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DESIGN FOR ISAM: MISSION ARCHITECTURES FOR SUSTAINABLE EXPLORATION AND DEVELOPMENT

Abstract

The use of On-Orbit Servicing, Assembly, and Manufacturing (OSAM) technologies in missions across the space industry demands new standards for space mission architecture development. Similar to the ascension of Design-for-Manufacturing (DFM) and Design-for-Assembly (DFA)philosophies across engineering disciplines, the introduction of this new paradigm of on-orbit capabilities drives development of a Design-for-OSAM (DFO) framework. Mission architectures, from inception through design, build, and test, are fundamentally altered with the addition of OSAM technologies. Compared to traditional spacecraft design, OSAM-based mission development expands the spacecraft design space through new on-orbit capabilities that enhance spacecraft resilience, sustainability, and versatility. Identifying opportunities and understanding the downstream development effects enabled by this new paradigm will become increasingly important as OSAM technologies proliferate into new mission architectures and throughout the space industry.

This paper categorizes the downstream effects of OSAM's introduction into spacecraft architecture by providing an overview of how OSAM technologies provide value and infuse mission architectures with novel capabilities and describes how these technologies and architectures drive a demand for a DFO approach as they alter the typical mission design lifecycle. A thorough comparison of an OSAM mission architecture with a traditional one informs the specific effects of this new paradigm in spacecraft design and provides actionable insights into methods for approaching OSAM spacecraft development.