

SPACE EXPLORATION SYMPOSIUM (A3)
Solar System Exploration (5)

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BEPICOLOMBO SCIENCE OPERATIONS VALIDATION DURING SPACECRAFT TEST PROGRAM

Abstract

BepiColombo is an Interdisciplinary Cornerstone Mission to the planet Mercury; it is a collaboration between the European Space Agency (ESA) and the Japanese Aerospace Exploration Agency (JAXA) of Japan. The mission consists of two orbiters dedicated to the detailed study of the planet and of its magnetosphere, the Mercury Planetary Orbiter (MPO) and the Mercury Magnetospheric Orbiter (MMO).

The MPO is ESA's scientific contribution to the mission. It is a three-axis-stabilized, nadir-pointing spacecraft which will be placed in a polar orbit with a period of approximately 2.3 hours, a periapsis of 400 km and an apoapsis of 1508 km, providing excellent spatial resolution over the entire planet surface.

The BepiColombo Science Ground Segment (SGS), located in Madrid, Spain, will coordinate the planning of the scientific operations. A Science Activity Plan (SAP) has been developed for the payload operations in the nominal mission, based on analysis of the different observation conditions around Mercury. The MPO is currently under test on a representative prototype, called Engineering Test Bench (ETB) in preparation of the MPO Flight Model (FM) test program, covering the final spacecraft and payload configuration. These tests cover, besides mechanical/environmental tests, platform and payload operations and functional verification (Electrical Interfaces, Telemetry/Tele-command, Hardware/Software interaction).

Although traditionally the science operations preparations have been separated from the spacecraft test program, on BepiColombo it has been possible to incorporate science operations planning at an early stage. By integrating SGS resources and knowledge for the test planning and definition, more realistic payload science operations scenarios have been executed, providing a more valuable output of the test. In addition, through SGS coordination of the payload teams, streamlined inputs were provided to the test program leveraging existing SGS software tools from missions in-flight (Mars Express, Venus Express and Rosetta). Through this involvement, the SGS acquired practical information on spacecraft operations, providing them with a strong knowledgebase for planning realistic operations at Mercury.

In this paper an overview of the science operations for BepiColombo are presented. It is explained how these science operations were adapted for the spacecraft test program and how the integration of the SGS at an early stage into the test program resulted in added value for the BepiColombo program as a whole. It also addresses the future challenges of this approach in the spacecraft Flight Model development.