

SPACE POWER SYMPOSIUM (C3)  
Small and Very Small Advanced Space Power Systems (4)

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MULTIFUNCTIONAL POWER CONTROL AND DISTRIBUTION UNIT FOR COMMAND CHAIN  
RECONFIGURATION**Abstract**

The Flying Laptop (FLP) is a small satellite developed at the Institute of Space Systems (IRS) at the University of Stuttgart. The 60x70x80cm<sup>3</sup> small satellite shall be launched into a sun-synchronous orbit for Earth observation and technology demonstration. The FLP serves as a precursor mission for future small satellite projects. The IRS developed a multifunctional Power Control and Distribution Unit (PCDU) in cooperation with Vectronic Aerospace GmbH. This paper addresses the PCDU configuration and its functional implementation that exceeds usual power unit capabilities. The FLP PCDU constitutes together with the Onboard Computer (OBC) system a nonrecurring satellite command and control design. Besides the standard power regulation and distribution tasks, the FLP PCDU comprises the function of the OBC reconfiguration unit. The overall OBC system incorporates three functional sections with two redundant boards each, which are the OBC Core boards with LEON-3FT microprocessor, I/O boards and CCSDS communication boards. The I/O board represents the interface for all satellite units to the OBC. The FLP PCDU features an autonomous recovery procedure in the event of a command chain unit malfunctioning. This recovery procedure facilitates the reconstitution of the OBC system by switching command chain units. The CCSDS communication boards directly forward so-called High Priority Commands (HPCs) from ground to the PCDU. In case the OBC system is not available, the satellite configuration can be modified by HPCs in order to regain control of the satellite. The PCDU possesses two hot-redundant CPUs, which monitor each other. Additionally, a CPU-toggle logic facilitates the functional capability of the PCDU by switching the CPU master unit. Two cross-coupled communication interfaces are available at the PCDU for each command type, either Common Commands by OBC via I/O board or HPCs via CCSDS board. Furthermore, the PCDU collects all analogue sensor data that are essential for regulation and housekeeping of the satellite system. After conversion of the analogue sensor data, the digital telemetry data are forwarded to the OBC. Thus, the FLP PCDU comprises not only power regulation and distribution, but facilitates the operations of the satellite as well as the reconfiguration and recovery functions of the satellite system in case of anomalies.