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

Author: Mr. Carlo Cassi
Thales Alenia Space Italia, Italy, carlo.cassi@thalesaleniaspace.com

Mr. Alberto Anselmi
Thales Alenia Space Italia, Italy, alberto.anselmi@thalesaleniaspace.com

EXOMARS MISSION REPLANNING FOR A 2016 LAUNCH

Abstract

The ESA ministerial conference in November 2008 confirmed ExoMars as the flagship European mission towards the red planet in the second decade of the 21st century. Demonstration of safe landing, Rover mobility and search for past and present traces of life make up a challenging set of objectives for European industry, led by Thales Alenia Space in the role of Prime Contractor. Startup difficulties of this pilot project for the exploration of Mars have recently led to reviewing the implementation plan: a Phase B2 extension is now foreseen to allow the Agency to explore possible international cooperation schemes, and the Prime Contractor to revise the system design in the new scenario. Meanwhile, Industry is carrying out an Interim-Preliminary Design Review to demonstrate the maturity of the earlier design baseline, the main features of which are expect to hold even in the new scenario. The nominal launch date is now 2016, with a backup opportunity in 2018. In the reference mission, in January 2016 an Ariane 5 vehicle launches the composite into a type 2 trajectory, featuring a large Deep Space Manoeuvre and reaching Mars in October 2016. That epoch falls at a time when Global Dust Storms are likely, and the GDS season will be waited out in Mars orbit. Shortly after the GDS season is over, a superior conjunction occurs. Only after this has elapsed, too, the first landing opportunity becomes available, at about 54 Mars solar longitude (August 2017). The landing window closes at about Ls 83 to allow 180 sol on the Mars surface before the next GDS season begins. The landing latitude can range from 5 South to 45 North; the final choice of the landing site will be made later, in consultation with the scientific community, compatibly with the DM engineering constraints. The selected waiting orbit has a period of 4 sol and a mean perigee of 500 km. Such orbit can incur long eclipses, and a special strategy has been devised which avoids eclipses longer than 3 hrs whatever the target latitude, at modest delta-v cost. At the time selected for landing, the carrier begins the de-orbit sequence, first by lowering the pericentre of the waiting orbit to 250 km. At one of the next apocentre passes, hence about two days before pericentre, a small braking manoeuvre is performed and the Composite is put into collision course with the planet. Two hours before reaching the altitude of 120 km (Entry Interface Point) the Composite is spun-up to 2.5 rpm and half an hour before EIP the DMC is separated. From then on a complex entry and descent phase starts, lasting approximately 6 minutes, at the end of which a Lander of 600 kg touches the Mars surface on a cushion filled with Helium. The Carrier goes on to be destroyed in the Mars atmosphere. This paper describes the consolidation of the Exomars enhanced baseline mission design and illustrates the design and development approach for a launch in 2016.