Distributed Avionics and Software Verification for the Constellation Program

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CONSTELLATION

Introduction

- Increasing cost and schedule pressures are leading to distributed avionics and software verification

DSIL Vision

The Cx DSIL will consist of multiple System Integration Labs (SILs), Simulators, Emulators, Testbeds, and Control Centers interacting with each other over a broadband network to provide virtual test systems for multiple test scenarios.

Simultaneous T&V Activities using DSIL
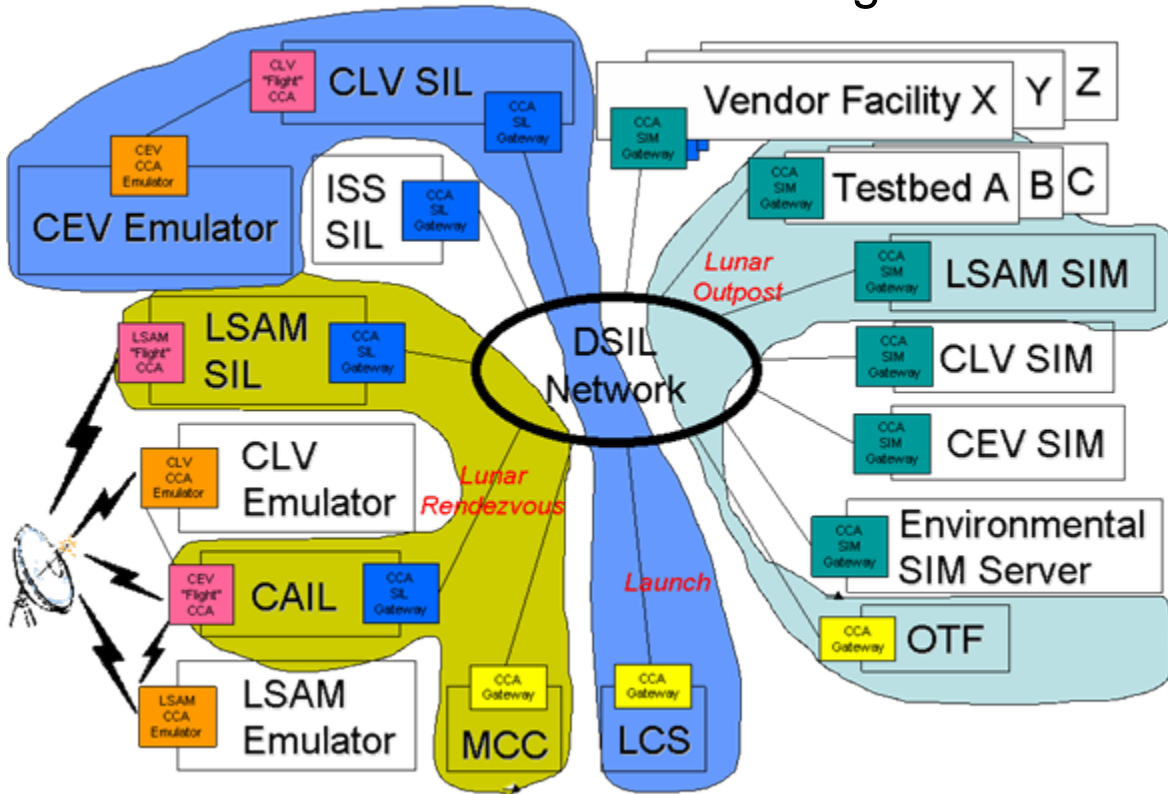
The Cx DSIL will be used to
- Sign-off Level 2 T&V
- Dry Run integration tests (e.g., Multi-Element Integration Testing (MEIT), Flight Element Integration Testing (FEIT)) in much the same way ISS SIL is used today
- Conduct Integrated S/W Load Testing
- Prove out C3I Architecture by using it

The Cx DSIL is also available to
- Early Hardware/Software Integration
- Conduct Level 3 integration tests
- Facilitate Crew Training

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DSIL - SIL to SIL : Sims + Avionics H/W

