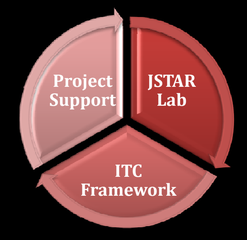
NASA IV&V Independent Test Capability

2011



Project Support

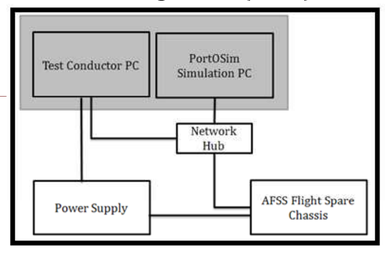
AFSS

✓Acquire and setup AFSS test configuration
- AFSS spare flight chassis

✓Selected COTS test coverage software

✓Developed reusable mechanism to generate system test coverage using socket
- LDRA Funnel (VxWorks task)
- LDRA Converter
- LDRA Receptor

Test Configuration (HWIL)



Test Coverage Results

1,000 Monte Carlo Simulations

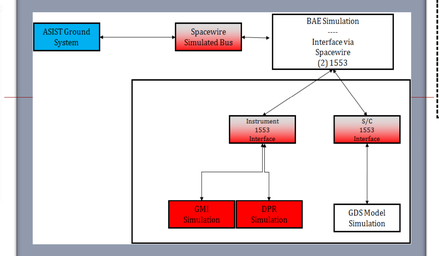
Statement Coverage	**60%**
The number of executable lines:	21,413
The number executed by all runs:	12,804
Branch/Decision Coverage	**53%**
Number of Branches/Decisions:	5,469
Number executed by all runs:	2,895

GPM

GPM Operational Simulator Components

✓ASIST Ground System Interface
✓Wind River Simics
✓Instrument Simulations (DPR, GMI)
✓ITC Synchronous Bus
- 1553 communications
- Spacewire Communications

✓GDS
✓Wind River Simics (RAD750)
✓Wind River Workbench Debugging

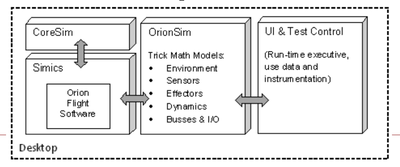


GO-SIM Features

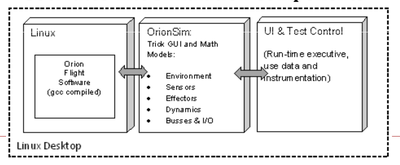
✓Load and run unmodified flight binary
✓Execute flight scripts
✓Single-step debugging
✓Inject errors via ground system
✓Stress system under test
✓Validate findings from other IV&V analyses

MPCV

Socrrates-Heavy Simulation Components



Socrrates-Lite Simulation Components



Socrrates Features

✓Software-only flight simulator
✓Utilizes flight software binary
✓Provides mechanism to test MPCV flight software for IV&V

Kedalion

Provide a hands-on environment to allow early and sustained engineering analysis and risk mitigation of space vehicle avionics and software

JUNO

JUNO IV&V SUROM Investigation

Objective:
Increase assurance through independent stress testing of SUROM process.

Approach:
Systematically explore combinations of page faults and image corruption.

Facilities:
- Wind River Simics
- Juno SUROM
- Juno FSW Image Files

Test Setup:
Nominal
- No image corruption
- No page faults

1. Run nominal boot, find setup of MMU and BAT registers, verify values in IBAT and DBAT
2. Verify image in SDRAM at boot completion

Test Output→ (Log File)

```
RUN 1
08/01/11 13:03:10
Memory modifications:
Index     orig_val  mod_val
0x25C04B  0xF0      0x18
0x17B22F6 0xFF      0xBD
…
Image modifications:
Index     orig_val mod_val
0x11AA9   0x18       0xAB
…
Orig_data_crc  mod_data_crc
Orig_head_crc  mod_head_crc
```

JWST

ISIM Software

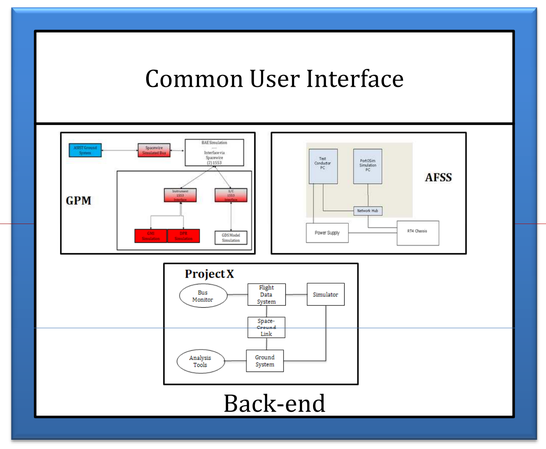
✓Science Instrument Development Unit (SIDU)
✓Hardware-in-the-Loop Test Environment
✓Components
- COTS PowerPC Board
- 1553 Cards
- Spacewire Test Set (SWST)
- ASIST / Eclipse Ground System

Spacecraft Flight Software

✓Scoping development of software-only test environment
✓ In-house Simics model development
- JPIM
- SBC

✓Successfully loaded SBC code onto Simics and see basic kernel scheduling and idle calls – requesting additional information from spacecraft developer

