MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures I - Development and Verification (Space Vehicles and Components) (1)

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MECHANICAL STRUCTURAL DEVELOPMENT OF SUMBANDILASAT, SA'S FIRST NATIONAL SATELLITE

Abstract

Sumbandila (which means "pathfinder" in Venda) was launched on 17 Sept 2009, becoming the first South African National Satellite. It was designed and built by SunSpace in a record time span of 9 months for the technical team and with a shoestring budget of US$1.5m (excluding launch and ground infrastructure). The owner of the satellite is the South African government.

Due to the time scales and the budget the mechanical structural development of the satellite could not include a physical qualification model and therefore no qualification testing could be done. This meant that the satellites' structural development was to a great extent solely done by means of finite element simulations. The simulations mainly concentrated on the structural stiffness through natural frequency analysis and design and random response analysis, both as an input for structural mass optimization as well as structural response input for the launch agency.

On a subsystem level the most critical subsystems were identified and tested on a subsystem by subsystem bases, the results from these tests were then fed back into the FE model at system level, to facilitate partial correlation of the FE model. Only at FM system level could the damping, which was higher than expected, of the complete satellite be taken into account in the FE model, this was done solely to correlate the final FE model as the design were already fixed at that stage.

Some of the main design constraints included a 40Hz lowest natural frequency structure, with mass limit of 82kg and an envelope of 1000mm x 600mm x 400mm, while packaging about 50 kg of electronics, including a 6.25m GSD imager, ADCS actuators and sensors, power system and control electronics. Finally, using a launcher with a 4.8g quasi-static and 11.3 gRMS random vibration level.

In this paper the design methodology to accomplish this in the amount of time given, along with the combined use of finite element analysis and partial subsystem testing, ending in the successful launch, will be presented.