IAF SPACE SYSTEMS SYMPOSIUM (D1)
Space Systems Engineering - Methods, Processes and Tools (2) (4B)

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SYSTEMATIC APPROACH FOR THE COST-EFFICIENT REENGINEERING OF AN EXISTING SATELLITE FOR A NEW MISSION WITH ADDITIONAL PAYLOADS, FOR EXAMPLE, ON THE SALSAT MISSION.

Abstract

These days small satellites become more and more important for a variety of scientific missions. Small satellites are used for a variety of tasks such as telecommunications, earth observation, disaster management system et cetera. One approach in development is a specialized satellite design for these explicit mission scenarios. A second approach is a bus platform used to handle a variety of different tasks. Depending on the model philosophy, some missions will have a complete substitute spare satellite. This paper will introduce a systematic approach for the cost-efficient reengineering of an existing satellite for new mission objectives with additional payloads. This purpose will be demonstrated in the nanosatellite mission SALSAT (Spectrum AnaLysis SATellite). The mission of Technische Universität (TU) Berlin aims to investigate the global RF spectrum use in the VHF and UHF radio bands and in scientific bands within S band. The primary payload of SALSAT is the spectrum analyzer payload SALSA and its antenna which is based on a Software Defined Radio (SDR).

The approach to accomplish this goal is to reengineer an existing S-Net flight spare satellite of the S-Net mission. The mission successfully deployed a cluster of four cubic nanosatellites with form factor of 24 cm side length. The Satellites have been designed by the TU Berlin and were successfully launched in February 2018 from the Vostochny cosmodrome. The development as well as model philosophy of S-Net was designed for five identical satellites. Four of the satellites have been required to fulfil the mission and create the in-orbit S band network. One satellite served as a flight spare. Consequently, the design of SALSAT aims to changes the payloads of the existing satellite and follows a cost-efficient reengineering process. In addition to the main payload and antennas, a camera for earth observation, a 3 axis FDA (fluid dynamic actuator) for altitude control experiment as well as a new S band transceiver will be integrated into the existing nanosatellite for technology demonstration purposes. This variety number of payloads poses a challenge at system level to be implemented within the SALSAT mission. The following paper presents the implementation and reengineering of the energy management, power supply, data management handling, software, structure and thermal design as well as verification philosophy for additional payloads. Efficient methods, architectures and topologies are examined to be suitable for the individual payloads regarding the boundary conditions, existing resources and assembly challenges at system level.