Diagram by Mike Matthews/GSFC

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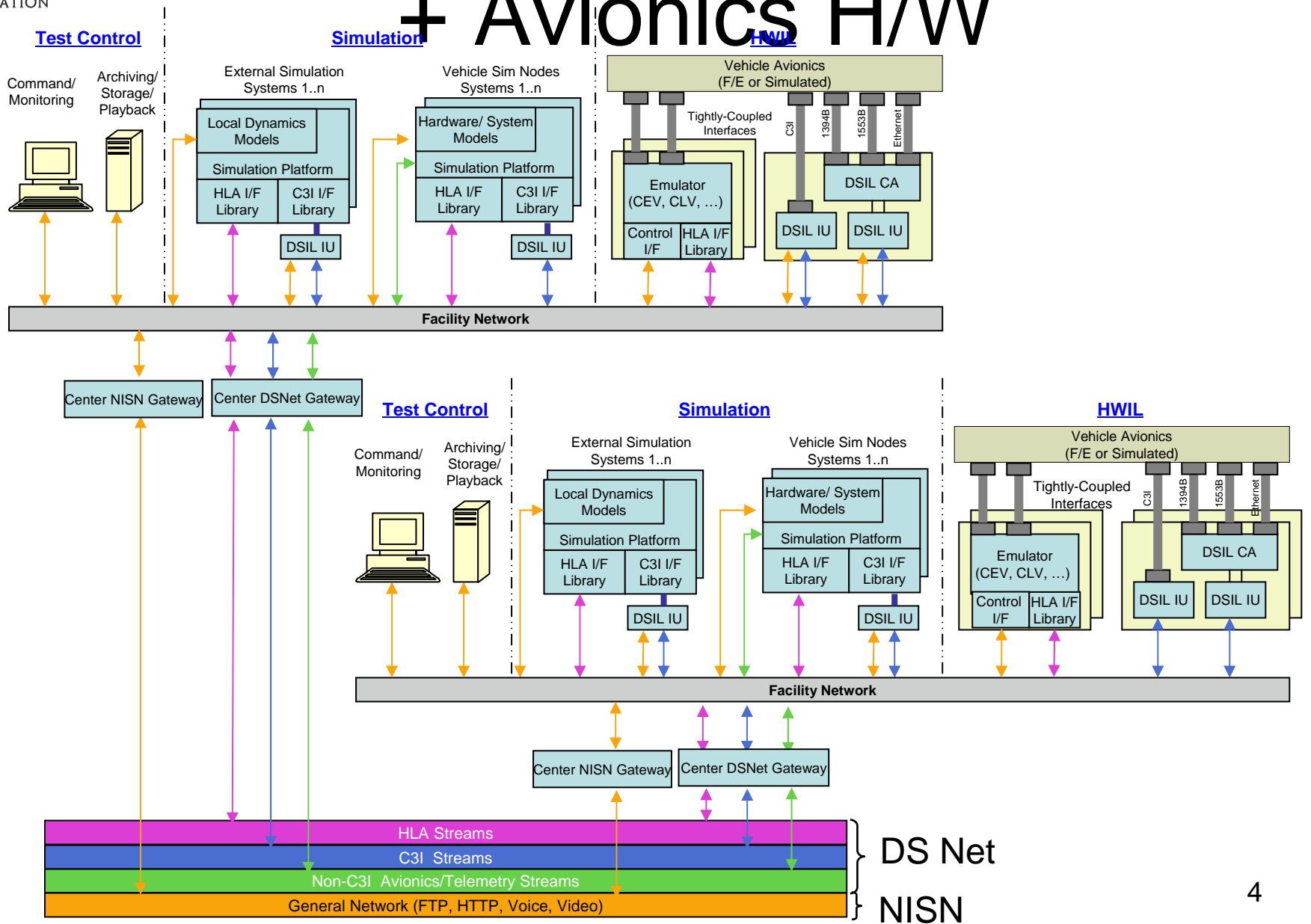
Challenges

- **Distributed Testing presents unique challenges versus traditional localized testing**
  - **Latency**
  - **Security**
  - **Timing**
  - **Data Integrity**
  - **Service Availability**

Cost Benefits

- **Cost benefits are anticipated for**
  - **Production**
    - **Less duplication of System hardware**
    - **Utilize assets already in place**
  - **Maintenance and Operations**
    - **Using the most up to date system representations**
    - **More experienced personnel maintaining each system**
  - **Travel**
    - **Less travel to monitor system integration tests**
    - **Less travel for each system to go to other systems facilities to maintain their system's emulators**

