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# EXOMARS 2016: SCHIAPARELLI COASTING, ENTRY AND DESCENT POST FLIGHT MISSION ANALYSIS

**Abstract**

The ExoMars programme is pursued as part of a broad cooperation between ESA and Roscosmos with significant contribution from NASA. Two missions compose the ExoMars programme with launches in 2016 and 2020. The main programme goals of the 2016 mission are to search for evidence of methane and other trace atmospheric gases as possible signatures of active biological or geological processes, and to test key technologies in preparation for the 2020 mission ("ExoMars Rover and Surface Platform Mission"). The ExoMars 2016 mission, led by ESA, has been launched by the Russian Proton on March 14th, 2016. The mission includes the Trace Gas Orbiter (TGO) and the Entry, Descent, and Landing Demonstrator Module (EDM, named Schiaparelli), both supplied by ESA. Thales Alenia Space Italia (TASI) acted as prime contractor for the ExoMars2016 Mission, leading the Spacecraft Composite development and verification, including system design and verification of the EDM and key GNC/EDL technologies. DEIMOS Space has been involved in Exomars since 2004 providing more than 12 years of technical activities in Mission Engineering (from launch to landing) and GNC. Schiaparelli separated from TGO on October 16th 2016, and reached Mars 3 days later: it successfully entered with a pre-defined FPA and performed a nominal hypersonic entry, decreasing its velocity until reaching subsonic regime under the parachute. During the descent phase an anomaly occurred, and the EDM separated from the backshell earlier than expected, compromising the landing phase. During the EDL, Schiaparelli was able to communicate with the TGO and with the Mars Reconnaissance Orbiter, transmitting its real time on-board telemetry. Data collected is extremely valuable in preparation to the 2020 mission. This paper focuses on the level 0 post-flight analyses of the Schiaparelli mission, presenting the activities performed by DEIMOS Space in strict collaboration with TASI, aimed to assess the main flight performance from the mission analysis perspective, and determine and compare the actual flight with the predicted one.

The analyses covered: trajectory reconstruction, entry aerodynamic and flying qualities analyses, EDL performance reconstruction and assessment, descent data analysis and trajectory reconstruction. A large part of the end to end Schiaparelli mission, from Launch to Descent, has been successfully validated with the 2016 flight. Post-flight results contributed to validate key technologies and design tools, including the DEIMOS Space Planetary Entry Toolbox (PETBox) for Mission Engineering and the related design methodology for Atmospheric Flight, now Flight Qualified for both missions on Earth and Mars.