

SPACE SYSTEMS SYMPOSIUM (D1)  
Space Systems Architectures (4)

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SATSIM - A REAL-TIME MULTI-SATELLITE SIMULATOR FOR TEST AND VALIDATION IN  
FORMATION FLYING PROJECTS

**Abstract**

**Purpose:** The Satellite simulator SATSIM was developed during the experimental PRISMA multi-satellite formation flying project, primarily to validate the GNC and OBSW in a simulated environment. The SATSIM system has as main features the ability to simulate sensors and actuators, spacecraft dynamics, RTUs, environmental disturbances, solar illumination conditions, solar and lunar blinding etc.

**Methodology:** The core of SATSIM is the Matlab/Simulink models of the hardware of the spacecrafts and space environment running on a separate PC that in the simplest scenario may be connected to Satellite Controller Boards through e.g. a CAN data bus. Each controller board is in this setup running the onboard software that is to be tested and validated. SATSIM is able, in conjunction with the RAMSES Test and Verification system, to perform open-loop, hardware-in-the-loop as well as full-fledged closed-loop tests by utilizing PUSIMs (Platform Unit Simulators). SATSIM does in the closed-loop tests, which are executed with complete flight model spacecrafts, send simulated sensor signals to the PUSIMs. The PUSIMs take these simulated sensor signals and generate the real analog signals to the spacecraft sensors, through a test port interface or directly to the interface electronics bypassing the real sensors. SATSIM can hence together with RAMSES be used in a wide variety of test and verification scenarios.

**Results:** The PRISMA project is at its conclusion and the satellites are at writing moment due for launch in April 2010. The SATSIM platform has been successfully used through all the test and validation phases of the PRISMA spacecrafts, and will also be used operationally to verify and validate procedures and experiments before they are uploaded and executed onboard.

**Conclusions:** The SATSIM platform can be used throughout a multi-satellite project, from early test of OBSW running on Satellite Controller Boards in a lab environment, to full-fledged closed-loop tests of satellite flight models. SATSIM can also be used during the operational phase, as in the PRISMA project, to validate and verify procedures before they are uploaded to the real spacecrafts. SATSIM can in conjunction with RAMSES with small effort be adapted for future multi-satellite projects, by defining new project specific Matlab/Simulink spacecraft models and RAMSES mission databases.