SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Future Space Transportation Systems Verification and In-Flight Experimentation (6)

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FLIGHT ACCEPTANCE OF A VERY PERFORMANT, HIGH-RELIABLE COMPUTER FOR THE ESA IXV RE-ENTRY VEHICLE - AN ELEMENTARY SUBSYSTEM FOR FUTURE SPACE TRANSPORTATION SYSTEMS

Abstract

Introduction

In collaboration with ESA, Thales Alenia Space and Alenia Aermacchi, QinetiQ Space developed the IXV-OBC. A state-of-the-art, very performant spacecraft control unit designed to serve as the main computer for the fully autonomous and highly reliable IXV re-entry vehicle. Thanks to its high configurability and open 'plug and play' architecture this computer can function as the heart of every spacecraft with high autonomy demands. Building further on the flight-heritage of the successful ESA Proba missions, this next generation avionics was developed and will serve as the IXV re-entry vehicle flight control unit. The FM-unit has been delivered and is awaiting system-level integration, the launch is scheduled for 2014.

The IXV re-entry vehicle

It is well known that a performant, highly integrated spacecraft control unit is crucial to succeed in the system design of re-entry vehicles with high autonomy demands. For this purpose a next generation avionics was designed that provides full integration of all data-handling, data-acquisition, TTC and GNC functions that are required for the IXV re-entry vehicle. This resulted in a significant reduction of the overall power, mass and volume of the avionics. The IXV-OBC presented in this paper also significantly increases the computing performance when compared to other spacecraft computers that are used today. This is of essence for the IXV mission since it will demonstrate challenging system performances like manoeuvrability, operability and precision landing. The IXV-OBC also incorporates easy adaptability and scalability allowing a growth potential for future missions.

The IXV-OBC qualification

To comply to the stringent reliability and availability requirements of the mission a quantitative component-level reliability analysis was conducted of which the outcome will be presented. Several new technologies like the AT697 from ATMEL and the RTAX2000 from ACTEL were incorporated into the IXV-OBC design and have been subjected to a qualification- and flight acceptance test campaign. The thermal-, shock-, vibration-, emc- and waterdrop tests results will be presented and discussed.

Conclusions lessons learned

The aim was to develop and qualify a reliable and performant computer that perfectly serves the IXV mission needs and that makes optimal re-use of the existing flight-heritage from the Proba avionics called ADPMS. This paper will present an overview of the lessons learned and will explain the current technology readiness level of this brandnew re-entry computer. It will outline the achieved performances and the technical difficulties that were encountered during the execution of the project.