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

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THE SUMBANDILA SATELLITE EXPERIMENTS PAYLOAD - TAKING THE STEP TO SPACE

Abstract

The Sumbandila Satellite was commissioned by the South African Department of Science and Technology as a "pathfinding" mission in developing low-cost space technology. A further objective of the project was to allow South African researchers to include research experiments on the microsatellite, in order to inform the process through which future space projects can be used as research platforms. This paper describes the design, implementation and integration of five engineering and scientific experiments that were included on the Sumbandila Satellite. Research results of specific experiments are not considered; rather, the use of a microsatellite as a research tool by means of a secondary payload is evaluated, and recommendations are made for future space research collaboration between government and academia.

Firstly, a brief overview is given of the five experiments, from four different research organizations, that were included on the satellite. These include a forced vibrating string experiment, a very low frequency receiver experiment, a software-defined radio (SDR) experiment, an amateur radio transponder experiment and a space radiation experiment. Due to strict limitations on weight, power consumption and volume, and an integration budget of only 30,000 Euro, the experimental payload had to be tightly integrated, with maximal sharing of resources between individual experiments. The project was run in an academic environment, with three full-time Stellenbosch University staff, and two full-time postgraduate students.

Secondly, the design, implementation and integration of the experiments are discussed. The integration team was responsible for designing the shared hardware, which consisted of a 32-bit processor, on-board RAM, 12 ADC channels, two full-duplex SDR channels, and a VHF-UHF transceiver. A commercial on-board computer (OBC) and VHF-UHF communications unit (VUCU) were used. For the remaining functionality, a custom daughterboard for the OBC was designed. Researchers from other universities provided modular prototype electronics for their experiments, which were then re-engineered to conform to the payload design and integration constraints. The Stellenbosch team designed the electronic system, software, firmware and the flight models of the mechanical appendages. The 10-month development time for the project allowed for only a single prototype step to validate the design.

The paper concludes with a critical assessment of the extent to which the experimental payload's objectives were reached. The success of individual experiments is considered, as well as that of the overarching design and integration methodology. The lessons learned are presented as considerations towards good practices for short time-frame, low-cost experiments on secondary space payloads.