



nos³

NASA Operational Simulator
for Small Satellites

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www.nos3.org

Overview

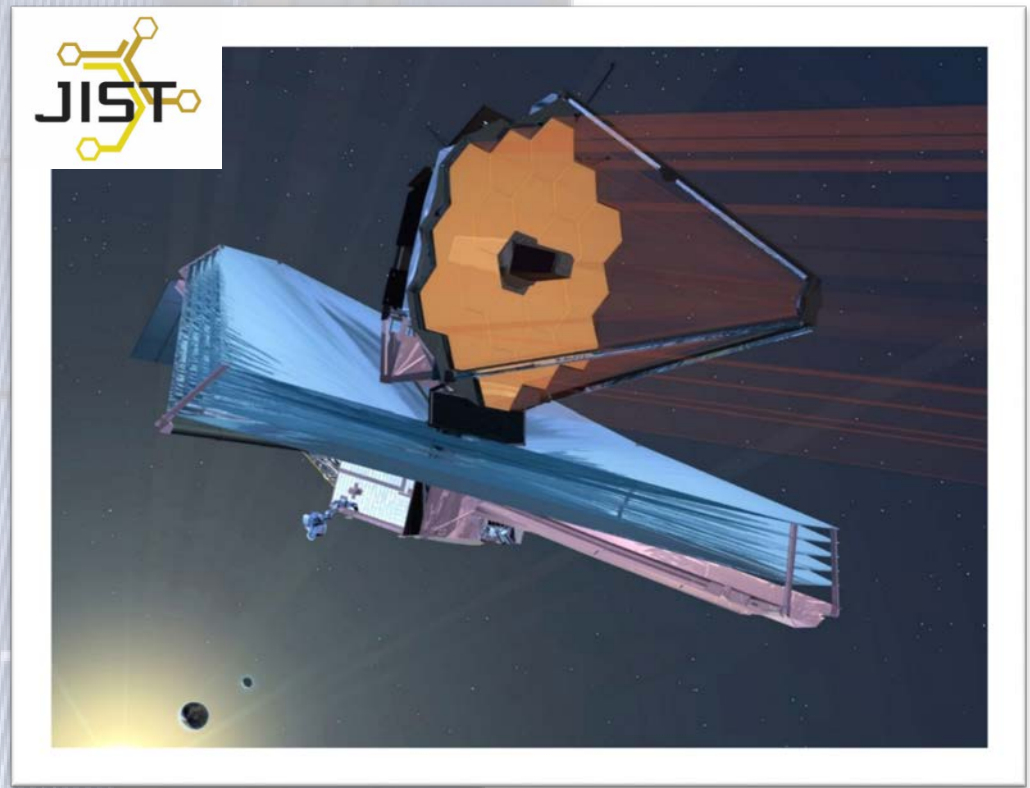
- JSTAR ITC Introduction
- STF-1 and NOS³
- Components
- Architecture
- Hardware Model
- Build System
- Demonstration



NASA IV&V – JSTAR ITC



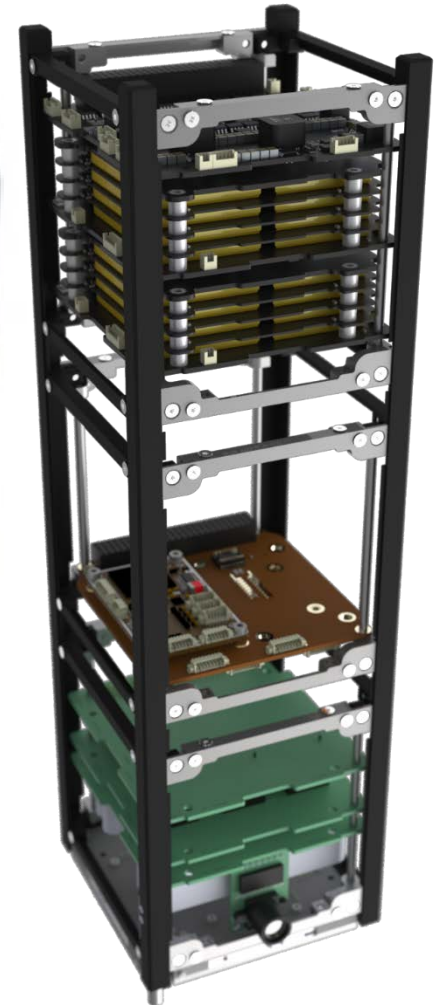
- Acquire, develop, and manage adaptable test environments that enable the dynamic analysis of software behaviors for multiple NASA missions .



