EVOLUTION OF THE EXOMARS ENTRY DESCENT AND LANDING MISSION ANALYSIS

R. Haya Ramos*, J.L. Cano, D. Bonetti, C. Parigini, F. Cacciatore

DEIMOS Space S.L.U., Tres Cantos, Spain
rodrigo.haya@deimos-space.com

S. Portigliotti, A. Anselmi

Thales Alenia Space Italy, Turin, Italy

ABSTRACT

The EXOMARS programme foresees two missions: the first, to be launched in 2016, consisting of an Orbiter plus an Entry, Descent and Landing Demonstrator and the second, with a launch date of 2018, consisting of two rovers. Both missions will be carried out in cooperation with NASA. This scenario is the result of a 4 years evolution in which the mission has moved from the launch with Soyuz of a Descent Module (DM) including a rover with hyperbolic release to the delivery of a fixed station in a reduced scale DM in the actual Entry, Descent and landing (EDL) Demo mission scenario. Intermediate scenarios have considered the release of a 1.2 Tons vehicle from an elliptic orbit.

The objective of this paper is to present the Mission Analysis of the EDL of Exomars that has been supporting this programme evolution. The changes in the Mission & System requirements that have driven the Mission Analysis are related to the launch system (Soyuz, Ariane 5, Atlas), the landed elements (rover, fixed platform), the release strategy (hyperbolic an elliptic), the launch window (2013 to 2018) and the landing site requirements (latitude band or selected sites).

In response to these Mission Changes, different DM designs have been specified to Mission Analysis in order to assess its feasibility and support the design trades. For instance, in terms of mass and size the DM has evolved from a 3.4 m diameter frontshield with 1.2 Tons entry mass for elliptic release to a 2.4 m diameter with 600 kg released from the arrival hyperbola. Different approaches for the EDL components have been also tackled (airbags, 2 stage system, single stage system, crushable structure) as well as different sets of engineering constraints.

The paper deals with the methods and tools and the main results and conclusion for each of the Mission Scenarios, with focus on the end-to-end approach linking the interplanetary phase design with the EDL phases. The rationale for the changes leading to the actual mission scenario, with main focus on the 2016 EDL Demo mission, is presented, as well as a summary of the actual status of the Exomars Mission Analysis and Design and the expected evolution towards the closure of Phase B2.