SPACE SYSTEMS SYMPOSIUM (D1)
System Engineering - Methods, Processes and Tools (1) (3)

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A MICROSATELLITE STANDARD – GETTING THE BEST OF BOTH WORLDS

Abstract

The emergence of the CubeSat standard has facilitated access to space and enabled missions that would otherwise never have existed. Numerous educational programmes and experimental projects owe their existence to the CubeSat Standard. CubeSat programmes typically benefit from plentiful low-cost launch opportunities and shorter development cycles.

The volume inside a nanosatellite remains a limiting factor and constrains the utility of the satellite such that nanosatellites are typically more suited to scientific missions with single payloads or educational programmes. The need for a standard form factor for larger nanosatellites has become evident with the recent expansion of the CubeSat standard. A 50kg microsatellite is seen as a possible sweet spot for this market segment. Such a form factor would be able to accommodate payloads with higher utility and industry value while bringing a similar advantage in launch opportunities as their smaller counterparts.

Despite their advantages, it has been recognised that CubeSats have a high failure rate. The failures can be attributed in many cases to lack of proper system level testing and not adopting adequate system engineering best practices. While failures in experimental and educational projects may be tolerated, the increased payload complexity and resultant cost means that satellite providers considering such a microsatellite standard are likely to demand a well-defined system engineering process that will reduce risk and provide for a longer operational lifetime than is typical for a CubeSat.

Conventional satellite projects are required to follow a strict project management and system engineering process while adhering to established standards in order to cope with complex systems that have many levels of decomposition and interfacing. The level of quality assurance needed to ensure the lifetime and performance typically results in long development, production and test phases. A full model philosophy and verification at each level of decomposition contributes to the high cost. In contrast, CubeSat engineering projects are relatively lean and ad-hoc in nature. The system is usually simpler and requires less decomposition with smaller teams and fewer external interfaces. The shorter development cycle, lower cost (mainly because of commercial components) and a standard launch interface reduces the need for a rigorous systems engineering approach.

This paper proposes a new microsatellite standard that, when coupled to an appropriate systems engineering approach, promises to yield the benefits of a rapid development cycle and regular, low-cost launch opportunities while at the same time maintaining a high level of performance and reliability.