SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Science, Instruments and Technologies (3B)

Author: Dr. Francesca Ferri
Università degli Studi di Padova, Italy

Dr. Özgür Karatekin
Royal Observatory of Belgium, Belgium
Prof. Francois Forget
Institut Pierre-Simon Laplace, France
Dr. Stephen Lewis
Open University, United Kingdom
Mr. Alessio Aboudan
CISAS – "G. Colombo" Center of Studies and Activities for Space, University of Padova, Italy
Dr. Giacomo Colombatti
CISAS – "G. Colombo" Center of Studies and Activities for Space, University of Padova, Italy
Mr. Bart Van Hove
Royal Observatory of Belgium, Belgium
Dr. Paul Withers
Boston University, United States

EXOMARS ENTRY, DESCENT AND LANDING SCIENCE

Abstract

The Entry, Descent and Landing System (EDLS) of an atmospheric entry probe or lander requires measurements in order to trigger the events of the descent sequence. These measurements besides being aimed to guarantee a safe landing, could provide essential information for the study of planetary atmosphere. Few in situ probes have entered the atmosphere of planetary bodies such as Mars, Venus, Jupiter and Titan, the largest moon of Saturn. EDL phases are critical with reference to mission achievement and require development and validation of technologies linked to the environmental and aerodynamical conditions the vehicle will face. An accurate knowledge of the dynamics of the probe during entry and descent (i.e. trajectory and attitude determination) allows the retrieval of the atmospheric vertical profile of values such as density, temperature and pressure at a vertical resolution far higher than previously explored and/or reachable by remote sensing.

The entry, descent and landing of the ExoMars program offer a rare (once-per-mission) opportunity to perform in situ investigations of the martian environment over a wide altitude range. ExoMars 2016 Descent Module and 2018 Surface Platform will provide new direct in situ measurements at different sites, season and time period complementing the few atmospheric profiles derived by previous probes (e.g. Viking 1 & 2, Mars PathFinder, Mars Exploration Rovers and Phoenix). The ExoMars AMELIA (Atmospheric Mars Entry and Landing Investigations and Analysis) team seeks to exploit the EDLS engineering measurements for scientific investigations of Mars' atmosphere and surface. From the measurements recorded during entry and descent, using similar methods and analysis employed on previous entry probe missions (e.g. ESA Huygens at Titan, NASA Mars PathFinder, MERs, Phoenix, MSL-Curiosity) we will retrieve an atmospheric vertical profile along the entry and descent trajectory. These data will contribute to exploring an altitude range not covered by an orbiter, providing surface and atmosphere "ground truths" for remote sensing observations and important constrains for updates and validations of the Mars atmosphere General Circulation models.

We will present our proposed methodology and objectives for exploiting the ExoMars EDLS measurements beyond their expected engineering information for scientific investigations of Mars' environment.