AS250 Core Avionics Hardware in the loop Demonstration using fast prototyping technologies

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In 2008, Astrium Satellite decided to start the development of a new avionics for Low Earth Orbit missions called AstroSat 250 (AS250). This avionics features several new technologies among which a new avionics based notably on a LEON3-based computer, on a new generation Star Tracker from EADS SODERN and an AOCS mode based on CMG actuators.

In the frame of AS250 it was decided to initiate a Core Avionics Demonstrator (CAD) activity in order to demonstrate early in the development cycle the new AOCS mode and the new related avionics components with Hardware-in-the-loop (HIL) tests. In order to be able to set up this CAD testing activity at the right time and with reasonable demonstration costs, the decision was taken to resort to prototyping technologies that will enable to output flight software components and tests bench components on top of or linked with more classical elements.

Indeed, the unique feature of this CAD activity is to test an AOCS mode implemented on the flight software V0 (DHS, interface with the computer) running on a representative computer board and connected to the computer, star tracker and CMG front-ends.

The AOCS mode is designed and implemented using the Matlab-Simulink-RTW set of tools, with the resulting autocoded software being implemented on top of a V0 version having been tested as the first version of the future AS250 flight software.

The test bench is based on in-house real-time simulations kernel and scheduler, and embeds some AOCS functional core models for equipments and environment. These models were also developed using autocoding from Matlab-Simulink-RTW environment, featuring a direct link with the models used in the AOCS closed loop simulations. Its unique feature is its capability to incorporate the Astrium LEON3 computer and the in-house 1553 drivers, whilst offering the direct coupling of the models and of the environment real time simulator.

The presentation will address in details:

- The methodology used to design, develop and assemble the HIL test bench and how the new technologies have enabled to get rapidly a successful closed loop simulation in a representative dedicated HIL environment.
- The benefits of this new approach in the global AS250 functional validation process for initial design and development, and for further potential evolutions of the AS250 avionics.
- The perspective for the further use of such new technologies/ approaches as auto-coding, AOCS-software co-engineering process and model-based test bench development.