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

Author: Ms. María Colombo
Instituto Nacional de Tecnica Aeroespacial (INTA), Spain, colombobm@inta.es

Ms. Eva Diaz
Centro de Astrobiologia (INTA), Spain, diazcem@inta.es
Mr. Andoni G. Moral
Instituto Nacional de Tecnica Aeroespacial (INTA), Spain, moralia@inta.es
Mr. Carlos Pérez
INTA - Centro de Astrobiologia, Spain, carlos.perez@cab.inta-csic.es
Mr. Tomás Belenguer
Instituto Nacional de Tecnica Aeroespacial (INTA), Spain, belenguer@inta.es
Mrs. Marianela Fernández
Instituto Nacional de Tecnica Aeroespacial (INTA), Spain, fernandezrm@inta.es
Ms. Paloma Gallego
Instituto Nacional de Tecnica Aeroespacial (INTA), Spain, gallegospi@inta.es
Mrs. Maria del Rosario Canchal
Instituto Nacional de Tecnica Aeroespacial (INTA), Spain, canchalmm@inta.es
Mr. Gonzalo Ramos
National Institute for Aerospace Technology (INTA), Spain, ramoszg@inta.es
Mr. Jose Antonio Rodriguez Manfredi
Centro de Astrobiologia (INTA), Spain, rodriguezmj@inta.es

A NEW SPECTROMETER CONCEPT FOR MARS EXPLORATION

Abstract

The ExoMars program is a one way space mission foreseen to explore the Mars atmosphere and its ground surface. The 2018 mission is a NASA lead mission with the contribution of a 300 kg rover by ESA that will carry a comprehensive suite of analytical instruments dedicated to exobiology and geology research (Pasteur payload).

One of the instruments included in the mentioned payload is the Raman Laser Spectrometer (RLS) instrument that is focused on the analytical analysis of the geochemistry content and elemental composition of the observed crushed samples obtained by the drill system of the Rover. This goal shall be achieved by means of the Raman spectroscopy technique.

One of the most critical Units of the RLS instrument is the Spectrometer unit (SPU) that performs spectroscopy technique and operates in a very demanding environment (radiation, temperature, dust, etc.) with very restrictive design constraints (mass, power, schedule). It is a very small optical instrument capable to cope with 0.09 nm/pixel of resolution and withstand with the Martian environment (operative temperature conditions: from -40 °C to 6 °C). The solution selected is based on a single transmisive holographic grating especially designed to actuate as the dispersion element.

The SPU Flight Model is being developed by a European Consortium composed by Spanish, German and UK as scientific and industrial partners.

At this stage of the project SPU Team is improving and optimizing the SPU FM design and a Delta RLS PDR will take place on July 2011. SPU PDR is expected on Autumn 2011.

In parallel, a set of activities have been already started by RLS SPU Team in order to achieve the Technology Readiness level 5(TRL5: Component and/or breadboard validated in a relevant environment) for RLS Delta PDR. These activities are:

* Grating validation test campaign: first results have been very successful.

* SPU breadboard which main AIT objectives are to: - Determine concepts feasibility and demonstrate the technical principles of immediate interest. - Prove and confirm the viability of the RLS SPU unit. - Ensure manufacturing tolerance and optical compensators. - Verify the critical areas in an early stage of the project. - Demonstration that the critical functionalities and/or interfaces work. - Verification of the optical analytical models. - Validate RLS SPU radiometric model - Verification of the susceptibility to thermal gradient in axis and some critical tolerances like collimation degree and focus shift vacuum. - Adjustment capability of CCD.