Simulation To Flight - 1



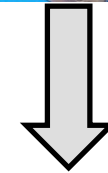
- First CubeSat from West Virginia
- Current launch ready date is April 2017
- ITC team:
 - C&DH, FSW, Integration, and Testing
- West Virginia University:
 - CSEE, GPS, IMU, and Space Weather
- **Primary Objective**
 - **Showcase simulation technologies developed at NASA IV&V while demonstrating and improving utility from concept to operations.**
- Secondary Objectives
 - WVU Research Payloads



NASA Operational Simulator for Small Satellites



- Uses:
 - Early Development
 - Integration
 - Mission Planning
 - Training
 - Verification and Validation
- Simulated Components:
 - Cadet UHF Radio
 - Clyde Space Batteries / EPS
 - Generic Science
 - GomSpace Nanomind A3200 Sensors
 - ISISpace Antenna
 - Novatel GPS





Components



open source

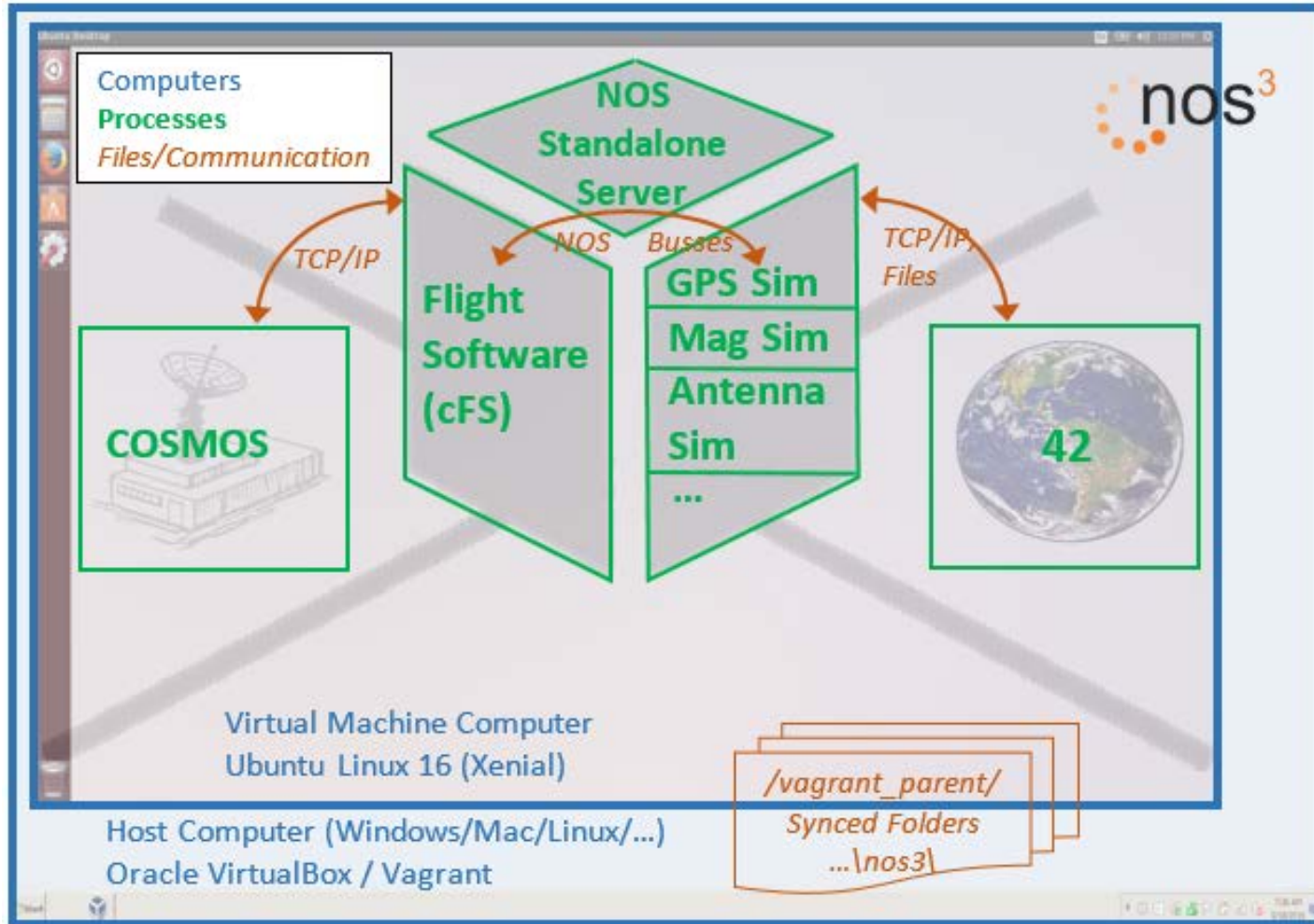
- 42, Dynamics Simulation and Visualization
- cFS, Core Flight System
- COSMOS, Ground Station Software
- Vagrant
- Virtual Machine

