SPACE OPERATIONS SYMPOSIUM (B6)
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ISS FSL GROUND SOFTWARE INTERFACE - UNLEASHING THE YAMCS TOOL SUITE

Abstract

Yamcs (Yet Another Mission Control System, https://github.com/yamcs/yamcs) is a cost-efficient Mission Control System that is lightweight, configurable, reliable, robust, scalable and not hardware dependent. This free, open-source mission control system has been developed by Space Applications Services in collaboration with the B.USOC (Belgian User Support and Operations Centre) and has been operational for more than 8 years for a variety of ESA payloads (SOLAR, PCDF, EUTEF, EDR). Throughout the years an open source tool suite has been gradually added to Yamcs to offer a complete end-to-end Mission Control System solution, including easy Display development (Yamcs Studio), interfacing to external applications via the Yamcs API, automated monitoring with remote notification (TYNA The Yamcs Notification Add-on), integration with SES's SPELL (Satellite Procedure Execution Language and Library).

Recently the responsibility for the ESA FSL (Fluid Science Laboratory) on-board the European Columbus module of the ISS has been transferred to the B.USOC which identified the need for a new mission control system to complement the ESA Columbus Decentralized Mission Control System (CD-MCS) and suitable to support the complex FSL operations. In this context, Yamcs and its new tool suite has been deployed to fulfill the B.USOC needs, including:

- Reception of CCSDS packet flight telemetry, ground and flight Processed Parameters.

- Flexible editing of displays, Mission Data Base and event definitions to support the successive FSL Experiment Containers and upgraded FSL sub-systems.

- Replay and export of archived data for operations and anomaly analysis.

- Forward of data to end users outside the control centre (typically Principal Investigators).

- Step by step scripted telecommanding, enabling the concept of telescience with FSL, yet providing full control to the Operators, in line with the ESA Columbus operations concept.

This is the first validation and operational deployment of the complete end-to-end Yamcs Tool Suite. This first deployment is called the FSL Ground Software Interface.

This paper describes the User Support and Operations Centre's needs and explains how the components of the open source Yamcs solution respond to these challenges. It concludes by describing the new features provided to the payload Operators allowing them to fully exploit all capabilities of complex operations, such as for the FSL laboratory on the ISS, and obtain a maximum of science return and troubleshooting capabilities, as well as the lessons learned from the FSL experience for future missions.