SPACE SYSTEMS SYMPOSIUM (D1)
System Engineering Tools, Processes & Training (3)

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SYSTEM ENGINEERING STRATEGY FOR DISTRIBUTED MULTI-PURPOSE SIMULATION ARCHITECTURES

Abstract

We describe system engineering strategies used to develop a distributed simulation for the creation, testing, and verification of new operations, sustaining, and capability development activities. This system engineering strategy focused on operations, extensibility, flexibility and reuse upfront to enable a multi-purpose simulation architecture. We believe the benefits from these strategies can be applied to the NASA Constellation Program and other future programs.

We used this strategy to develop an ISS simulator (note 1) that runs real ISS flight software, system models, and command interface (for the astronaut's command and control laptops). The use of real flight software provides an enhanced level of assurance that the simulation is true to real flight software behavior and response. The open design built into the system allows for simulated components to be replaced by real components if required later on.

The initial intent of the ISS simulator was to create, test, and validate crew and ground controller procedures using a portable, distributed system that allows access to ISS flight software and models. This capability reduces the cost and scheduling issues associated with utilizing standalone simulators in fixed locations, and facilitates discovering unknowns and errors earlier in the development lifecycle. Since its inception, the flexible architecture of the ISS simulator has allowed its purpose to evolve to include ground operator system and display training and flight software modification testing. The simulator is currently being applied as a test bed for autonomous command string creation, verification and execution, and the integration of intelligent algorithms and tools for ground-based decision support for the Crew Exploration Vehicle. The lesson learned is sound, upfront system engineering strategies helps design systems to expand and evolve to support current and future capabilities and programs.

(note 1) The ISS simulator is patent pending technology.