SPACE OPERATIONS SYMPOSIUM (B6)
New Operations Concepts and Commercial Space Operations (2)

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EFFICIENT OPERATION CONCEPT VALIDATION USING THE GROUND SYSTEMS TEST AND VALIDATION INFRASTRUCTURE (GSTVI)

Abstract

The ESA Ground Systems Test and Validation Infrastructure (GSTVi) is an off-the-shelf efficient system that enables assembly, integration and verification tests for the ground segment. The system provides a set of simulation models which can be customised for specific missions and allow simulation of the complete telecommand and telemetry chain from the Mission Control System (MCS) to the spacecraft and vice versa.

In the early phases of new missions, there is often the need to have a system, with limited effort and investment, the validation and checking of the suitability of innovative operation concepts, new technologies and protocols.

In this context, GSTVi can provide, with limited modification, a system to set-up robust communication architecture, establish operation concepts and systems, and choose the best suited protocols. The following features of GSTVi are of particular interest for this use case:

- Implementation of the standard CCSDS telemetry and telecommand protocols used on ground and on the spacelink.
- Communication with external systems via Delay Tolerant Network protocol. The GSTVi system integrates a DTN node, can communicate with external systems via DTN, and also allows using DTN over a simulated spacelink.
- Provision of a simple robust Mission Control System.
- Provision of a highly configurable model of a Packet Utilisation Standard (PUS) based spacecraft that can be extended to simulate specific spacecraft or robots.
- Generic system easily configurable and extensible for mission specific needs.
- Robust and clear architecture allowing easy addition of new function.
- Integrated system with easy deployment and configuration.
- Remote monitoring and control.

In addition, the GSTVi system provides a large number of specific functions to perform non nominal operations, and easy modification of the visibility, bit rates and delays on the various communication channels (including up and down link) to check the impact on operations.

Additional functions are foreseen for the GSTVi system to support file based operations, file transfer via the CFDP protocol, display of retrieved videos (video streaming), image viewer for images taken by an orbiter or a robot, control of a robot from the MCS model via a specific command panel.

In conclusion, GSTVi is a very powerful system already allowing plug-and-play of components and protocols and allowing validation of realistic operations. GSTVi can be used to exploit and investigate infrastructure, technologies and operation concepts for all new coming missions, and to later train the spacecraft operators on a realistic system.