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MODULAR NANOSATELLITE SUBSYSTEM ARCHITECTURE - OPTIMIZED FOR AN IMAGE CAPTURING BASED PAYLOAD

Abstract

In 2016 the University of Manitoba Space Applications and Technology Society (UMSATS) introduced a new modular nanosatellite structure which greatly simplified the society's nanosatellite system architecture down to 4 major modules: Communications and CDH module, Payload module, ADCS module and finally the Power Management Module. Spacecraft modularity allows for well-defined interfaces to simplify multi-organizational collaboration with minimal additional electrical and mechanical interface definitions between the establishments. This paper we examine the power, signalling, sensing, and data processing hardware system architecture used on the UMSATS TSAT5 spacecraft which takes advantage of the modular spacecraft design. It will detail these architectures at the spacecraft, module and inter-module levels. Additionally, this paper will examine the single 15 pin Micro-D module level connector definition and the harness minimization justifications. Finally, the paper will examine the new payload data processing hardware architecture.

To meet our new spacecraft mission requirements, the society was pushed to create a new custom high reliability image capture system. This solution takes advantage of a single event upset immune FPGA as our interface to the redundant image sensor system before data transfer to our new custom Command and Data Handling unit for post processing. This unique solution additionally pushed the society to redesign the Command and Data Handling to support on board image processing at the same level of reliability.

Together these systems are all powered by a custom power control unit that is optimized for operation in this modular architecture through the single module level connector tying all these systems together. This paper presents one solution to creating a modular spacecraft architecture.