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THE EVOLUTION OF A MODULAR CAN-BUS BASED SATELLITE ARCHITECTURE FOR THE SOUTH AFRICAN EO-SAT1 MISSION

Abstract

The South African Space Agency (SANSA) is contracting the development of the second government funded satellite, EO-Sat1, to Denel SpaceTeq. EO-Sat1 is an operational earth observation satellite with an expected lifetime of 7 years, and is South Africa's contribution to the African Resource Management Constellation (ARMC). The satellite bus and payload are being developed by SpaceTeq and build on the heritage of the precursor SumbandilaSat mission.

SumbandilaSat, launched in 2009, was developed and built in a record time of 15 months and at a cost of less than $3M. As a technology demonstrator, the satellite was built around a new modular architecture utilizing the CAN bus as an intra-satellite communications bus. The short development cycle and low cost necessitated the use of COTS components with little or no space heritage. The satellite was operational for two years after launch, during which time the architecture has proven to be extremely flexible and resilient.

The lessons learnt from the SumbandilaSat mission can now be used to improve and refine the architecture for the EO-Sat1 satellite. This paper presents a number of these lessons, how anomalies were successfully overcome in the SumbandilaSat mission, and how the architecture was updated and improved for the EO-Sat1 satellite. The examples include the porting of attitude control software from one processing unit to another with relative ease; and the successful mitigation of unexpected latch-up conditions by firmware updates to various CAN nodes.

The pure COTS EEE parts approach enforced by the SumbandilaSat budget added an unknown risk element to the project. The larger EO-Sat1 budget allows for a more mature EEE parts program. However, combining the COTS approach of the original architecture with the Hi-Rel approach of more traditional space programs poses a unique challenge. The paper shows how this challenge is addressed through the selective use of high reliability parts and cost-effective acceptance testing of COTS parts. It is believed that the result is a uniquely innovative and flexible architecture that is expected to form the basis of many future cost-effective and reliable satellite development programs in South Africa.