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Lessons Learned in Space Systems: Achievements, Challenges, Best Practices, Standards. (5)

Author: Mr. Dennis Langer
Norwegian University of Science and Technology, Norway, dennis.d.langer@ntnu.no

Dr. Sivert Bakken
SINTEF, Norway, sivert.bakken@sintef.no
Dr. Roger Birkeland
Norwegian University of Science and Technology, Norway, roger.birkeland@ntnu.no

TESTING OF SMALL SATELLITE OPERATION AND SOFTWARE WITH TARGET HARDWARE AND REHEARSALS

Abstract

Satellites following the standard CubeSat form factor make it easy to launch and fly novel payloads for targeted applications by procuring already flight-proven subsystems or complete satellite buses. These novel payload systems often require custom software with extensive use of onboard processing that provide more functionality and operational flexibility. However, this imposes extensive software testing requirements before launch. This paper discusses software testing and rehearsal strategies, the challenges encountered throughout developing the 6U HYPSO-1 (HYPerspetral Smallsat for Ocean observation-1) CubeSat and the advantages and lessons learned of rehearsals, code reviews, and manual and automated testing.

It is important to determine if the tests will cost more to implement and perform than what they will unveil will be worth. Automation in software development can help free time but is not useful if the time-benefit tradeoff does not work out. Hardware-in-the-loop testing should use components as close to flight hardware as possible ('FlatSat'), as opposed to dev-kits and possible previous versions of hardware, however this might be expensive. Team members are working on different tasks in the project and have varying knowledge of the different system aspects and they have different methods of solving problems. Code reviews and rehearsing operational scenarios are effective ways to learn from each other and consolidate unequal system knowledge and problem-solving methodologies. Especially of note are scenarios simulating a need to identify and fix an issue on the satellite, which was particularly engaging and forced members to think in different ways. Software updates are a planned part of the operation of the HYPSO-1 and manual testing on target hardware as part of code reviews, can be combined with rehearsing operational scenarios.