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INTEGRATION OF SUPPLEMENTARY PAYLOADS INTO A NON-DEDICATED NANOSATELLITE BUS FOR SPECTRUM ANALYSIS ON-BOARD SALSAT

Abstract

Small satellites are becoming increasingly important and the number of launches is rising steadily. As a result, it becomes more important to exploit the available communication frequencies effectively. The SALSAT project of the Technische Universität (TU) Berlin aims to identify the global RF spectrum use utilizing the SALSA spectrum analyzer payload. The payload is integrated into an existing flight spare satellite. Since communication payloads often induce high requirements to the individual satellite bus it became apparent that available resources must be used efficiently on-board a nanosatellite to satisfy these needs. Small satellites are limited in terms of available space, mass and energy supply. The integration of supplementary payloads, such as the SALSA spectrum analyzer, creates special demands on data handling as well as on power control management for payloads. These requirements inherit the need for adjustments of structure and electronics to an existing satellite bus.

This paper will introduce the adaptation and integration of an existing nanosatellite bus in the SALSAT project of the Technische Universität (TU) Berlin with one primary and two secondary payloads in one nanosatellite: Spectrum analyzer (SALSA), camera with image processing unit (IPU) and a three-axis fluid dynamic actuator (FDA). Based on a Software Defined Radio (SDR) the main target of the project is to investigate the global RF spectrum in different amateur radio bands. Payload Data Handling (PDH) electronic needs to be implemented to support all additional interfaces of the payloads. The communication path is decentralized and allows a direct downlink of payload data without detour via the OBC, enabling the PDH to send and receive data directly via the integrated S band transceiver (SLINK). A miniaturized PayLoad Electrical Power Supply (PLEPS) is integrated within the same PCB to distribute the existing power buses of the satellite bus as well as controls and measures the individual power supply of each SALSAT specific payload. Due to the limited space on the nanosatellites surface and to avoid crosstalk a miniaturized, space qualified RF switch is utilized to connect one UHF antenna either to the satellite bus UHF transceiver or to receive signals with the SALSA spectrum analyzer.

The current project results show that it is possible to equip a nanosatellite bus with additional functionality and capacity to meet the increasing demands of utilization. Different payloads are integrated to serve

differentiated research quests and increase the performance of nanosatellites to shift their limits in space science.