Schedule Benefits

- **Schedule Benefits**
  - **Scheduling of limited resources**
  - **Early Testing**
  - **Less rework due to anomalies in test support equipment**
  - **Reduction of anomaly reports**
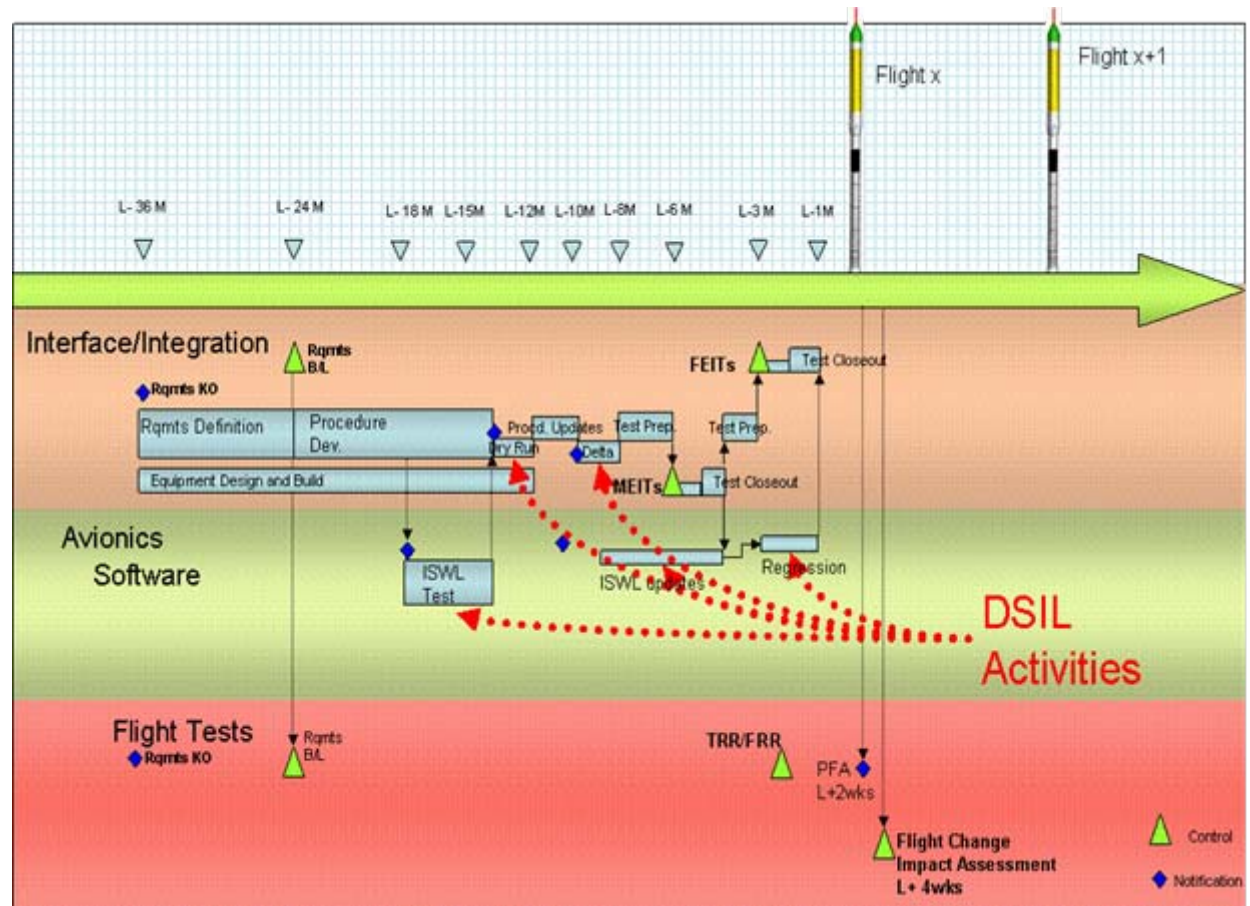
Risk Reductions

- **Having Integrated Testing available throughout the life of the Program**
- **Prototype system interfaces early to test compliance (e.g. C3I interoperability)**
- **Buy down the risk of failure during larger scale testing later in the program life cycle**
  - **Dry run MEIT and FEIT tests using distributed SILs**
  - **Check out procedures**

