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EVOLUTIONARY SPACECRAFT DESIGN ALLOWING CONSTELLATION GROWTH AND ADAPTATION OF EARLY TECH-FUTURES

Abstract

A multi-phase constellation mission requires implementation of evolutionary features in the foundational configuration to allow for future commercial or scope growth. In commercial new-space the cost-time impact of platform and interface redesign of bespoke solutions for successive phases economically limits the total possible size (access) of a constellation with limited funding. To abide by cost constraints, the design of an all-purpose plug-and-play architecture was proposed. The design centers on a minimized small satellite bus with an integrated "Universal Header Interface Module" (UHIM). The UHIM hosts all low and high speed data busses, power busses, and auxiliary/external unit interfaces. The bus minimizes the volume required for hosted control units, with external interfaces for additional units and/or required structural members. Highly valuable tech futures can be built into early phases due to the UHIM and base architecture that allows subsystem adaptability for rapid TRL raising. These tech-futures can subsequently deployed within updated configurations as baseline with minimal systems engineering overhead for platform and architecture redesign. The paper overviews the top level design, and outlines the benefits and negative impacts of this kind of technical interface. An analysis on the evolutionary growth capacity of the design is presented together with and impact assessment on possible future technical specifications and systems engineering configuration management effort. A cost-analysis demonstrates the future economic benefit of such a platform for a commercial growth constellation (CGC).