Axient Program Highlight: Reliable Expandable Satellite Testbed (REST)

Purpose

REST is a HWIL testbed framework used to support the design, development, and testing of satellite avionics and flight software.

- Configurable: Integrate models of the satellite components to be used in testing of hardware and software elements.
- Expandable: Evolves as your satellite system matures, enabling rapid assessment of future design enhancements and additional missions.
- Adaptable: Maximize investments in one satellite system to provide appreciable cost reductions in building additional satellites.

History

REST was developed by Dynamic Concepts, LLC (DCI), an Axient subsidiary, for a US ARMY Space and Missile Defense Command (SMDC) customer with NASA Marshall Space Flight Center (MSFC) as a supporting partner. NASA provided the ARTEMIS framework software, the first satellite test article, and the associated lab floorspace. The two organizations' main goal was to ensure the Army's and NASA's investments in satellites would be fully integrated and tested prior to deployment in order to ensure mission success. REST leverages the Avionics HWIL testbed framework used to support the SLS Avionics testing. This framework has been and continues to be instrumental in testing the avionics through a number of critical nominal and off-nominal scenarios where many issues were identified and corrected that would have compromised the mission. In addition, the SLS program realized significant cost savings by using the same simulation software running within the framework to satisfy many different integration and test needs across multiple avionics and software test labs. REST is intended to be a low cost instantiation of that concept for satellites.

OVERVIEW

REST is a combination of the ARTEMIS (Advanced Real Time Environment for Modeling, Integration, and Simulation) simulation framework and a suite of generic satellite system models used to integrate a few satellite components and sensors using real interfaces. This reflects the concept of providing a real-time distributed simulation with actual flight software and avionics. REST is designed to be configured to use full suite of models using real system interfaces to assess the Satellite interfaces, and functionality. As real hardware is available, REST can be configured to replace models with the hardware (prototype EDU or production FEU). However, there is important value in using models of hardware because the models provide the ability for assessing off nominal system behavior. This integrated system representation of the satellite enables the assessment of monitoring and control software in a controlled environment.

When performing these tests, REST is designed to record simulation and avionics data and hardware signals for detailed posttest analysis. There is also a suite of tools available for the analysis of the recorded data. The goal is to use this capability throughout the satellite program lifecycle, requirements, design, development and qualification testing, continually evaluating the system and its ability to complete its mission. SMDC and NASA recognize the importance of catching defects early in the program reduces cost and schedule impact and increases mission success.

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Summary

Experience gained across many programs' development cycles has shown that the key to successful development is to integrate early, and integrate often. The REST Simulation Framework and Test Operator Interface provide a foundation for any HW/SW program to enable that to occur. It provides a proven foundation that enables systems integration early in the program using models with real interfaces to feed early system design cycle decisions. As prototype or candidate HW become available, the system enables it to be integrated and assessed as the system transitions from development to testing. This testing can be performed for nominal and off-nominal conditions across the entire mission timeline. The main goal is catch defects early in the lifecycle to avoid the exponential cost and schedule impacts of defects later in the program.

Benefits:

- Proven real-time simulation framework & test operator interface.
- Designed to facilitate reconfiguring the system to swap a model out for a prototype of FEU hardware.
- Provides key insight to the integrated system as the process through development to delivery.
- Reduces program cost & schedule risk by identifying and fixing defects early in the life cycle.

About Axient

With over 2,200 employees, Axient is the result of the merger of four leaders in the defense and civil markets: QuantiTech LLC, Millennium Engineering and Integration LLC, Systems Engineering Group, and Dynamic Concepts LLC. Axient is headquartered in Huntsville, Alabama and has provided premier services and solutions to the Federal Government for more than three decades. Axient is certified in the following: ISO 9001:2015, AS9100 Rev D, CMMI-DEV Maturity Level 3, and has a DCMA Purchasing System, DCMA Property System, and DCAA Accounting System.

Core Capabilities

Simulation Framework features:

- Simulation Executive that provides a common framework for models to execute and interact.
- Real-time Synchronization & Timing services to control timing, execution, and shared data for distributed executable. In addition it provides the architecture to perform fault insertion.
- Input/Output modules that provide the interfaces to actual and simulated bus hardware (e.g. 1553, RS422, Gigabit Ethernet, Discrete I/O, Analog Sensors)
- Real-time Satellite Simulation models accelerate adaptation for similar application for similar applications Real-time Satellite Simulation models accelerate adaptation for similar application for similar applications
- Real-time data recording of simulation, buses, and HW data.

Simulation Test Operator Interface features:

- Simulation test setup, execution, monitoring, and termination.
- Real-time plots and tabular data of simulation parameters.
- Visualization displays.