ExoMars 2016 Trace Gas Orbiter

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The ExoMars programme is a joint activity by the European Space Agency(ESA) and ROSCOSMOS, Russia. It consists of the ExoMars 2016 mission, launched 14 March 2016, with the Trace Gas Orbiter, TGO, and the Entry Descent and Landing Demonstrator, EDM, named Schiaparelli, and the ExoMars 2020 mission, to be launched in July 2020, carrying a lander and a rover.

The overarching objectives of the ExoMars programme can be divided into two branches, a scientific branch and an exploration branch. The scientific main objectives are: to search for signs of past and present life on Mars, to investigate the water/geochemical environment as a function of depth in the shallow sub-surface, to study martian atmospheric trace gases and their sources, and to characterise the surface environment. The exploration related objectives are: to develop and demonstrate technologies for future missions to Mars, including demonstrating Entry, Descent and Landing technologies, Rover surface mobility, drilling ,sample collection and sample handling and analysis. For the TGO the objectives are further refined and these are for science: search and characterisation of trace gases, their variability, their sources and sinks, and search/mapping and characterisation of subsurface water, and general characterisation of the surface with respect to regions of interest related to trace gasses and water. The main technology objective of TGO is to act as a relay orbiter for the ESA/ROSCOSMOS Rover and Surface station after arrival in 2021, and to support present and future NASA landers.

TGO and EDM arrived at Mars on 19 October 2016. After a nominal entry and first phase of the descent, the EDM failed at an altitude of about 4 km and fell freely to the surface, near the centre of the landing ellipse in Meridiani Planum. The communication link was maintained up until the failure and a large data set was acquired, allowing for a complete analysis of the first successful part of the mission and an investigation of the anomaly leading to the failure. The origin of the failure is now fully understood and is related to a higher than expected rate of motion at the time of the parachute deployment and the way how the system dealt with these data.

The TGO spacecraft was inserted into a near equatorial, highly elliptical 4 sol period capture orbit. Two orbits in late November were dedicated to instrument calibration and initial science observations, where an excellent performance of all instruments could be confirmed. In January 2017 the orbital plane was changed to its final inclination of 74 degrees and the period was reduced to one Sol. Early March an additional two orbits were scheduled for instrument tests and observations, after which a long period of aerobraking commenced. The final operational orbit, with a 2 hour period, is expected to be reached in April 2018.

The TGO scientific payload consists of four instruments. These are: ACS and NOMAD, both being spectrometers for atmospheric measurements in solar occultation mode and in nadir mode, CASSIS, a multichannel camera with stereo imaging capability, and FREND, an epithermal neutron detector for search of subsurface hydrogen. The mass of the TGO is 3700 kg, including fuel and the mass of EDM was 600 kg. The EDM was carried to Mars by the TGO and was separated three days before arrival at Mars.

This presentation will cover a brief description of the Trace Gas Orbiter mission, results from the initial activities since arrival at Mars, the present status of the aerobraking and a few scientific results derived from this, and the planned future activities.