SPACE PROPULSION SYMPOSIUM (C4)
Interactive Presentations (IP)

Author: Mr. Jacob Herscovitz
RAFAEL, Israel

Ms. Danna Linn Barnett
Rafael Advanced Defense Systems Ltd., Israel
Mr. Micha Kedem
Israel

VERIFICATION OF THE VENUS TECHNOLOGICAL MISSION MODULE

Abstract

The Technological Mission of the VENμS Satellite is aimed at validating the newly developed Electric Propulsion System (EPS), which is the Israeli Hall effect Thruster (IHET) payload. It will demonstrate mission enhancement and performance of autonomous orbit correction. In order to fulfill the ambitious mission goals, the Technological Mission Module (TMM) software is required to determine the optimal thruster direction and activation duration, taking into account numerous limitations and constraints from the attitude sensors and imaging camera, and limited satellite resources while providing on-board orbit control. Additional TMM requirements are EPS housekeeping. The utmost challenge was to pack all this functionality in a relatively modest resource onboard computer, limiting the software footprint, without compromise on overall module performance.

In the process of verifying the TMM - tests were performed on several different platforms. Complete Proof Of Design (POD) test scenarios were performed to check the overall mission envelope as well as algorithm behavior. These tests were iterated several times throughout the design cycle due to evolution and refinement of requirements as the project evolved. Verification of the TMM behavior was tested on a development simulator. Some scenarios' results were compared when running the TMM on a host PC to running them on the target computer. As the TMM is designed to provide autonomous close loop control of the orbit, the testing process required to provide all the relevant GPS and AOCS instantaneous data, which is usually simulated during the test.

Additional tests were performed on a more realistic satellite simulator in IAI laboratories, allowing for a detailed AOCS simulation, and involving the ground system mission rules limitations. Other tests were performed in the IAI Hybrid lab with the target satellite computer.

The TMM also has to monitor all of the IHET telemetry, provide alerts, produce mission events and make on-board decisions whether a disruption in the IHET operation is required. The verification of the monitoring functions were mostly using an IHET simulator and partly with the actual IHET payload.

This paper will present the different tests, verification and validations of the TMM, the different test concepts and limitations. One of many conclusions is the necessity of a combined test process involving all of the different systems and platforms, to complete and achieve the required validation.