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AUTOMATED TRANSFER VEHICLE (ATV) SYSTEM VALIDATION TESTING (SVT): FROM
PROTO-FLIGHT TO PRODUCTION

Abstract

Two ATV (Automated Transfer Vehicle) missions have flown, both of which were very successful. System Validation Testing is the only testing campaign that combines the spacecraft, communications systems and ground control systems and so is a major contributor to the confidence that ATVs can be controlled successfully from the ground.

The first ATV, Jules-Verne and its ground segment, underwent an extensive System Test Validation (SVT) campaign over a period of more than 4 years comprising 14 tests. However the second ATV, Johannes Kepler and its ground segment, underwent only 2 tests starting from just 10 months before launch.

This paper describes the system that was tested followed by an explanation of the objectives, philosophy, technical set-up and organisation of ATV SVT testing.

Some of the major validation challenges from technical, schedule and organisational points of view are discussed. For instance, the ATV SVT campaigns differ from conventional ESA spacecraft SVT campaigns in that many more partner organisations are involved. A further challenge is that ATV is acknowledged as the most technically complex spacecraft that ESA has yet developed. Another mission design feature that was included in the system validation is the command and telemetry path between ATV-CC and the ATV spacecraft that routes through several ground networks as well as geostationary relay satellites operated by NASA and ESA.

The types of test that took place, their rationale and results are described. These included end to end communications chain functional testing, telecommand and telemetry database validation, and mission scenario testing. The design complexity of the ATV system had the potential to increase the test complexity and test time required. Given that the test resources were limited, methods for containing the amount of testing are described.

The transition from ATV-1 a proto-flight model to ATV-2, a production model changed the testing focus. The number of tests and test time were reduced but without reducing the quality of the final product. This change of approach and its justification are described.

In conclusion the SVT testing campaigns were significantly different for Jules-Verne and Johannes-Kepler. In both cases the tests were carried out successfully achieving their objectives and contributing to the great success of their respective ATV missions.