Production of Autonomous Orbital Navigation (AUTONAV) On Board Software

AUTONAV is an algorithm developed internally in Thales Alenia Space Italy S.p.A. (TAS-I) useful for real-time computation of the optimal thrust strategy for electrical satellite orbital transfers.

The AUTONAV software should be part of space avionic software and its purpose is to compute in real time the optimal satellite trajectory during an orbital transfer in order to reduce the communications with the ground segment and therefore greatly reduce costs associated with them.

We succeeded in porting the MATLAB prototype to C language assuming as reference target the SPARC architecture: LEON3 and LEON4 CPUs. The performance and precision of the AUTONAV software component outcome is acceptable and therefore the project is sustainable for the future. The algorithm written in C is converging in the same number of iterations for all orbital steps as MATLAB execution, for all test case scenarios. The complete software was modeled based in Rhapsody IBM tool and design was forseen to be easily integrated in the final avionic software.

In this first phase of the project, we strictly followed the standards of ECSS-E-ST-40C and ECSS-E-ST-80C. Based on the reported results we are confident that the AUTONAV software will reach TRL 6 (Technology Readiness Levels) and criticality C at the end of the proposed second phase of the project (mostly focused on formal verification and validation).

The aim of this activity is to develop in C language the on board algorithm for the optimal, autonomous and efficient control of electrical satellites.

We achieved a good understanding of SPARC architecture and a better understanding of standards. We thrust that the software will be used in real space missions.