

SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Part 1 (3A)

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EXOMARS 2016 MISSION DESIGN

Abstract

The long-term cooperation plan established by ESA and NASA in June 2009 has made further progress to consolidate the two missions of the ExoMars project as the System PDR was held in December 2010 and the Industry submitted a committing Price Proposal for the C/D Phase in February this year. This paper addresses the ESA-led mission, launched in 2016, which comprises an Orbiter Module (OM), with scientific and data relay assets, and an Entry Descent and Landing Demonstrator Module (EDM). On January 2016 the ExoMars Spacecraft Composite is launched by an Atlas V 431 “type” vehicle, from Cape Canaveral Air Force Station (Florida, USA), into a type-2 transfer trajectory to Mars which it reaches, after a cruise of about 9-month duration, on 16 October 2016. The EDL-Demo is separated from the Orbiter and coasts autonomously for 3 days before crossing the Entry Interface Point (EIP) at 120 km, from which it performs the hyperbolic entry, descent and landing at its Meridiani Planum landing site (Longitude = 6.15 deg W, Latitude = 1.82 deg S). Twelve (12) hours after deploying the EDM, the Orbiter executes a Retargeting Manoeuvre (ORM) to raise the pericentre of the incoming hyperbola and avoid collision with Mars followed by the Mars Orbit Insertion (MOI) taking it into a highly eccentric orbit with period of 4 sidereal days. At the second apocentre of the insertion orbit, 6 days after MOI, an inclination change manoeuvre (ICM) takes place to reach 74 deg, the target inclination of the science/relay orbit; at the next pericentre, 8 days after MOI, the Apocentre Lowering Manoeuvre (ALM) is performed in order to reduce the orbital period to 1-sol. Further reduction of the apoapses is then achieved by aerobraking over a period of several months, to reach the final science/relay circular orbit (altitude of 405 km) for detection, characterisation and source- localisation of the Mars atmospheric trace gases. The science mission will have to be interrupted for few days around 14 January 2019, to overview the arrival of the Rovers mission launched in 2018. After that, the science mission and the Rovers data relay mission will continue in parallel until, nominally, end of July 2019, followed by further relay operations up to the end of 2022 for the so called future ESA-NASA missions to Mars.