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AUTOMATED TESTING FOR SATELLITE ON-BOARD SYSTEMS

Abstract

Testing of the on-board systems is an essential part of a manufacturing process. Complexity and importance of an on-board computer (OBC) functionality have a need to perform detailed all-levels functional tests several times during a manufacturing process. By doing that the correctness of manufacturing, assembly and subsequent software functioning can be ensured. In this paper, we present an automated test setup for small satellite onboard computers. The system will do a full-test of OBC's functionality without human involvement. After the test completion, the system provides the detailed test report for an operator with the description of founded discrepancies.

This study is a part of a project developed together with Ghalam Company. Ghalam launched KazSTSAT in December 2018, a small Earth observation satellite jointly developed by Surrey Satellite Technology Ltd and Ghalam. KazSTSAT acquires image data and carries several experimental and demonstration units, including a novel on-board computer – OBC-ARM.

While developing the automated test setup, we use engineering model of the OBC-ARM and test all its electrical interfaces with emulators, based either on hardware or software EGSE (Electrical Ground support equipment) modules. Hardware modules are provided with common programming interface and API (Application Programming Interface) library that simplifies our development process. Automated test program uses Python programming language. The first iteration of the test program is based on the current version of OBC-ARM functional test procedure. Initially this test procedure was written for operator usage in manual mode. The second iteration of the program will allow evolving the test approach and getting deeper understanding of the module functionality implementing new test scenarios and repeating tests at different environmental conditions. Features of new test scenarios require automated operations, which are not feasible in manual mode.

By implementing a fully automated test system, the risk of human errors, time and finance spent to perform tests are significantly reduced. Other factors that make automated OBC testing advantageous are identifying faults that the operator cannot notice; ability to accurately repeat the tests; compare the results at different stages; accumulate statistics in a convenient format; and accelerating the production process. All these reduces the cost of the testing that allows us to justify our development. This type of the test system is necessary for the automated assembly line projects like OneWeb, which is planning to produce up to 15 satellites per week and offering dramatically reduced cost in large volumes for high performance space applications.