- FSW Hardware Abstraction Layer
- Hardware Simulators
- NOS Engine Middleware
- Orbit Inview & Power Prediction (OIPP) Tool
- Scripts





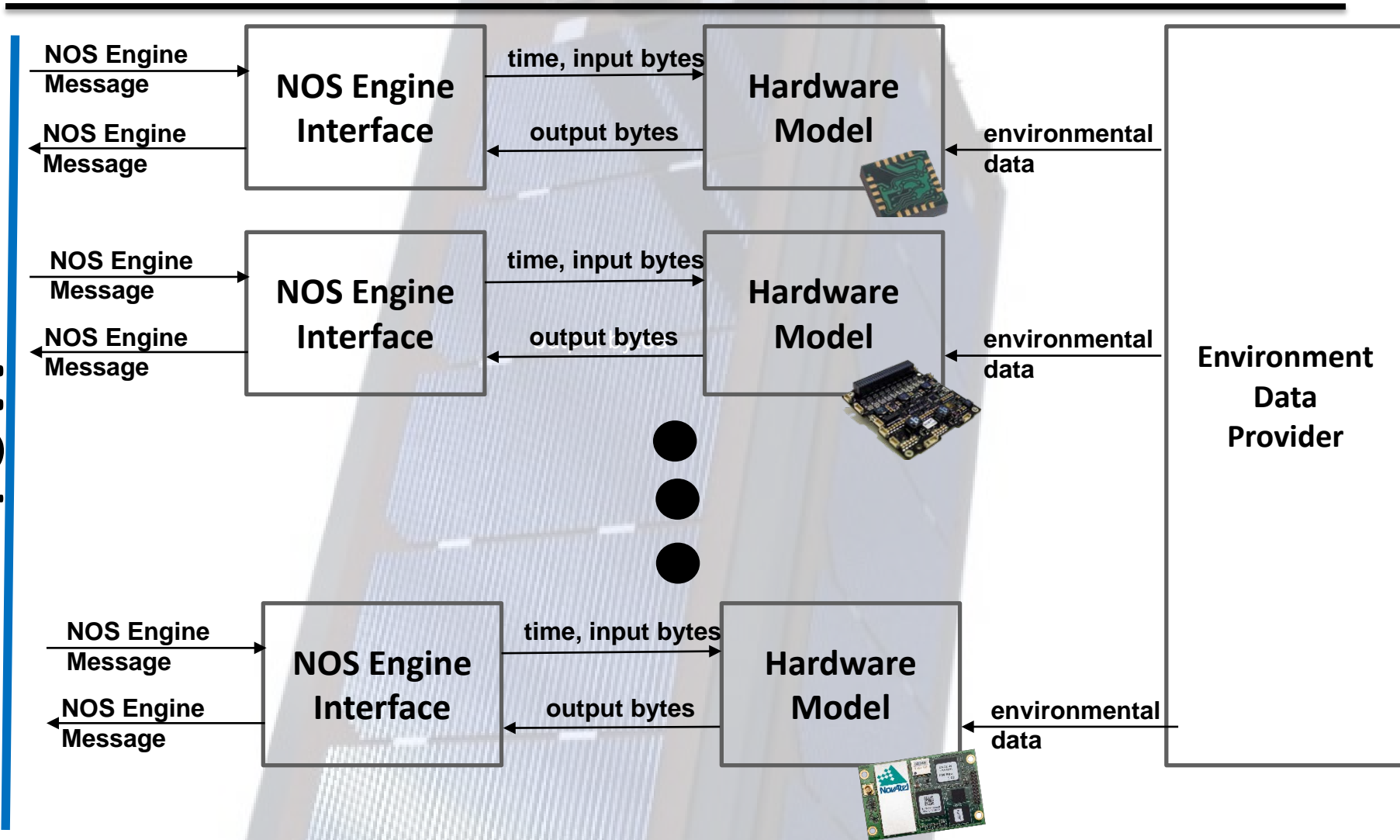
Architecture





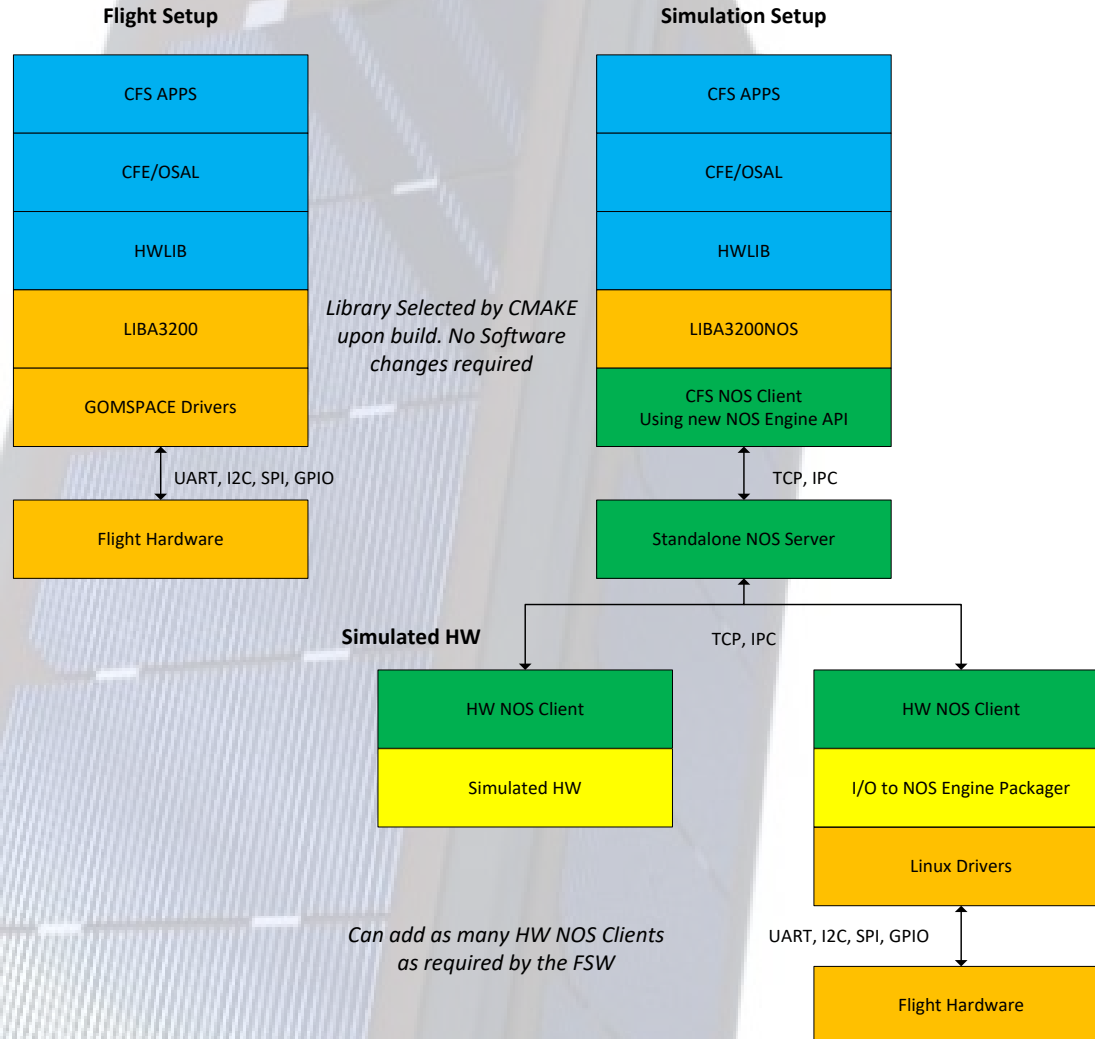
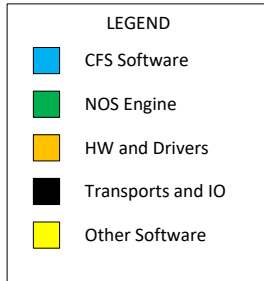
Hardware Model

FSW





Build System




Framework for Spacecraft Security



- Simulation Test Bed for Security Technologies
- Realistic Spacecraft Operations – End-to-End
- CryptoLib integration design complete
 - Will demonstrate AES encryption on the downlink
 - Software encryption – no specialized hardware needed
 - Integrates with cFS
 - Coding has started, will wrap up by September
- Demonstrates Real-World Standards Based Spacecraft Security
 - Does not have to be expensive
 - Does not have to be time consuming
 - Can be applied to both large and small systems

Questions?

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Backup

The screenshot displays the NOS3-Run application interface, which is divided into several functional areas:

- 42 Cam (Top Left):** A window showing a satellite view of Earth with a red border. It includes a sidebar with various parameters and a central display area. A white box with the number "42" is overlaid on the right side.
- NOS Engine (Top Middle):** A window showing the "nos³" logo and a terminal window with system logs. A white box with the text "NOS Engine" is overlaid on the right side.
- COSMOS (Top Right):** A window showing a command input field with "IMU_CMD_MODE_5" and a "Send" button. Below it is a table with columns for Name, Value or Status, Units, and Description. A white box with the text "COSMOS" is overlaid on the right side.
- FSW (Bottom Left):** A window showing a terminal window with system logs and a white box with the text "FSW".
- SIMs (Bottom Middle):** A window showing a terminal window with system logs and a white box with the text "SIMs".
- COSMOS Table (Bottom Right):** A table showing logging status with columns for Size, Rx Q Size, Bytes Tx, Bytes Rx, and Cmd. The table contains two rows of data.