

# Joint Distributed Engineering Plant Technical Framework

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# Purpose and Topics

- **Purpose**

- Provide an overview of the Joint Distributed Engineering Plant Technical Framework

- **Topics**

- Background and History of JDEP
- JDEP Strategy and Technical Framework
- 02 Activities and Experience to Date

# Background and History

# Joint Distributed Engineering Plant (JDEP) Defined

“ The JDEP program was established as a DoD-wide effort to link existing service and joint combat system engineering and test sites (including design activities, software support activities, test and evaluation facilities, training commands, and operational units). JDEP is designed to improve the interoperability of weapon systems and platforms through rigorous testing and evaluation in a replicated battlefield environment. ”

[DPG Update FY 2002-2007, Guidance, p.112]

# The Big Idea

- Doctrine and operations are increasingly dependent on **Joint SoS**
- This demands **new approaches to SoS development**, integration, test and assessment
- **JDEP** addresses this need by providing users with the means to create SoS environments by linking existing, distributed system HWIL assets
- Assets, built and used for individual system development and test, are **shared and applied** in different configurations to address SoS
- JDEP supports users to identify the right resources, to configure resources to address **interoperability issues**, providing access to common reusable assets (networks, security devices, scenarios, etc.)

# JDEP History and Major Milestones

## Initiation

AT&L/ J8  
Memo  
Following  
NDEP Visit

Engineering  
Task Force  
and Executive  
Steering Group

Task  
Force  
Report

June  
July  
Nov  
1999

## "Start-up"

Formal Start

Planning initiated for POC event

JDEP Strategy  
Study Kickoff

JDEP  
Strategy  
Adopted

Management  
Plan Accepted -  
Transition  
Begins

Sept  
Oct  
Jan  
June  
2000

## "Stand-up"

Initial JDEP  
POC Event

Standard-based  
Tech Framework  
Established

New Mgt  
Structure  
Established

FY02 Events  
Selected and  
Planned

Sept  
Oct  
Jan  
July  
2001

### • 99 Memo creates JDEP

- Formed Steering Group & Engineering Task Force
- Adopted initial plan for JDEP implementation with JTAMD

