



BepiColombo MPO Data Handling & Archiving Operations Concept



F. Pérez-López¹, S. Martínez¹, A. Macfarlane², P. Osuna², M. Casale¹

¹ BepiColombo MPO Science Ground Segment (SGS),

² ESA Science Archives Team (SAT),
European Space Astronomy Center (ESAC), Madrid, Spain

Introduction

BepiColombo is an interdisciplinary ESA mission to explore the planet Mercury in cooperation with the Japan Aerospace Exploration Agency (JAXA). The mission consists of two separate Mercury orbiters: ESA's Mercury Planetary Orbiter (MPO) and JAXA's Mercury Magnetospheric Orbiter (MMO), which are dedicated to the detailed study of the planet and its magnetosphere.



MPO Scientific Payload

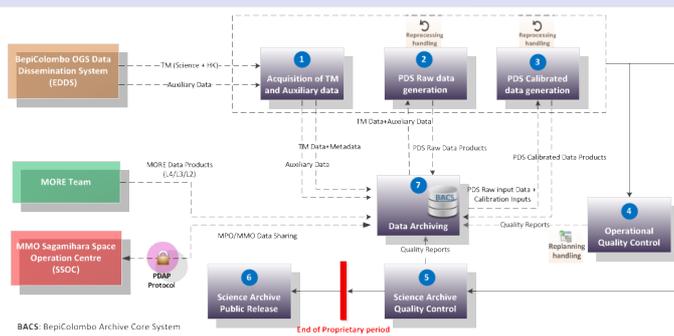
- BepiColombo Laser Altimeter (BELA)
- Italian Spring Accelerometer (ISA)
- Mercury Thermal Infrared Imaging Spectrometer (MERTIS)
- Mercury Gamma-Ray and Neutron Spectrometer (MGNS)
- Mercury Imaging X-ray Spectrometer (MIXS)
- Mercury Orbiter Radio Science Experiment (MORE)
- Mercury Magnetometer (MPO-MAG)
- Probing of Hermean Exosphere by Ultraviolet Spectroscopy (PHEBUS)
- Search for Exospheric Refilling and Emitted Natural Abundances (SERENA)
- Solar Intensity X-ray and particle Spectrometer (SIXS)
- Spectrometers and Imagers for MPO BepiColombo Integrated Observatory System (SIMBIO-SYS)

The Data Handling and Archiving (DHA) operations concept was presented in November 2012, to the MPO instrument teams and will be implemented by the BepiColombo MPO Science Ground Segment (SGS) and the ESA Science Archives Team in coordination with the MPO Instrument Teams.

The DHA Operations Concept covers the different processing options chosen by the MPO instrument teams being compatible with the archiving procedures and the existing data standards (e.g. NASA's Planetary Data System). It describes an efficient operational quality control on the generated science products that will be used as input for rescheduling observations in the next science planning cycles or for early detection of pipeline bugs and data errors.

It also describes the archiving concept by including a central archive (BepiColombo Archive Core System, BACS) which stores all mission data (science operations information and also all science data products) which will be used operationally and will evolve during the mission from launch to long term archiving.

DHA Operations Concept Description

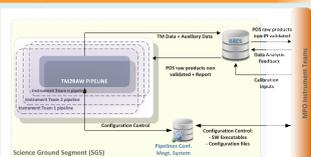


Step 1: Acquisition of Data



- Executed immediately after availability of data in the BepiColombo EDDS
- The objective is the acquisition and pre-processing of telemetry and finally the storage in the BACS.

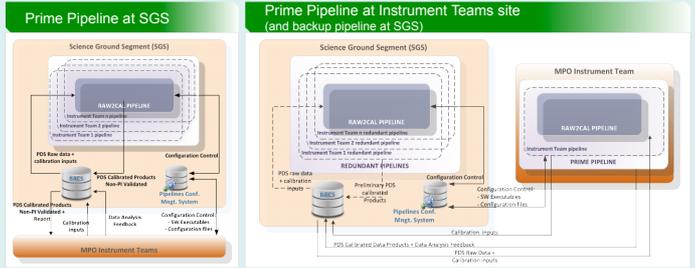
Step 2: PDS Raw Data Generation



- PDS Raw products for instruments are systematically generated by the SGS (using SW provided by the teams) once new telemetry becomes available in the BACS.
- Generated raw products will be stored in the BACS and distributed to the science team for further processing

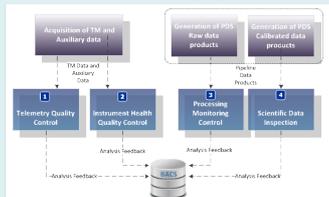
Step 3: PDS Calibrated Data Generation

PDS calibrated products are generated using PDS raw data, calibration files and additional data needed as input data. Two possibilities:



Step 4: Operational Quality Control

To evaluate deviations from expected results. There are various types of operational quality control processes to be performed at different concept steps:



Step 5: Science Archive Quality Control

- This process includes an independent peer-review to assess the completeness and scientific usability of the long-term science products stored.
- Products to be peer-reviewed will be flagged in the BACS as "ready for peer-review" (after Instrument Team's confirmation) and as "successfully peer reviewed" once the process finished.

Step 6: Science Archive Public Release

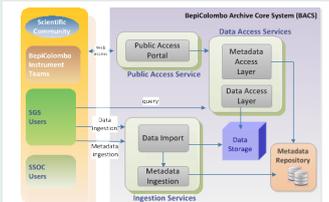
- MPO instrument teams are granted a proprietary period of 6 months for the products generation/validation/analysis. After this, science products could be made public.

and ...

- The DHA concept includes also details about:
 - Radio Science Data Archiving: MORE team will produce the products and will provide them to SGS for BACS ingestion.
 - MMO science data exchange: Access to MMO science data, raw and calibrated will be possible by using the IPDA Planetary Data Access Protocol (PDAP).

Step 7: Data Archiving

The BACS functionalities can be broken down into the following core services:



- Data/Metadata Ingestion by Instrument Teams will be provided through the SGS
- The BACS science data products forms part of the ESA's Planetary Science Archive (PSA).

Conclusions

- The DHA operations concept presents a highly integrated system used from planning to generation and distribution of science products. It will allow timely access to data for re-planning purposes.
- The integration of the archiving steps into the data flow will guarantee that products distributed to the teams for analysis during the nominal mission will be the products available in the long term archive.
- This concept will allow all complex processing, analysis, human interactions and decision steps to be captured in the long-term archive for analysis.

Acknowledgements

The authors would like to thank the BepiColombo SGS team, the DHA Working Group (DHAWG), the PSA-DH and SAT members for their time and for their valuable comments in all the DHA concept analysis discussions.

Contact Info

Fernando Pérez López
Phone: +34 91 8131 203
Fernando.Perez-Lopez@esa.int
European Space Astronomy Center (ESAC),
P.O. Box 78, 28691
Villanueva de la Cañada, Madrid, Spain