ITC Framework



Current Features

Launch and monitor simulations (GOSIM; JUNO)

Track and view data

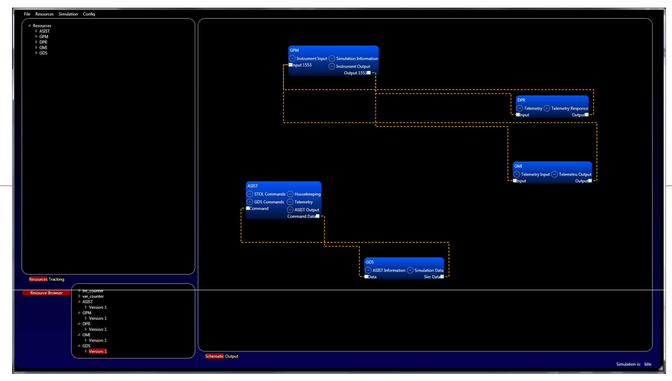
Watch Window

Inject Fault Data

Data logging

Visualization Software Integration

Breakpoints



Jon McBride Software Testing and Research "JSTAR" Laboratory

Objectives

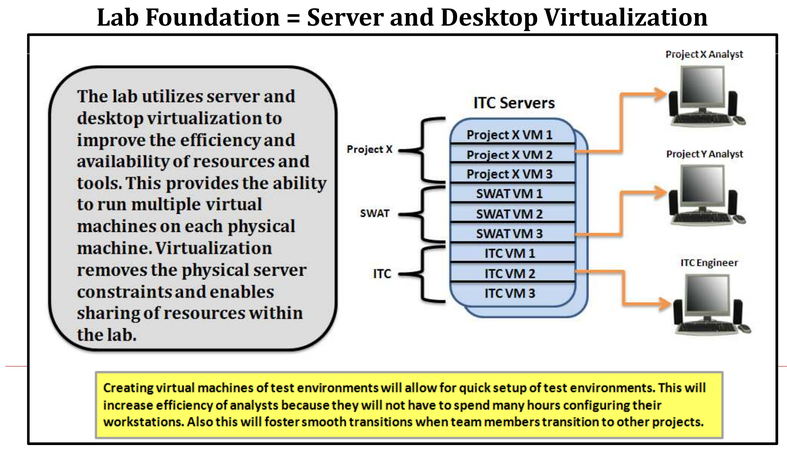
✓Software and test environment development by ITC Engineers

✓Testing by IV&V analysts
- Using ITC developed test environments
- Using various tools

✓Tools support (SWAT)
- Perform evaluations test tools (new, upgrades)
- Perform acceptance testing of tools

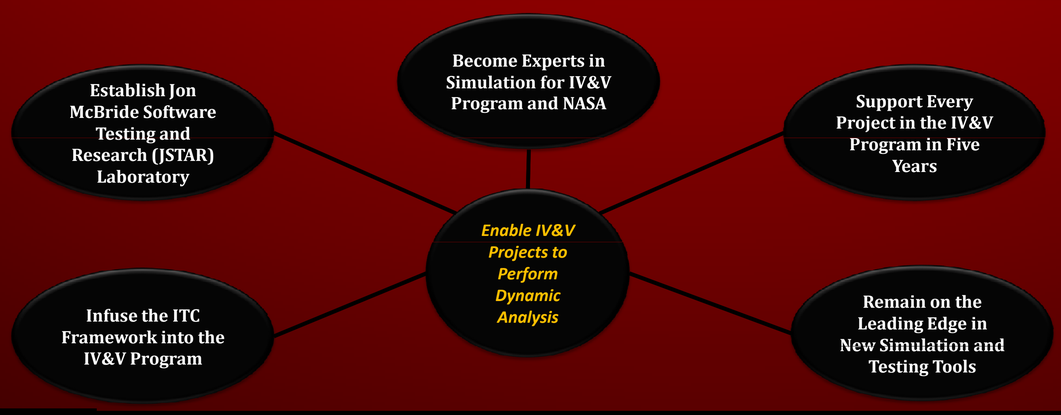
✓Training Environment

Lab Foundation = Server and Desktop Virtualization



Tools	Virtual Images
Wind River Workbench 3.2	GPM FSW Tool Chain / Build Environment
Wind River Simics 4.4	GPM Ground System (Sammi lic req.)
ASIST Ground System	PITS
MSDN Subscription	Solaris 10 (x86)
Tornado	CentOS version 5 (i386 & x86_64)
LDRA TestBed	RedHat Enterprise 5 (x86_64)
IBM Rational Synergy	Ubuntu 10_4
IBM Rhapsody	ISS MADE
MagicDraw UML	Windows (XP SP3 (32 bit), 7 (32/64 bit), Server 2003 R2, Server 2008 R2
Understand for C/C++	Socrrates Lite & Heavy (April 2011 ver)

VISION



Validate Other IV&V Findings

Measureable Repeatable

Independent Testing Value

Unbiased Q2 and Q3

Develop Core Expertise in Testing

ITC
Independent Test Capability

Team Members

Justin Morris Jeff Joltes
Steven Seeger Justin McCarty
Brandon Bailey Dan Nawrocki
Shawn Carroll David Soto

ivv-itc@lists.nasa.gov

http://itc.ivv.nasa.gov