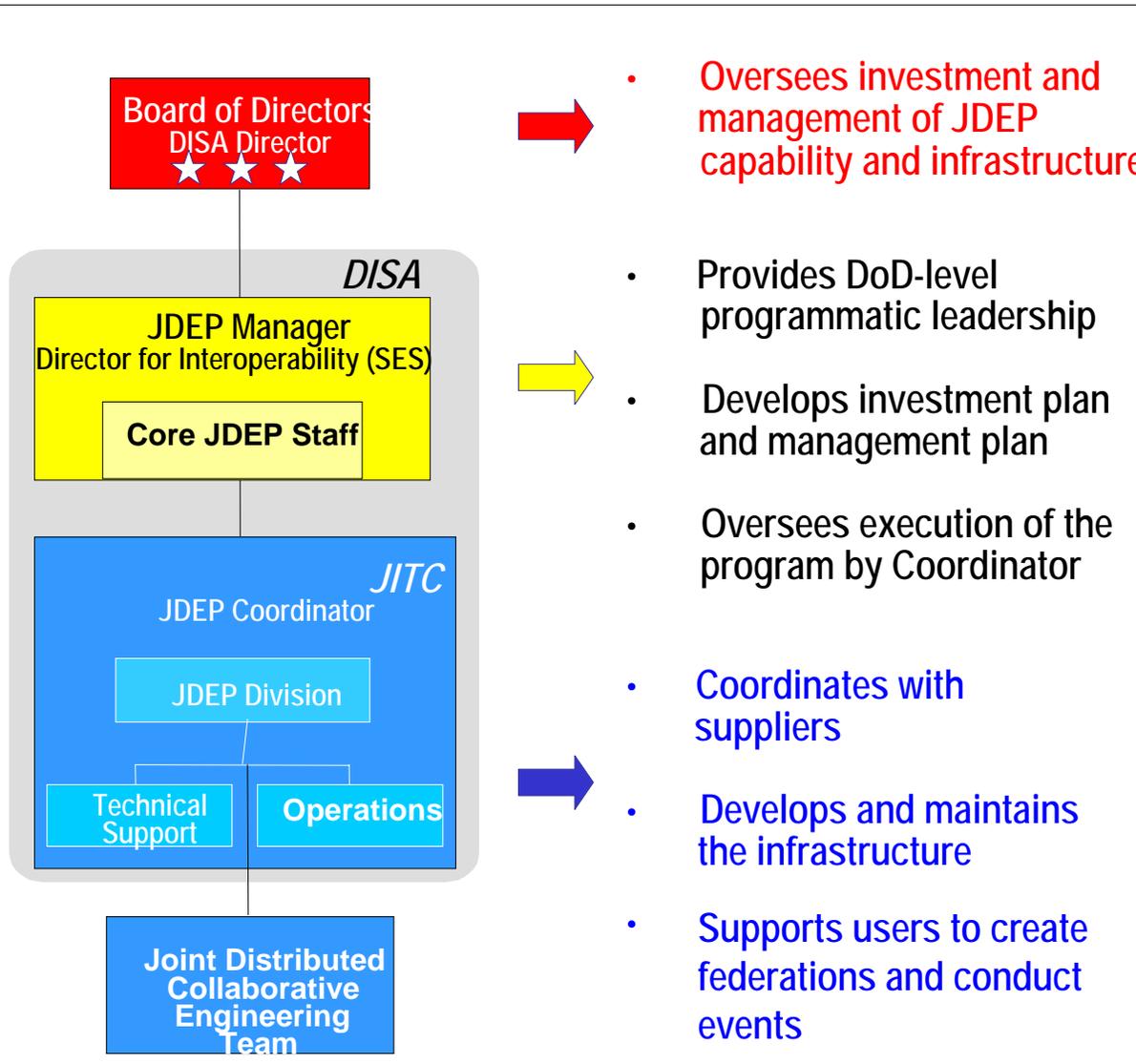
### • Sept 00 Program Start

- JTAMD Interim Manager
- POC Event Planning
- JDEP Strategy Adoption

### • Current Status

- 01 POC Event Executed
- New Management Structure In Place
- 02 events planned

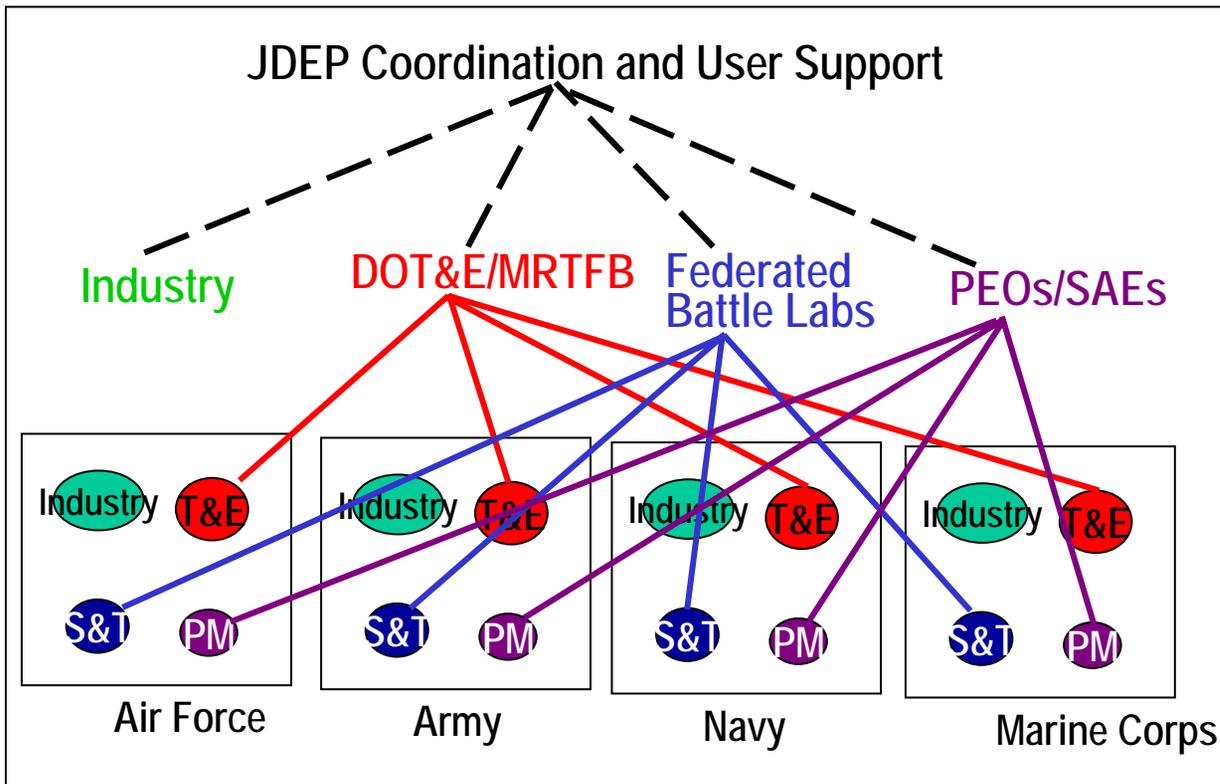
# JDEP Management Structure



- Single management structure supporting multiple user communities
- Users (PMs, test agencies, etc) work within their existing structures to conduct events with JDEP support to meet their needs
  - JNIC will coordinate JTAMD applications of JDEP

