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UTILIZING AN ENVIRONMENT SIMULATION TO HELP SMALL SATELLITE SOFTWARE DEVELOPMENT TEAMS AT THE EXAMPLE OF SALSAT

Abstract

Software quality assurance is an important part in any software related business. Nonetheless, in space applications software-quality-assurance before the first release, most commonly the launch date, is especially important as updates and bug fixes are limited by the operation times.
In small software development teams with a limited budget and tight schedules, time for in-depth long-term testing is often too short to find all issues. Particularly, logical or design errors are often not detected as those usually occur after a couple of days or weeks of operation.
Funding agencies require a qualification campaign. However, the required tests do not accurately represent the long operation times and take place at the end of the development phase. Hence detected, non flight critical bugs or design errors might not be fixed before the launch.
Since 2019, the TU Berlin develops an environment simulation, at first based in the ROS Space initiative and later continued in the SALSAT project. This environment simulation is developed based on poliastro, SPENVIS and ROS and is focused on versatility rather than accuracy to the true environmental conditions. This design choice was made to ensure an easy setup and a flexible use for various space applications and development teams, whilst applying adequate sensor data to the flight software.
The framework allows teams to expose their software very early in development to a simulated space environment, even when development is only limited to commercial-of-the-shelf development boards. This is done by utilizing sensor mock-ups, receiving simulation data and passing it to the flight software. The setup can evolve with the development state of the satellite hardware as software mock-ups for sensors might be switched to hardware mock-ups or even to test facilities, such as thermal vacuum chambers.
Additionally, a long term simulation might be setup, simulating communication times, shadow phases and much more. This helps finding errors, occurring only after days of operation, or helps teaching the operation personal in advance, long before the launch. With the developed framework the satellite software has been tested to a much higher degree and, therefore, helps to assure a problem free operation phase.
This paper will present the current state of the environment simulation framework and how it supported the SALSAT project in development of the satellite software updates.

Keywords: satellite software, environment simulation, validation, verification, qualification, quality assurance