

## **The Gaia Real-time Simulator (RTS) and Avionics SCOE**

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In this paper the real-time simulator (RTS) and Avionics SCOE for Gaia are presented. For these developments elements of Astrium's SimTG have been integrated in a EuroSim-based system which also inherits many aspects from the Herschel-Planck SCOEs.

The purpose of the Gaia Real-time Simulator (RTS), developed together with Terma, is to support the following activities:

- Central software (CSW) validation and debugging. The RTS acts as Software Validation Facility (SVF).
- Spacecraft Operations engineering. The RTS acts as Operation Validation Facility (OVF).
- AIT preparation. The RTS acts as Simulator AIT (SimAIT).
- Avionics AIT. The RTS is part of the Avionics Model (AVM).
- Spacecraft PFM AIT. The RTS is part of the Spacecraft PFM AIT bench (S/C PFM).

To this end two configurations for the RTS are foreseen: the RTS numerical bench, used for the SVF, OVF and SimAIT configurations, and the RTS hybrid bench, used for the AVM and S/C PFM configurations.

In the numerical bench, the CSW is executed on an environment, provided by the RTS, that simulates the behaviour of the on-board computer (CDMU). This CDMU Simulator consists of an ERC32 processor emulator, the Emulator Interface layer, and the simulated CDMU Model layer. The CDMU Simulator interfaces with the so-called Simulated Spacecraft model layer, which simulates S/C units, thermal behaviour, dynamics, and environment. All models, including the ERC32 emulation, are fully embedded inside EuroSim.

In the hybrid bench, the CSW is executed on the real CDMU which interfaces, via the Avionics SCOE and the EGSE Interface layer with the Simulated Spacecraft model layer of the RTS. In addition, for the hybrid bench configuration, individual S/C unit models can be replaced by real equipment, in which case it may be required for the Simulated Spacecraft model layer to supply stimuli to the appropriate equipment SCOE.

The Avionics SCOE is the EGSE equipment that will be used for the assembly, integration and test of the Gaia Avionics and its subsystems. Its main function is to implement the electrical interface functions needed to support the verification of the spacecraft avionics. The SCOE will provide hard real time access to discrete, MIL1553, SpaceWire and PacketWire spacecraft interfaces. In closed loop configuration the RTS performs interface acquisitions and commands stimuli updates via the reflective memory Real Time Network connecting the RTS and the SCOE. In open loop configuration responder models are used to monitor spacecraft interface data and to generate predefined stimuli scenarios. The SCOE and RTS equipment will be combined with other EGSE subsystems to become an integrated part of the Gaia test benches used during AVM and PFM AIT.