EARLY SCIENCE OPERATIONS AND RESULTS FROM THE ESA MARS EXPRESS MISSION: FOCUS ON IMAGING AND SPECTRAL MAPPING. P. D. Martin, T. Zegers, and R. Pischel, Research and Scientific Support Department, European Space Agency, ESTEC, Postbus 299, NL 2200 AG Noordwijk, The Netherlands; patrick.martin@rssd.esa.int.

Introduction: The Mars Express orbiter went into Mars orbit as planned on 25 December 2003 and has started delivering the first scientific measurements and results. High-resolution, down to nearly 10 m/pixel (HRSC) and 2 m/pixel (SRC), stereo color images are being processed following the preliminary data acquisition, as well as high-resolution spectral data from the OMEGA imaging spectrometer. Other instruments, PFS, SPICAM, and ASPERA are taking measurements as well in the early orbits of the Mars Express mission, and radio science data are being collected using both ESA New Norcia and NASA DSN ground stations. The status of the mission is briefly given below, followed by a description of the scientific goals and planning focused on the imaging and mapping spectrometer data.

Mission Status: After a successful launch on 2 June 2003 from Baikonur, Kazakhstan, the Mars Express spacecraft was inserted into orbit around Mars on 25 December 2003. Several manoeuvres were then performed using again the spacecraft main engine (plane turn manoeuvre and apocentre reductions) and several other manoeuvres will be performed (using thrusters) until the mapping orbit is reached on 28 January 2004.

The Beagle-2 lander was separated from the Mars Express orbiter on 19 December and is assumed to have landed in Isidis Planitia on 25 December. However, attempts to communicate with the lander have so far been unsuccessful.

Meanwhile, the orbiter scientific payload commissioning has started. During this early phase dedicated to instrument checkout and calibration, images and spectral measurements of the planet are being acquired. The radio science experiment is also obtaining data of significant importance. The MARSIS radar, which is scheduled for deployment at the end of April 2004, is conducting further checkout activities. The early orbits of Mars Express (until mid-February 2004) constitute the best opportunity for optimized observing conditions (illumination, targets of interest, distance to the Sun, lack of eclipses) and therefore maximum science return.

Scientific Goals and Planning: The main scientific objectives of the Mars Express mission are listed in [1]. The essential characteristics of the high-resolution stereo and color camera (HRSC), its super resolution channel (SRC), and the OMEGA mapping spectrometer are given in [2, 3, 4]. The aim of these two instruments onboard Mars Express is to perform detailed surface investigations using high-resolution imaging and mineralogical detection and mapping. In achieving the global coverage objectives set for the mission, and in obtaining high-resolution measurements of a number of carefully selected targets of geologic interest, these investigations will play an essential role in the study of the Martian surface geology, composition and evolution.

Important scientific objectives of these investigations are:

- To better understand and constrain the geologic processes that created and modified rocks and soils on the planet.
- To provide additional essential information and clarify the debate about the detection, presence, abundance, and mixing degrees of surface constituents such as oxides, hydrates, silicates, clays, frosts, carbonates, sulfates, and palagonitic-like materials.
- To decorrelate the respective contributions of the soil, dust and atmosphere.
- To update the models of evolution of the Martian surface, in relation with the geologic timescales.

The early scientific planning of the HRSC and OMEGA data is driven by the opportunity to take images and spectral measurements of a number of areas of interest under excellent observing conditions. Later on, once the final mapping orbit is achieved, the focus will be extended to global coverage, image mosaic construction, and high-resolution imaging and spectral mapping of local surface targets. Figure 1a and 1b gives an overview of the ground tracks to be covered by the planned targeted observations of the two instruments before reaching the selected mapping orbit. These observations take place in general near pericentre and cover a variety of essential Martian surface features and targets of interest such as volcanic terrains (e.g., orbits 16, 32, 37, 49, 56), chaotic terrains near Valles Marineris (e.g., orbit 18), Isidis Planitia with the Beagle-2 landing site (orbit 8, 22, 38, 41, 47), and the Spirit landing site (Gusev Crater; orbit 24).

