

SPACE SYSTEMS SYMPOSIUM (D1)
System Engineering - Methods, Processes and Tools (2) (6)

Author: Dr. Yaseen Zaidi
Cape Peninsula University of Technology (CPUT), South Africa

Dr. Norman Fitz-Coy
University of Florida, United States
Prof. Robert Van Zyl
Cape Peninsula University of Technology (CPUT), South Africa

RAPID, AUTOMATED TEST, VERIFICATION AND VALIDATION FOR CUBESATS

Abstract

CubeSat development is characterized by decisions in mission objectives, system requirements, payload/bus configurations and launcher selection that are often revised late in the engineering cycle. In order to accelerate the development and to readily adjust to the project dynamics, the French South African Institute of Technology through a systems engineering approach, is proceeding to develop a mission assurance facility.

The facility is envisioned for cutting the engineering cycle by overlapping the iterative phases of design, development, verification and environmental validation, as soon as the prototypes are available. Functional testing of assembled and integrated hardware and software units can be performed rapidly, and thereafter subjected to environmental qualification. The facility is conceived to achieve high coverage of design verification. From the success and the lessons learned through the ZACUBE-1 mission, the expertise and legacy equipment are being re-used to piece together a test automation set-up in a phased way. This approach is adopted to avoid a hefty and immediate one-time investment. In the meantime, technical needs analyses are under way for the procurement of the remaining elements that will upgrade the facility to full compliance toward space level qualification. The priority of qualification is on mechanical loads and thermal cycling loads in vacuum.

The main elements of qualification automation are the "Missurance" software suite and an instrumentation bus hosting a variety of physical layer interfaces and communication protocols. The usability, expandability and the re-configurability of the networked test apparatus in the automation set-up are emphasized. Missurance is built around an integrated development platform with libraries for measurement, analysis and User Interface designs. The core of Missurance is real-time module that ensures reliability and determinism in the electrical measurements. Missurance is a modular architecture that has product, test suite and Automated Test Equipment centric views. Depending on the user requirements, test applications can be configured to a specific product or test, or simply an ATE. Missurance may also be re-built for limited applicability, e.g., testing a suitcase model, automation of the Electrical Ground Support Equipment or in situ verification of the satellite in the launch vehicle. Due to the variety of interfaces in the ATE, the bus supports high accessibility of the measurements: IEEE-488B/GPIB, USB, LAN/TCP, UART and RS-232.

The concept and initial establishment of the facility are presented, followed by a demonstration of the automated qualification of an S-Band transmitter and a telemetry and command radio.