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TURN-KEY SMALL SPACECRAFT FOR GENERIC SCIENCE MISSION SUPPORT

Abstract

Nanosatellite development teams have become commonplace for commercial and academic groups worldwide. With hundreds of systems launched to orbit annually, the small-scale satellite has proven cost effective to accomplish system development and a variety of science missions. As commercial and government developers continue to adopt the technology, the satellite community must provide increased reliability of the miniature systems. One method to balance the increase in reliability while maintaining a competitive price is to develop a turn-key spacecraft solution.

A spacecraft development team is doing just that, building a spacecraft to support 1 kg to 20 kg of payload. Three areas of standardization have been recognized to enable the turn-key development. First, a common payload interface has been identified to link data and power to all the supporting systems through a common interface bus. The electrical and data supplied by the bus is similar to that of open-source embedded system development kits. With the adaptable interface, the payload can be integrated into a spacecraft at minimal cost.

A higher risk area of satellite development is the flight software. For a turn-key option, the satellite software must be useful for a variety of customers. Standard flight software will be limited to scheduled events and triggered events only. Subsystems like the science payload, attitude control, and power management would be responsible to perform with a limited set of functions given by the primary flight software. By isolating the primary flight software to a limited function list, the software design team can rapidly deploy a robust software package to variety of satellites missions.

Finally, advanced manufacturing techniques are being utilized to assemble the spacecraft circuitry and structure. As seen with cell phone development and other portable computers, single-board electronics significantly reduces the product cost while maintaining quality standards required in spaceflight, all in a production environment. For structural and payload interfacing, 3D printing technologies allow for dramatically reduced part counts and complicated structural elements with the convenience of a printer. The electrical and mechanical advantages found promote expedited assembly times for satellite development.

These three areas of standardization allow the development team to reduce integration and launch readiness to less than 12 months. The author will detail developments in these three areas. He will show the interfaces selected and tools used in the turn-key small spacecraft. Finally he will present the risk management strategies of the development team.