Preliminary Science Results: Stereo and color images, multi-/hyper-spectral visible and near-infrared data sets, and UV-infrared spectra are being acquired and delivered by the HRSC/SRC, OMEGA, PFS and SPICAM instruments onboard the orbiter. This first Mars Express scientific data represents among the highest spatial and spectral resolutions ever achieved and returned from Mars orbit.

The first HRSC (11-12 m/pixel) and OMEGA data sets already bring important information about the Martian surface features, in particular chaotic regions, outflow channels, the crustal dichotomy boundary, the volcanoes. The Mars Express mission has successfully started its scientific programme, which will complement previous data and results dealing with surface mineralogy and rock and soil compositional variations, the nature of volcanic surface materials, the occurrence of aqueous mineralization, dust transport and accumulation processes, and geologic and climatic processes.

[1] P. D. Martin et al. (2001) LPS XXXII, Abstract # 1575. [2] G. Neukum et al. (2000) LPS XXXI, Abstract # 1906. [3] Puget et al. (1995) Proc. SPIE, 2583, 323. [4] P. Martin (2003) LPS XXXIV, Abstract # 1648.

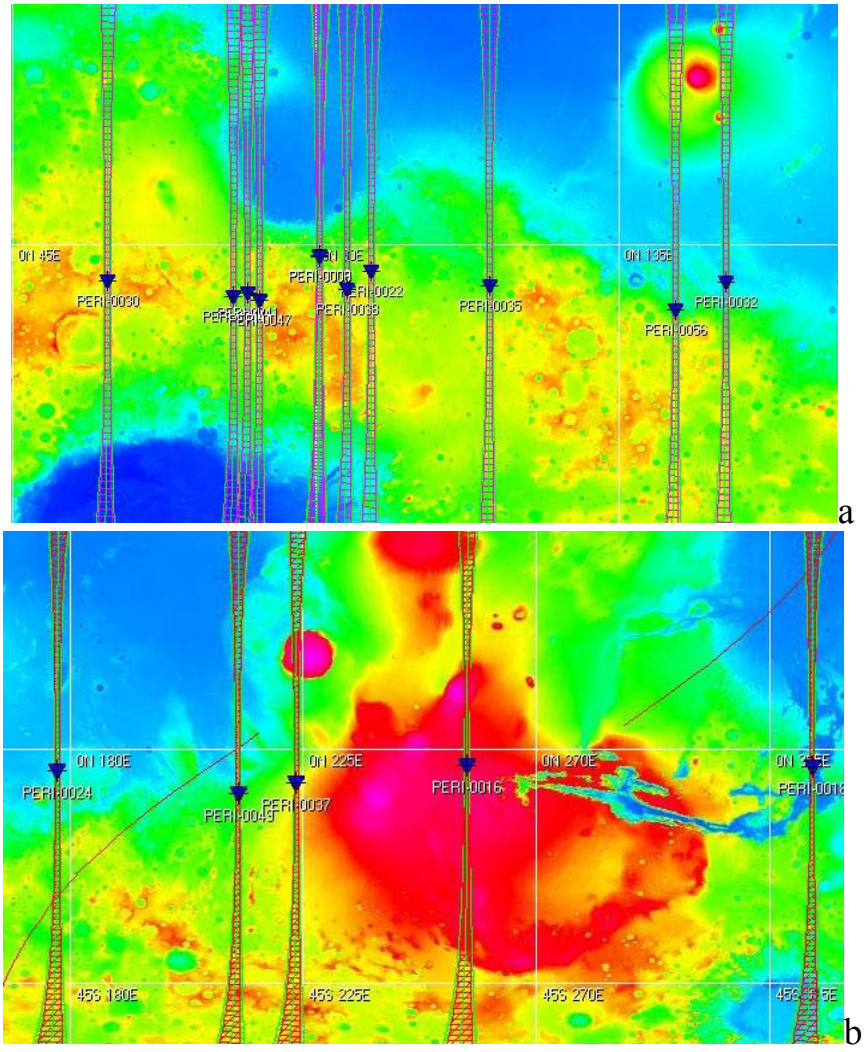

Figure 1a and 1b: Examples of early orbits covered by the Mars Express orbiter instruments HRSC/SRC and OMEGA, overlaid on a MOLA topographic map. Triangle-shaped icons feature the pericentre passage.