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SPACE SYSTEMS SYMPOSIUM (D1)
Lessons Learned in Space Systems (5)

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SYSTEM VERIFICATION AND AIT LESSONS LEARNED FOR THE EXPERT RE-ENTRY DEMONSTRATOR

Abstract

In the case of re-entry missions, many aerodynamic phenomena occurring throughout the trajectory cannot be fully reproduced within existing ground facilities, and this often only at very high costs. The European Experimental Re-entry Testbed EXPERT is an experimental vehicle developed by ESA and European Industries and Research Institutes with the purpose of providing in-flight measurements of specific re-entry phenomena and testing of new materials such as advanced ceramic and metallic hot structures for atmospheric re-entries. Analyses have played an important role during the design and test definition highlighting critical areas. EXPERT is not equipped with telemetry means able to transmit measured data during the short re-entry flight, so that a flawless autonomous operation of the vehicle together with a sufficient margin policy is essential for mission success. These circumstances had to be reflected in the approach for the verification of the design and operational requirements of the vehicle, which in turn also had an impact on the design requirements. An extensive test campaign on equipment as well as system level has verified the design and ensured that the vehicle and the experiments can survive the launch as well as the re-entry conditions.

This paper describes the implemented verification approach and the model philosophy (PFM) for EXPERT, supported by descriptions of the hardware models employed and relevant examples of the functional and environmental tests performed. It identifies the critical areas encountered during the later project phases (manufacturing and AIV) and discusses the most important lessons learned which can support both the design and verification approach of future re-entry vehicles.