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IAF SPACE POWER SYMPOSIUM (C3)
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(SPACE)**2: A MANAGEMENT OPERATIONS CONTROL ARCHITECTURE APPLICATION FOR EVOLVING SPACE SOLAR POWER SYSTEMS

Abstract

The Synergistic Predictive Analytical Control Environment $(SPACE)^2$ [pronounced SPACE Squared] research project is intended to yield an implemented framework for abstracting and integrating available qualitative and quantitative data within Sensible Programmable Analyzable Control Envelopes. This is an open-source instance of Management Operations Control Architecture (MOCA) applications that entails building near real-time state models of the system-of-systems that have utility throughout the lifecycle of any applicable contemplated, developing, or fielded system.

The $(SPACE)^2$ deliverable product is the development of an instance of an extensible, interoperable simulation framework with selectable venues, variables, and boundary conditions for Space Solar Power and ancillary service Beaming (SSPB) on an end-to-end and piecewise basis suitable for the trade space (i.e., problem + solution space) of the space-to-space, surface-to-surface, space to lunar/asteroidal surfaces, and Space-to-Earth application(s). The model will have sufficient fidelity to provide correlatable power input to the power delivered for specified applications of interest.

The $(SPACE)^2$ project is fundamentally an iterative and recursive product. The architecture of $(SPACE)^2$ is based on building a dynamic knowledge base that can incorporate any data set that has items, that have attributes, that have values (Items (Attributes (Values))) and contextualize that data propagating constraints faster than the problem space is changing and within the computation limits of the system to posit viable solution spaces. This is intended to enable the system to scale to accommodate the level of complexity deemed necessary to meet any given application's functional requirements. This system-of-systems architecture allows for continuous development critique and substantial field demonstration of the products in public and confidential practical use cases.

The 1st Design Spiral of $(SPACE)^2$ will yield a state-of-the-art Function-driven analytical sandbox. A Synergistic, Predictive, Analytical simulation framework using verified simulation engines and enhanced with real-world data, intended for use in multiple functional applications ranging from conceptual engineering to Concept of Operations planning with intuitive gamified user interfaces. Expanding this robust framework to the 2nd Design Spiral allows evolution to a Dynamic function-driven control testbed, which adds dynamic Control using cataloged and sensed data, and to the 3rd Design Spiral, which extends the framework to an Adaptive shared control transition toolkit that adds Environment data fusion in a deployable framework for operational systems (i.e., Synergistic Predictive Analytical Control Environment within Sensible Programmable Analyzable Control Envelopes $(SPACE)^2$.