SCIENCE DATA PROCESSING, QUICK-LOOK ANALYSIS AND ARCHIVING APPROACH FOR ESA'S PLANETARY MISSIONS

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Introduction:

The data processing, quick-look analysis and archiving approach for ESA's planetary missions is evolving towards a very strategic concept with a clear focus in getting science data with the highest-quality possible into the archive and in promoting the exploitation of all mission data by the science team and the scientific community in a very open and collaborative manner over the entire mission to maximise the scientific results. This strategy, with a stronger ESA involvement in the data processing and archiving workflow, involves a number of challenges and requires a very close and productive cooperation with the PI teams.

Details:

This contribution will describe the functionalities of the science operations downlink system developed for the BepiColombo mission [1] (launched in 2018 and scheduled for arrival at Mercury in 2025) and how these functionalities are being adapted to the next ESA large-class planetary mission, JUICE (scheduled for launch in 2022 and with a very exciting cruise phase prior to arrival at the Jupiter system in 2031).

The main functionalities of the downlink system are listed below:

- Data Acquisition, Storage & Dissemination
- Parameter Storage & Dissemination
- Data Processing [2]
- Quick-Look Analysis [3]
- Monitoring & Control
- Data Distribution
- Archiving [4]

Due to the modular design/architecture of this downlink system and the commonalities on the science operations downlink requirements of ESA's planetary missions, it is straightforward to identify and isolate the SOC downlink system components to be reused for future missions. In addition, the system has evolved into a service-based architecture, offering several advantages towards reusability (namely better scalability, better decoupling, and better control over development, testing, and deployment). The possibility to reuse software, interfaces, processes and infrastructure, as well as knowledge, offers a significant advantage and cost-effective solution not only to ESA but also to the PI teams in our planetary community.

The BepiColombo downlink system is in operation since launch (2018) and its functionalities have been incrementally added, validated and exercised during the Cruise phase in preparation for the nominal mission (2026). The flybys are unique opportunities to exercise and consolidate the downlink system capabilities, and to evolve the system based on the feedback from the science team. Continuous interactions between the science users and the development team are very important to align the system with the mission needs as it evolves and to foster creativity and innovation when looking for solutions.

The science operations downlink system is currently being enhanced with a monitoring & control service aiming at streamlining the downlink operations to increase the efficiency during the nominal mission, and allowing the SOC and the science team to focus all the efforts on the validation, analysis and interpretation of the science data. Capturing any relevant information during the planning process and the post-analysis of the executed observations is also key to understand the full context and ensure a good understanding of the acquired data.

Building on the experience from previous missions, and on the lessons learned during the development and Cruise operations for BepiColombo, the existing downlink system is aiming at providing a very ambitious but robust and efficient solution for future planetary missions.

References:

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