SPACE SYSTEMS SYMPOSIUM (D1)
Innovative and Visionary Space Systems Concepts (1)

Author: Mr. Benjamin Corbin
United States, Benacor@gmail.com

THE EMERGENT CAPABILITIES OF DISTRIBUTED SATELLITE SYSTEMS

Abstract

Distributed satellite systems have been shown to exhibit better lifecycle properties, such as "resilience," "changeability," "robustness," and "upgradeability" compared to their monolithic predecessors; however, because of the added expenses, distributed systems have not been seen as attractive alternatives to monolithic systems in space science missions. Rather than re-examining and exclusively looking at how distributed systems can replace monolithic systems, this research examined how distributed satellites can uniquely satisfy several classes of science missions that monolithic systems are inherently incapable of accomplishing.

Seven specific unique capabilities have been identified that can directly impact the value proposition of a satellite system as opposed to indirectly adding value over the course of the systems lifecycle. *Shared Sampling*, *Simultaneous Sampling*, and *Self-Sampling* are three fundamentally unique capabilities that can create science data products that no single satellite possibly can. *Census Sampling* and *Stacked Sampling* are two analytically unique capabilities that leverage the quantity of measurements to build a more complete science picture of a given phenomenon. *Staged Sampling* and *Sacrifice Sampling* are operationally unique capabilities that allow missions to accomplish science goals that allow mission operations to evolve in real-time and conduct operations that would be considered too risky under a monolithic systems paradigm.

Four mission concept studies were conducted to examine the value proposition of these emergent capabilities. The Responsive Systems Comparison method was used to compare up to ten million designs in each mission's tradespace. From these options, decision makers can choose a design that "best" suits their needs across a range of possible contexts—especially in the absence of a formal definition of "optimal")