# JDEP Strategy and Technical Framework

# Purposes of JDEP



- JDEP will support three types of users
  - **Developers** to engineer interoperability into systems
  - **Testers** to test and evaluate interoperability among systems
  - **War fighters** to assess operational capabilities of forces

- By providing technical support to identify, access, and configure HWIL and SWIL federations of SoS to meet users' needs

# JDEP Strategy

- **Strategy** was developed and adopted in FY01
- **Purpose**
  - Guide JDEP organization and development to extend the capabilities of JDEP to support HW and SW in the loop integration and interoperability testing for applications across mission areas to meet needs of the developer, the tester and the war fighter
- **Key Ideas**
  - JDEP Capabilities
  - JDEP Events
  - JDEP Participants
  - JDEP Technical Framework

# JDEP Capabilities and Events

- JDEP **capabilities** are
  - HWIL/SWIL assets and processes,
  - owned by different organizations,
  - reused in different federations to address different SoS issues,
  - 'coordinated centrally' to support reuse and access by multiple users for different purposes

Common across users; how they are used & for what purpose varies

- JDEP **events**
  - occur whenever JDEP components are 'federated' may be large or small with multiple events running concurrently
  - may not be a single event, but rather an ongoing event series

# JDEP Participants

- JDEP **users** define the problems to be addressed by the JDEP federation and applies the results to meet their needs
- JDEP **providers** support users in several ways
  - **Coordination and technical support organization** helps users to identify, access, and configure assets and provides common tools and processes to meet their SoS needs
  - **Event conductors** direct specific events on behalf of users
  - **Suppliers** share their assets with different users to address SoS issues
- JDEP **management** looks across all JDEP uses and events to
  - Provide infrastructure investment,
  - Oversee asset coordination, and
  - Arbitrate access to scarce resources

# JDEP Technical Framework

- **JDEP technical framework** defines how components are 'composed' to create a 'federation' including
  - The types and functions of components
  - The interfaces between components
  - Guidance on how to configure components into federations
- Today **different communities** use **different approaches**
  - Include, among others, Navy DEP, BMDO 'TMDSE', 'D-Net', TENA
- JDEP challenge is to define a framework to **bridge communities**
  - Sufficient structure and standardization to get efficiency through ease of reuse and reconfigurability and
  - Sufficient flexibility to support different user needs and accommodate legacy capabilities with realistic investment

# So... Proposed Approach for JDEP

- Create a common framework for as basis for JDEP investments
  - Upgraded systems and new systems interfaces will be implemented using framework
- Owners of current infrastructures can reuse upgrades or new systems through gateways or other CM based 'interface switches'
- JDEP events will be based on federations using framework
- JDEP framework will be based on **open industry standards and standards-based commercial software and tools**

# JDEP 01 Experience with Existing Approaches

- **In 01** a proof of concept event was conducted
  - DEP based, addressed subset of SIAP SE issues, identified gaps
  - Exercised process and offers source of lessons for future
- **Late in 01**, MDSE was nominated for use for SIAP SE 02 event
  - Assessment showed similar tech issues as found with DEP
  - In addition, because MDSE is an environment owned and developed by a particular organization for its own needs
    - Needs of owner take priority for MDSE integration and exercise resources
  - SIAP SE recommended no MDSE event

# JDEP 01 Proof of Concept Event



- Initial planning based on
  - Use of NDEP process to produce 'Caps and Lims'
  - Reuse NDEP network, scenarios, data collection and analyses
  - Limited funding
- SIAP SE selected customer
  - Required rethinking
  - Placed constraints on event due to schedule and funding
- Experience supported development of JDEP technical framework
- Event objectives
  - Characterize performance against with SIAP metrics
  - Identify added capabilities needed for SIAP follow-up analysis
  - Develop JDEP process
- Event was executed in September 01; analysis underway

