The Independent Test Capability (ITC) Research and Development team has formed a partnership with the GSFC GO-SIM team to develop a software-only simulator for GPM. The GPM Operational Simulator (GO-SIM) includes the GPM ground system and database, flight software executable, and spacecraft simulators. This will provide the GPM IV&V team the ability to load and run software binaries, inject errors via the ground system, stress the system under test, and validate findings from other IV&V analyses. A demonstration will be provided of the work accomplished to date.
GO-SIM
September 16, 2010

Presenters:
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Agenda

- Background
- GO-SIM Architecture
- GO-SIM Demonstration
- Integrating GO-SIM Components into the ITC
- Summary
GO-SIM Background

- Examined current IV&V projects for pilot study

- GPM Project Identified
  - Collaboration with GPM Operational Simulator Project
    - GSFC team investigating software-only simulation tools using ground simulator and spacecraft simulators

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Means to Achieve</th>
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<tbody>
<tr>
<td>2 Perform dynamic analysis on a current mission</td>
<td>Collaborating with GSFC GO-SIM effort to build software-only</td>
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## GO-SIM Overview

### Software-only Simulator

<table>
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<tr>
<th>Components</th>
<th>Capabilities</th>
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<tr>
<td>Wind River Simics</td>
<td>Load and run <strong>unmodified</strong> flight software binaries</td>
</tr>
<tr>
<td>Primary Instrument Simulations</td>
<td>Execute flight scripts</td>
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<td>ASIST Ground System</td>
<td>Single-step debugging</td>
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<td>Goddard Dynamic Simulator (GDS)</td>
<td>Inject errors via ground system</td>
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<tr>
<td>Wind River workbench integration</td>
<td>Stress system under test</td>
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<td></td>
<td>Validate findings from other analyses</td>
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GO-SIM Value

GSFC (GO-SIM)
- Reduce time & functionality needed from FlatSat
- Means to validate new procs prior to use on observatory
- Faster Development
- Ground Ops Training Platform
- Simulate long term operations
- Means to stress system w/o risk to hardware components
- Software-only simulator → no hardware maintenance or acquisition and increases number of potential users
- Checkpoints

IV&V (ITC)
- Increases IV&V capabilities and Project relationship
- Increases understanding of system dynamics and related tools: ASIST, GDS, and Primary Instruments
- Earlier Identification of software issues

GSFC Customer: Mission Operations

ITC Customer: IV&V GPM Team
ASIST Ground System

Spacewire Simulated Bus

BAE Simulation
----
Interface via Spacewire
(2) 1553

Instrument 1553 Interface

GMI Simulation

DPR Simulation

S/C 1553 Interface

GDS Model Simulation

Key

IV&V
Joint Effort
GO-SIM
ASIST Team

NASA IV&V Facility Independent Test Capability
• Primary Instrument Simulations
  – Pack and unpack formatted messages and packets
  – Receive and respond to instrument commands and requests for data
  – Handle necessary telemetry components
  – Maintain state just like the real instrument
GO-SIM DEMONSTRATION
ASIST
- GPM Ground System
- Features
  - Database-Driven Command, Monitoring & Control
  - Interactive Commanding
  - Script-Driven Test Procedures
  - Real-Time Page Displays
  - Real-Time Events Log
  - Command Status Window
  - Limit Checking
  - Real Time Plots (via gnuplot)

Simics
- Complete functional virtual platform
- Provides toolset to define, develop, and deploy system simulators
- Model system components
  - BAE RAD 750
  - 1553 models (2)
  - Spacewire
  - IO card simulation

GO-SIM Demonstration
Current State
INTEGRATING GO-SIM COMPONENTS INTO THE ITC
Integrating GO-SIM Components into the ITC

Will support GPM’s independent testing

GPM FSW on Wind River Simics

ASIST Ground System

Stimulate FSW on emulated hardware

Common User Interface

Simulation and Test Environment

Adaptable and Reconfigurable

Integration of simulation, tools, models, and test articles

NASA IV&V Facility Independent Test Capability
Integrating GO-SIM Components into the ITC

Central Server
Heartbeat Monitor
Broker
Simics

Windows

Message Bus (GMSEC & ActiveMQ)

ITC Database

GUI Prototype

Windows

Wrapper

Broker

Wrapper

ASIST

Linux
ITC DEMONSTRATION WITH GO-SIM COMPONENTS
• gc_hs_gencmds.prc
  – Verifies that CFS Health and Safety command function properly
  – Commands Tested
    • NO-OP
    • Reset Counters
    • CPU Aliveness
    • Other miscellaneous commands
    • Invalid versions of commands tested
The 3 Questions: Command Testing

Q1
- **Events:** Send a No-op Command
- **Expected Results:** Upon receipt of a No-op command, HS shall increment the HS Valid Command Counter and generate an event message.
- **Requirements:** HS1000; HS1003

Q2
- **Events:** Send an invalid HS command.
- **Expected Results:** The Command Rejection Counter increments and an error event message is generated.
- **Requirements:** HS1004

Q3
- **Events:** Send a No-op Command with an invalid command length
- **Expected Results:** The Command Rejection Counter increments and an error event message is generated.
- **Requirements:** HS1002, HS1004

NASA IV&V Facility Independent Test Capability
Conclusion

• Background
• GO-SIM Architecture
• GO-SIM Demonstration
• Integrating GO-SIM Components into the ITC
• Summary
QUESTIONS?