Latest Demo of DSIL

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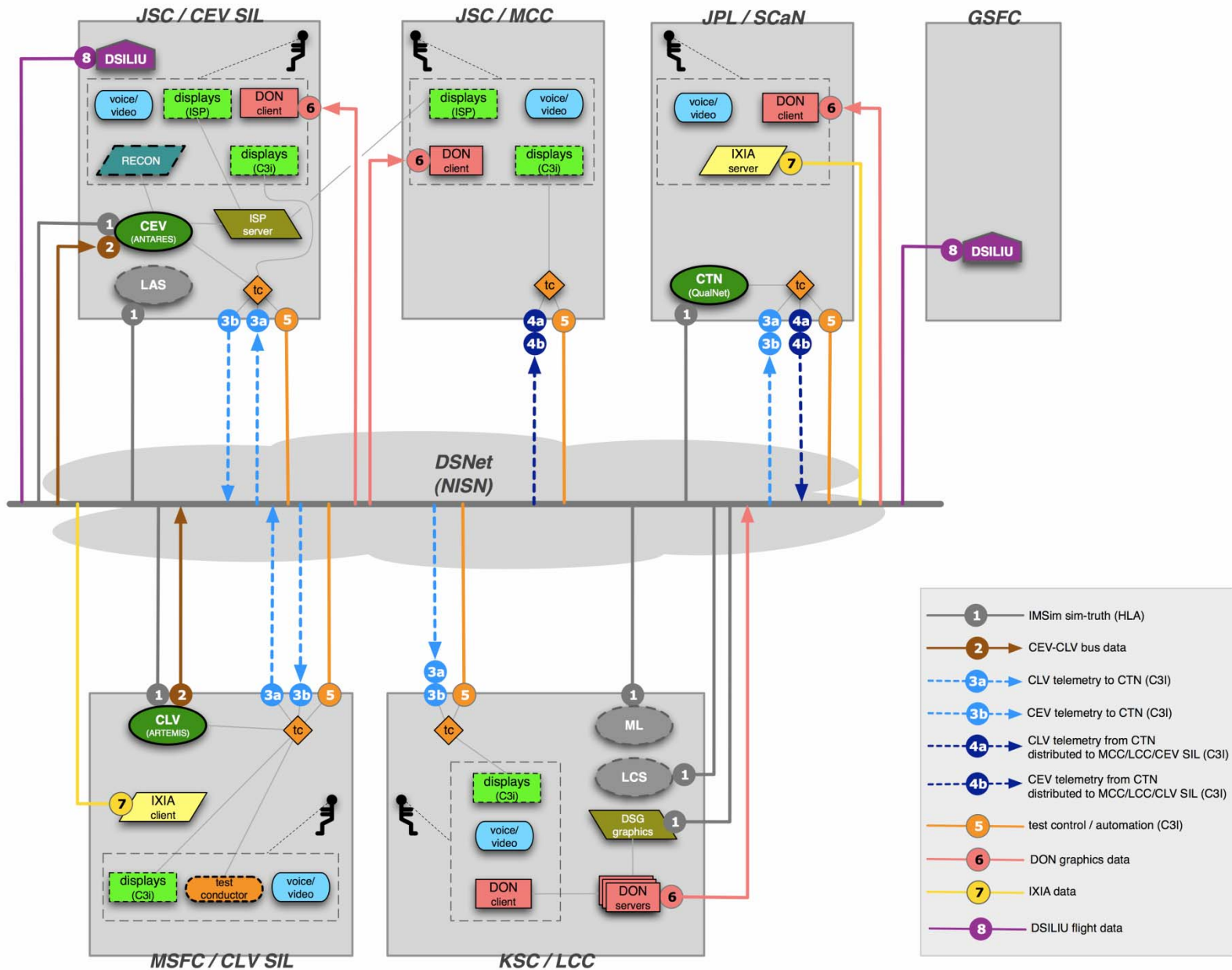
Summary

- **While distributed avionics and software verification presents challenges there are a number of anticipated benefits.**

Acronyms

- C3I – Command, Control, Communications and Information
- CAIL – CEV Avionics Integration Laboratory
- CEV – Crew Exploration Vehicle
- CLV – Crew Launch Vehicle
- CTN – Communications and Tracking Network
- Cx - Constellation
- DON - Distributed Observer Network
- DSIL – Distributed System Integration Laboratory
- DSILCA – DSIL Communications Adapter
- DSILIU – DSIL Interface Unit
- FEIT - Flight Element Integration Testing
- HLA – High Level Architecture
- HWIL – Hardware In the Loop
- LSAM – Lunar Surface Access Module
- MCC – Mission Control Center
- MEIT - Multi-Element Integration Testing
- SIL – System Integration Laboratory
- T&V – Test and Verification