# Outstanding SIAP Issues With Infrastructure

- HWIL Sim-Stim Fidelity
  - Need ability to stimulate the HWILs in ways not now supported
    - Update simulations (radar, sensors, communications systems) which are generating inputs to HWIL mission computer systems to systematically and predictably introduce 'biases' in the inputs to the HWIL to reflect operational conditions
- Need to collect data from HWILs in ways not now supported
  - Extract added data from both simulations and HWIL mission computer systems
- Flexibility
  - Need the ability to quickly and at a low cost to
    - Change scenarios, add or substitute systems in federation, adapt simulation capabilities (change how systems are being represented, incorporate biases)
  - Need the ability to address engineering issues as well as test systems
    - Examine effect of changes as well as verify interoperability of current systems
    - Implications for incorporation of digital system representation

# Role of Simulations in JDEP Federations

- Simulated elements may be incorporated to address
  - Elements of the systems of interest in the 'sim-stim' for a systems (e.g. platform movement)
  - Area-wide effects (e.g. communication or electronic warfare)
  - Threat systems and blue systems, which need to be present to meet the needs of the event but do not require HWIL
- Simulations offer advantages .... and disadvantages
  - flexibility, portability, and cost (although not always low cost)
  - questions of validity
- Need for valid system representations is likely to increase as demand for SoS integration and test out strips available of HWIL assets

Provide opportunity to assess proposed, vice implemented, capabilities to supports development as well as test

# Framework Considerations

- Support multiple, concurrent federations
- Include simulated as well as HWIL capabilities
- Support small as well as large federations
- Address current, fielded systems and new, developmental systems
- Support evolving system configurations
- Support coalition interoperability
- Include industry as important participants, and potential users

# JDEP Technical Framework

## Applications

Utilities  
Partitioning of representation

## Application interface

flexible support for data exchange and setup

## Data exchange specification

conditions, syntax/semantics of data exchange

## Information/data management

support efficient delivery, filtering, etc of data

## Communications

local/area wide; physically move data

**Commercial**                      **Representation**  
**Utilities (IEEE 1561)**   **Partitioned by Function**

**Flexible FOM, with setup data in FOM**

**Suite of extensible of Federation Object Models  
(IEEE 1516, Object Model Template)**

**HLA/RTI (IEEE 1516, Runtime Interface)**  
**-- TENA Middleware**

**Industry standard communication services**  
**Defined for each application**

# Advantages of An Open Industry Standards-Based Approach

- Available **commercial** products make federation development faster, cheaper, and easier to upgrade
- By separating systems and other representations from the infrastructure, **potential to easily 'upgrade'** or substitute different renditions (e.g. better sensor model)
- Because interfaces are based on industry standards, it is possible for multiple developers to work **concurrently** and for components developed for one application to be more readily reused in another
- Using industry standards means some of the components may **already be compliant**
- The components can be **reused** in many different federations, with different managers and users, with the same federate participating in multiple different federations

## However...

- A 'Standards-Based Framework' is still only a framework....
- It is still necessary to .....

  - Clearly define the problem
  - Select/develop the right federates with the right characteristics
  - Verify, validate and accredit the federation for the problem

**it does provide guidance on a consistent process to accomplishing these**

- It is still necessary to .....

  - develop and maintain the federates (simulated and HWIL) with the fidelity and characteristics needed for the problem being addressed

**which should be more readily reusable if implemented using recognized standards**

- There is no guarantee that federates developed to address one problem will be appropriate to address another problem

**but those which are appropriate can be more readily accessed and reused**

# 02 Technical Activities and Experience To Date

# JDEP 02 Activities

- As a result of the 01 POC experience and the assessment of other available infrastructures, began to apply JDEP technical framework
  - Role of JDEP Coordinator and Support Organization
  - General Approach to Implementation
  - 02 federation development and events

# Role of JDEP Coordinator and Support Organization

- User organizations select topics of interest and provide major funding for federation development and execution
  - Air and Missile Defense (AMD) JDEP Use:
    - Participants: JTAMDO/JNIC, Services, Agencies
    - JTAMD Process: JCoCaC (JTAMD Council of Captains and Colonels)
- JTIC provides user support
  - Provide expertise, identifies products and federate candidates, supports implementations, retains experience base
  - Technical lead for infrastructure
    - Pilot implementations, reference FOM, product assessments, network
  - Plan, manage and support conduct of federations in partnership with users
  - Invest in reusable products/infrastructure for reuse across federations
  - Build product - experience base for support of next user
    - Includes industry tools and capabilities

