitive platinum wire wrapped around PEEK elements supported by a titanium frame. Thanks to its innovative design, the sensor is particularly suitable for the measurement of temperature fast fluctuations in low pressure environments. BEXUS gondola attitude and trajectory reconstruction were performed thanks to a synergic approach in the data analysis and collected meteorological data allowed the atmospheric environmental models to be validated: as a relevant result, variations in the atmospheric profiles show the strong interference of solar radiation on the measurement of the external temperature. This effect led to some original improvements and changes have been introduced and implemented in the design of the MarsTem Flight Model (such as shields for the UV and infrared radiation coming from the Sun and from the probe itself respectively). After the flight, thermal tests on the prototype which flew on BEXUS and the Flight Model of the sensor have been performed using CISAS Solar Simulation facility (able to reproduce the solar flux up to 6/7 Solar Constant) and test results allow to provide a comparison between the different thermal behaviors of the sensors.