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## BEPICOLOMBO MISSION TO MERCURY: FIRST YEAR OF FLIGHT

**Abstract**

BepiColombo is an ESA cornerstone mission to Mercury in collaboration with the Japan Aerospace Exploration Agency (JAXA). The two scientific orbiters –ESA’s Mercury Planetary Orbiter (MPO) and JAXA’s MIO orbiter– were launched together in October 2018 as a single composite spacecraft, including a module with electric propulsion to support the 7-years cruise phase with planetary flybys at Earth (1x), Venus (2x) and Mercury (6x). Flight operations of the composite spacecraft are performed by ESOC Darmstadt, Germany.

The BepiColombo spacecraft and mission design result in a number of challenges for operations in cruise, including the following:

- Solar electric propulsion is used during cruise in 21 “thrust arcs”, i.e. periods when electric propulsion is used continuously to adjust the trajectory. Thrust arcs can last from several days up to 2 months. The electric propulsion system employs 4 gridded ion thrusters mounted on pointing mechanisms, allowing single and dual thruster operations. The power demand of up to 11kW is supplied by the cruise module’s large solar arrays (30m span).
- Spacecraft modularity, with the configuration changing significantly throughout the mission. Module separation operations upon Mercury arrival are among the most critical activities of the mission.
- The harsh thermal environment at Mercury and during most of the cruise phase leads to strict attitude and pointing constraints, also requiring a hot redundancy approach to guarantee attitude control during transient outage of the main on-board computer.
- Despite approaching the Sun, the mission is highly power-constrained. Below 0.62 AU Sun distance, the solar arrays have to be offpointed to avoid overheating. The available power drives the commanded electric propulsion thrust levels, in turn affecting the trajectory. This requires a complex planning process to get the most of the system, de-risking the thrust arcs as much as possible.

Following launch on 20th Oct 2018, near-Earth commissioning took place until mid December. Following a stepwise commissioning of the electric propulsion system, the first thrust arc started in late 2018 and is set to complete in early March 2019, with a second thrust arc planned from September to November 2019. Thereafter, preparations will start for swingby at the Earth in April 2020.

Starting with a mission overview, the paper will present the operations in the first year of flight, the current status of BepiColombo, as well as providing an outlook on upcoming activities and events.