# General Approach to Implementation

- FEDEP as a framework applies throughout federation process
  - Initial scoping mechanism for federation planning
  - Structure for WBS, federation action plans, and archives
- VV&A
  - User responsibility, JDEP/JTIC support, build on existing VV&A pedigrees
- Reference FOM
  - Common starting point for federations
  - Prototype, version of merged JVB/JSB FOM
- Reusing existing products
  - HWIL, Simulation (digital system representations), commercial products (utilities), network services
  - Commercial interface kits with 'agile' FOM capabilities
  - Team with organizations with current expertise

## 02 Federations and Events

- Technical track pilot in joint time sensitive targeting test bed
  - Assess issues in implementation of framework using commercial products to support existing tri-service test bed
- AF sponsored Multi-Source Correlator (MSCT) event
  - Assess multi-source tracker with HWIL
- SIAP Pilot Federation
  - Address data registration and time synchronization issues
  - Basis for federation evolution
- Engineering Analyses for JDEP AMD extensions
  - Added systems representations for future SIAP and AMD applications
- Technical assessment of added JDEP federation capabilities
  - Communications, environment

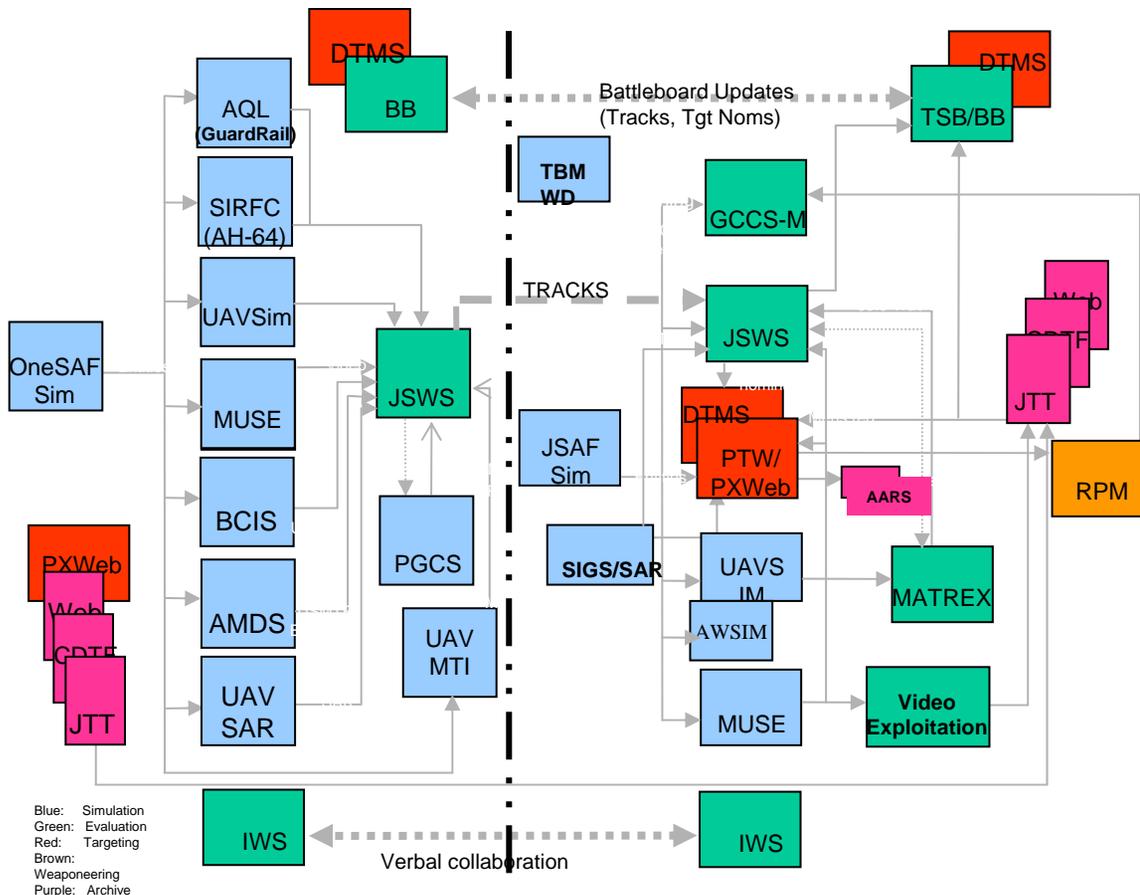
# Next Steps

- Technical Framework
  - Review and revision based on 02 Federation experiences
- Industry Advisory Group
  - NDIA JDEP Advisory Committee - NDIA Systems Engineering Division
  - 2001/2 NDIA hosted JDEP industry technical roundtables
  - Formalized advisory group formed in August; first meeting in October
- FY03 AMD Federations
  - FY03 User priorities established, initial planning underway
- Prospective next Application Areas
  - Joint BMC2
  - Single Integrated Ground Picture
  - Precision Engagement - Time Sensitive Targeting
  - Homeland Defense

