MARS EXPRESS SCIENTIFIC OVERVIEW AFTER ONE MARTIAN YEAR IN ORBIT. A. Chicarro[1], [1]European Space Agency, Space Science Department, ESTEC/Code SCI-SB, Postbus 299, 2200 AG Noordwijk, The Netherlands (email: agustin.chicarro@esa.int).

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.

Following the Mars Express spacecraft commissioning in January 2004, most experiments onboard began their own calibration and testing phase already acquiring scientific data. This phase lasted until June 2004 when all the instruments started their routine operations. The MARSIS radar antennas, however, were deployed in May-June 2005, following comprehensive simulations of boom deployment and mitigation of potential risks, to benefit from nightime conditions required for subsurface sounding before the pericentre natural drift in latitude, when illumination conditions become favourable to the other instruments. Initial science results are summarised below.

The High-Resolution Stereo Colour Imager (HRSC) has shown breathtaking views of the planet, in particular of karstic regions near the Valles Marineris canyon (pointing to liquid water as the erosional agent responsible for modifying tectonic and impact features in the area) and of several large volcanoes (Olympus Mons caldera and glaciation features surrounding Hecates Tholus). The IR Mineralogical Mapping Spectrometer (OMEGA) has provided unprecedented maps of water ice and CO_2 ice occurrence in the South pole, showing where the two ices mix and where they do not. The Planetary Fourier Spectrometer (PFS) has confirmed the presence of methane for the first time, which would indicate current volcanic activity and/or biological processes. The UV and IR Atmospheric Spectrometer (SPICAM) has provided the first complete vertical profile of CO_2 density and temperature, and has simultaneously measured the distribution of water vapour and ozone. The Energetic Neutral Atoms Analyser (ASPERA) has identified the solar wind interaction with the upper atmosphere and has measured the properties of the planetary wind in the Mars tail. The Radio Science Experiment (MaRS) has studied for the first time the surface roughness by pointing the spacecraft high-gain antenna to the Martian surface, which reflects the signal before sending it to Earth. Also, the martian interior has been probed by studying the gravity anomalies affecting the orbit due to mass variations of the crust. Finally, preliminary results of the subsurface sounding radar (MARSIS) indicate strong echoes coming from the surface but lack of echoes under the young smooth Northern plains, which may indicate the presence of thick and homogeneous plains deposits.

Water is the unifying theme of the mission to be studied by all instruments using different techniques. Geological evidence, such as dry riverbeds, sediments and eroded features, indicates that water has played a major role in the early history of the planet. It is assumed that liquid water was present on the surface of Mars up to about 3.8 billion years (from crater counting relative ages), when the planet had a thicker atmosphere and a warmer climate. Afterwards, the atmosphere became much thinner and the climate much colder, the planet loosing much of its water in the process as liquid water cannot be sustained on the surface under present conditions. Mars Express aims to know why this drastic change occurred and where the water went. A precise inventory of existing water on the planet (in ice or liquid form mostly below ground) is important given its implications on the potential evolution of life on Mars, as the 3.8 b.y. age is precisely when life appeared on our own planet, which harbored similar conditions to Mars at that time. Thus, it is not unreasonable to imagine that life may also have emerged on Mars and possibly survive the intense UV solar radiation by remaining underground. The discovery of methane in the atmosphere could indicate just that or the presence of active volcanism. From previous orbital imagery, volcanoes on Mars were assumed to have been dormant for hundreds of millions of years. This idea needs a fresh look as the implications of currently active volcanism are profound in terms of thermal vents providing niches for potential ecosystems, as well as for the thermal history of the planet with the largest volcanoes in the Solar System. Mars Express is already hinting at a quantum leap in our understanding of the planet's geological evolution, to be complemented by the ground truth being provided by the American MER rovers.

The nominal lifetime of the orbiter spacecraft is of one Martian year (687 days), potentially to be extended by another Martian year to complete global coverage and observe all seasons twice. *Mars Express* is the first European mission to another planet. For details: **http://sci.esa.int/marsexpress/**