

THE MARS EXPRESS MISSION – INITIAL SCIENTIFIC RESULTS FROM ORBIT

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The ESA *Mars Express* mission was successfully launched on 02 June 2003 from Baikonur, Kazakhstan, onboard a Russian Soyuz rocket with a Fregat upper stage. The mission comprises an orbiter spacecraft, which has been placed in a polar martian orbit, and the small Beagle-2 lander, due to land in Isidis Planitia but whose fate remains unknown. In addition to global studies of the surface, subsurface and atmosphere of Mars, with an unprecedented spatial and spectral resolution, the unifying theme of the mission is the search for water in its various states everywhere on the planet. *Mars Express* is the first European planetary mission ever.

The specific scientific objectives of the *Mars Express* orbiter are: global high-resolution imaging and imaging of selected areas with super-resolution, global infrared mineralogical mapping, sounding of the subsurface structure down to a few km, global atmospheric circulation study and mapping of the atmospheric composition, study of ozone, CO₂, H₂O and dust as main drivers of the climate, study of the interaction of the interplanetary medium with the upper atmosphere, as well as study of gravity anomalies and surface roughness with radio science.

The scientific payload on the *Mars Express* orbiter includes a Super/High-Resolution Stereo Colour Imager (HRSC), an IR Mineralogical Mapping Spectrometer (OMEGA), a Subsurface-Sounding Radar Altimeter (MARSIS), a Planetary Fourier Spectrometer (PFS), an UV and IR Atmospheric Spectrometer (SPICAM), an Energetic Neutral Atoms Analyser (ASPERA), and a Radio Science Experiment (MaRS). The mass of the orbiter instruments is about 110 kg.

Mars Express was captured into orbit on 25 December 2003 and was placed soon after in a highly elliptical martian orbit with closest approach of 250 km, orbit inclination of 86.35° and period of about 6.75 hours. The nominal orbiter lifetime of one martian year (687 days), following an almost seven-month cruise, is to be extended by another martian year to complete global coverage and observe all martian seasons twice. To fulfil its objectives, the *Mars Express* orbiter is 3-axis stabilized.

Following the spacecraft commissioning, the orbiter experiments began their commissioning in mid-January 2004 and started to acquire scientific data from Mars and its environment. The radar antennas will be deployed later in order to maximise early daylight operations of the other instruments, before the pericentre natural drift to the Southern latitudes. Thus, instrument operations will start their routine phase in early March and early April 2004 (without and with the radar, respectively). Already all experiments have acquired extraordinary and unexpected scientific data.

ESA has provided the launcher, the orbiter and the operations, while the instruments were provided by scientific institutions through their own funding. The ground segment includes the ESA station at Perth, Australia, and the mission operations centre at ESOC. The *Mars Express* Prime Contractor was Astrium in Toulouse, France, and a large number of European companies were involved as subcontractors. The ESA engineering and scientific teams are located at ESTEC.

International collaboration, either through the participation in instrument hardware or through scientific data analysis represents an important aspect of the mission to diversify the scope and enhance its scientific return. Collaboration with the NASA MER mission will play an important role, as the science goals of both missions are very much complementary to each other.

The European Space Agency has undertaken an ambitious planetary exploration programme aiming at Mars, the Moon, Titan, Venus, comet 67P/Churyumov-Gerasimenko and Mercury, with a series of missions arriving at their destination in the coming years (Mars Express in 2003, Smart-1 in 2004, Huygens in 2005, Venus Express in 2006, Rosetta in 2011 and BepiColombo in 2014, respectively).

Details on *Mars Express* and its initial scientific results are here: <http://sci.esa.int/marsexpress/>