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

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EXOMARS 2016: SCHIAPARELLI MISSION ANALYSIS

Abstract

The ExoMars programme is pursued as part of a broad cooperation between ESA and Roscosmos. This cooperation foresees two missions within the ExoMars programme for the 2016 and 2018 launch opportunities to Mars. The ExoMars 2016 mission, reaching Mars on October, 19th 2016, is led by ESA and will be launched by the Russian launcher Proton. The mission includes the Trace Gas Orbiter (TGO) and the Entry, Descent, and Landing Demonstrator (EDM, named Schiaparelli), both supplied by ESA. The TGO scientific mission aims at investigating atmospheric trace gases: it is expected to begin in December 2017 following an aerobraking phase, and to run for five years. Schiaparelli will provide Europe with the technology for landing on the surface of Mars with a controlled landing orientation and touchdown velocity. The 2018 mission includes a carrier Module and a Mars Rover developed by ESA, and a Descent Module including a Surface Platform developed by Roscosmos. It is scheduled to be launched by Proton in 2018. DEIMOS Space has been involved in the Exomars Programme (2016 and 2018 missions) since 2004 providing more than 10 years of technical analyses in the areas of End to End (from launch to landing) Mission Engineering and GNC. In autumn 2015, the backup launch window of 2016 mission has been activated postponing the launch to the period 14th-25th March 2016, replacing the nominal launch window originally set in January 2016. This paper presents the Mission Engineering activities performed by DEIMOS Space in support to Thales Alenia Space Italia, acting as prime contractor for the ExoMars2016 Mission. Support is dedicated to the analysis of the Schiaparelli mission, from separation from the TGO to landing, for the March 2016 launch. The analyses performed

aim to assess the impact of the switch to the back-up launch window, and cover multiple aspects: system margins identification through Local Entry Corridor analyses and 3DoF/6DoF End to End Monte Carlo campaigns, verification of nominal ESA trajectories and separation maneuver optimization for landing site targeting, EDM aerodynamic database inspection and Flying Qualities Analysis, and TGO-Schiaparelli geometric visibility analyses. All the analyses rely on DEIMOS Space state of the art tools for Mission Engineering (PETbox, Planetary Entry Toolbox and LOTNAV, Low-Thrust Interplanetary Navigation Tool) whose results and design methodology for Atmospheric Flight have been recently Flight Qualified through the successful ESA IXV mission, in which DEIMOS Space was responsible of the Mission Analysis and re-entry GNC.