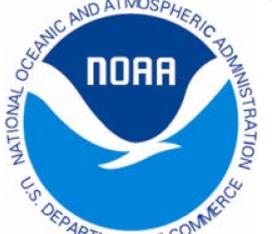




# Integrated Data Modeling and Simulation on the Joint Polar Satellite System Program



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## Context

The Joint Polar Satellite System is a modern, large-scale, complex, multi-mission aerospace program, and presents a variety of design, testing and operational challenges due to:

- System Scope: multi-mission coordination, role, responsibility and accountability challenges stemming from porous/ill-defined system and organizational boundaries (including foreign policy interactions).
- Degree of Concurrency: design, implementation, integration, verification and operation occurring simultaneously, at multiple scales in the system hierarchy.
- Multi-Decadal Lifecycle: technical obsolescence, reliability and sustainment concerns, including those related to organizational and industrial base. Additionally, these systems tend to become embedded in the broader societal infrastructure, resulting in new system stakeholders with perhaps different preferences (i.e., weather, positioning, comm. etc. are all enablers of economic activity).
- Barriers to Effective Communications: process and cultural issues that emerge due to geographic dispersion and as one spans boundaries including gov/contractor, NASA/Other USG, and international relationships.

## Purpose

A number of innovations and approaches leveraging computing and information technologies have been conceived, productized and employed to address aspects of the challenges of a modern aerospace program (e.g., MBSE/RVTM tools, SysML/UML, and Concurrent Eng. Tools, etc.).

However, a successful Integrated Data Modeling and Simulation capability must be defined within a manageable scope.

- This poster focuses on the role of the Flight Vehicle Test Suite within the broader JPSS Ground System

An Integrated Data Modeling and Simulation capability strategically defines, builds, and sustains the set of test support assets that enable test events to occur at varying levels of scope and for different objectives throughout the program lifecycle.

## Overview

JPSS Ground System Test Support Assets include:

- High and Moderate fidelity Flight Vehicle Simulators
- Well-characterized "Canned" Data Sets
- "Mini" Ground Data Processing or Command & Control Elements
- End-to-End Data Flow Monitoring and Analysis Tools

Each test support asset has a specialized but versatile role within the overall System Integration and Test plan

- Specific test events will drive **specialization** among assets.
- Standard and scalable asset interfaces should not preclude grouping or integrating assets to satisfy the scope or objectives of other (perhaps even unforeseen) test events or even other purposes (e.g., **versatility**), such as training activities or anomaly investigations.

This poster highlights a major effort to architect an element of the JPSS Ground System – the Flight Vehicle Test Suite – in accordance with the principles underlying an Integrated Data Modeling and Simulation capability

## FVTS Concept

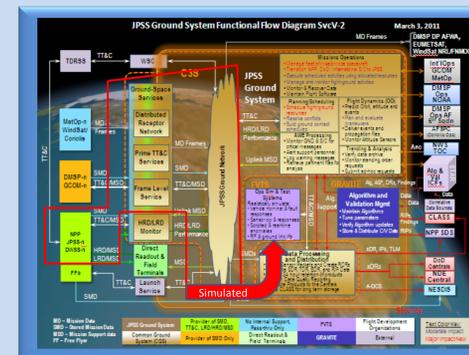
The Flight Vehicle Test Suite is an Element of the JPSS Ground System that provides Instrument, Spacecraft and Ground-link command and telemetry responses enabling test events including:

- Verification of software and table load products
- System Rqmt. and procedure maturation (e.g., EEO, Dry-run, Run-for-Record)
- Mission rehearsal and operations training
- Anomaly investigations

## FVTS Logical Architecture

The FVTS is comprised of the following Elements:

- Instrument Simulator (one per instrument)
- Spacecraft Simulator
- Ground-link Simulator
- FVTS Control Module

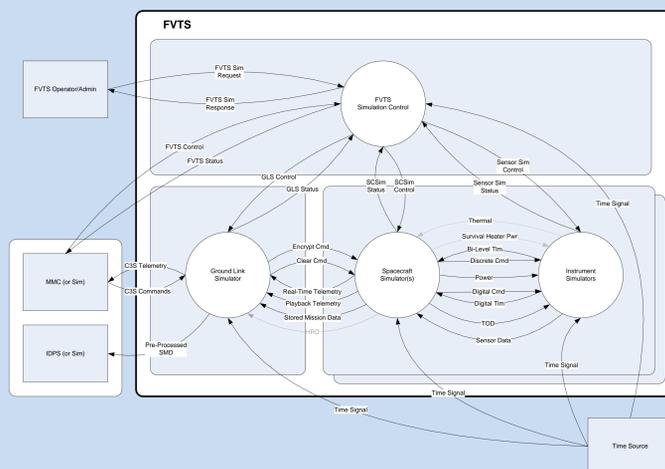


The FVTS simulates command and telemetry responses from the observatory(ies) and a portion of the Ground System, yet it is itself an Element of the Ground System. This is necessary since instances will be co-located with the Mission Operations Center, not broadcasting RF from space like the actual observatory!

## FVTS Multi-Mission Concept

Current efforts are focused on architecting two classes of J-1 observatory simulators (**specialization**) and common Ground-link and FVTS Control Elements to enable numerous multi-mission test events, training scenarios or anomaly investigations that may be presently unforeseen (**versatility**).

The FVTS logical architecture characterizes the information flows between the 4 FVTS System Elements, as well as its internal and external interfaces with the broader Ground System.



The FVTS multi-mission concept illustrates the principles of **specializations** and **versatility**.

Shown are two classes of observatory simulators with differing fidelities (EM and OPS) and representing different flight vehicles (NPP, J-1, etc.), operating simultaneously and interfaced with a single instance of the ground-link simulator, which provides external connectivity to other geographically dispersed facilities and test support assets.

