TARGETING MARS - THE MARS EXPRESS SCIENCE PLANNING AND OPERATIONS. R. Pischel[1,2] and T. Zegers[2], H. Hoffmann[1], E. Hauber[1], V. Mertens[1], T. Roatsch[1], R. Jaumann[1], K.-D. Matz[1], V. Companys[1], M. Lauer[3], M. Denis[3], A. Moorhouse[3], E. Rabenau[5], M. Ricketts[4]; [1]Deutsches Zentrum für Luft- und Raumfahrt (DLR), German Aerospoce Center, Institute of Planetary Research; Rutherfordstr. 2, 12489 Berlin, Germany; (rene.pischel@dlr.de), [2]ESTEC, Keplerlaan 1, Postbus 229, 2200 AZ Noordwijk, The Netherlands; (tzegers@rssd.esa.int), [3]ESOC, Robert Bosch Strasse 5, 64293 Darmstadt, Germany, [4]Rutherford Appleton Laboratories, Chilton, Didcot, Oxfordshire OX11 OQX, UK, [5]NOVA Space Associates Ltd, 11 Kingsmead Square, Bath, BA1 2AB, UK

Introduction: The European Mars Express mission arrived at its elliptical orbit around Mars in January 2004. Since then the Red planet has been circled by the orbiter more than 1200 times and the 6 orbiter instruments have observed the Martian surface and atmosphere under various conditions. The paper describes the complex process of planning the science operations for Mars Express. This process is explained using the example of the High Resolution Stereo Camera (HRSC) and highlighting the question of how the accuracy of imaging specific targets is maintained from the planning step to the actual execution of spacecraft pointings.

Europe at Mars: The European Mars Express mission is ESA's first planetary project. Since the beginning of payload operations at Mars in January 2004 the Mars Express spacecraft has been orbiting around the planet more than 1200 times and conducting more than 600 science observations. Routine operations started in June 2004 after all orbiter instruments had demonstrated their excellent science performance during a four months commissioning period.

The planning of science operations for the ESA Mars Express is challenging in terms of complexity, reliability, and flexibility. The challenge comes mainly from the diversity of instrument objectives as well as from the main mission goal of achieving global observations for a broad variety of targets (surface, atmosphere)

Frozen Orbit: There are several methods in the planning and in the operations which foster an optimum science return. One of the key elements for planning is the "frozen orbit" concept warranting a highly accurate long-term orbit predict and thus a detailed long- to mid-term planning cycle. The orbit was designed in such a way that adjacent images overlap assuming a nominal nadir pointing of the spacecraft. In addition, many payload requests ask for specific spacecraft pointings like off-track pointing or inertial pointings for star occultations, dedicated Mars observations and Phobos imaging. For all these observations a highly accurate pointing of the spacecraft is a key prerequisite for fulfilling the instruments' scientific objectives, in particular for the HRSC with a pixel size of 8 arscec and 2 arcsec for its super resolution channel. The paper shows how observations are planned with emphasis on the accuracy of the information used in the planning cycle and describes which "targeting" accuracy has been actually achieved by analyzing HRSC images.

References:

[1] Pischel, R.; Jaumann, R.; Behnke, T., Neukum, G., de Niem, D., Hoffmann, H, (2001), *26. EGS* The Application of the High Resolution Camera's (HRSC) Super Resolution Channel for Imaging Landing Sites on Mars, 26. EGS General Assembly, Nice, Proceedings

[2] Pischel, R., 2002, From Mars to Earth: The development of a high resolution sensor system, Laser and optics conference, Berlin, 2002, proceedings

[3] Rabenau R., Peschke, S, (2004) Space ops conference, Experience Gained with a Mission Planning System for a Mission to Mars