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Generic Technologies for Nano/Pico Platforms (6B)

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PLUG-AND-FLY SATELLITE (SPIN-1 MISSION)

Abstract

One of the time- and cost-consuming phases of spacecraft development is the assembly, integration, and testing (AIT) phase. Although many off-the-shelf components are existing, interfacing them to the on-board computer along with verification and validations command and control still remains a complex task to perform. This is due to the difficulty in space standards in both traditional and new-space sectors where the protocols and connectors are unique and customised to the mission requirements. Challenges in integration of multiple subsystems are often due to software incompatibility or seemingly minor hardware/documentation errors like swapped pins or connectors. As a solution, SPiN developed an innovative command and data handling (CDH) design based on a decentralised and a configurable data handling architecture using an intelligent data node called MA61C (Multipurpose Adapter Generic Interface Connector). This technology was presented in IAC-2019. Some of the features are plug-and-play, device management, and data routing with protocol conversion. Rather than focussing on customising the communication protocols to a set of standards, all standards in the current Cubesat/Smallsat industry such as RS232/422/485, I2C, Canbus, SpaceWire, and SPI are incorporated. This allows SPiN to commoditise the component selection as it is now available from many prospective providers. To exhibit the proof of this technology, SPiN decided to launch a 1U Cubesat in the second half of 2021. Towards the end of Q4 2020, this mission was announced with the invitation to partners/external subsystem suppliers to provide payloads/components. At the end of the call, 6 different partners/suppliers were chosen in January 2021. The goal is to take these external subsystems whose hardware and software are black-box elements and have a quick integration in a few weeks' time with SPiN's 'Plug-and-Fly' CDH system. The three main motives behind the mission are quantifying the cost and time saving during AIT; allowing component integration from different partners to gain in-orbit experience for new products; and in-orbit reconfiguration, i.e. switching between hardware while the satellite remains operational. Details of the mission, giving proof of a simplified AIT with the subsystems enumerated by the 'intelligent data node' as-and-when they are integrated will be presented and the technology for in-orbit reconfiguration will be explained. This paper will present the first embodiment of the 1U Cubesat SPiN-1 satellite mission using MA61C as a CDH system.