# Backup

# Technical Track Pilot: Joint TST Test Bed

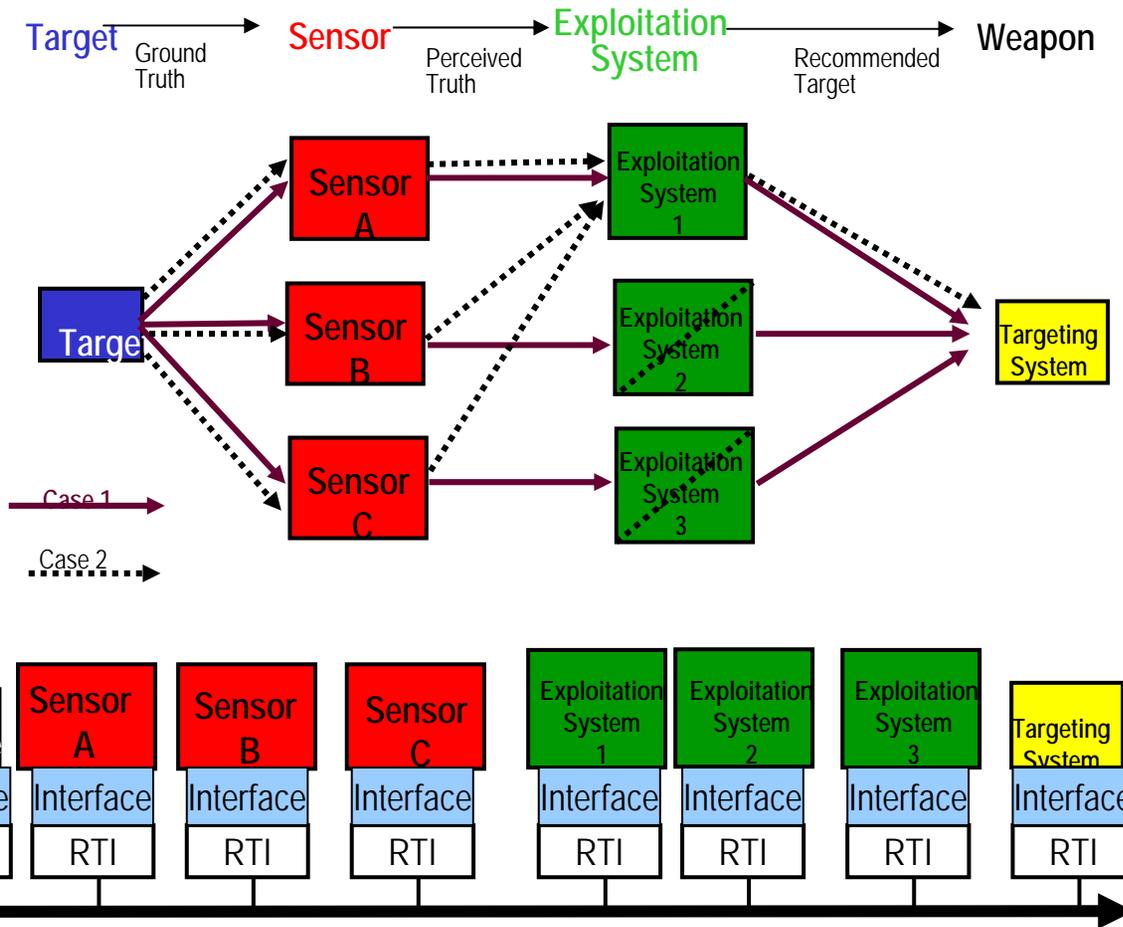
## TST SIMEX 6 Configuration



- Linked Service Labs under MITRE MOIE to address joint TST issues
  - Navy Strike Cell
  - CECOM I2WD
  - AF ESC SWIFT Lab
- Current configuration is a direct integration of available capabilities
  - Opportunity to examine viability of JDEP technical framework, migration approaches, issues and costs, and to assess advantages

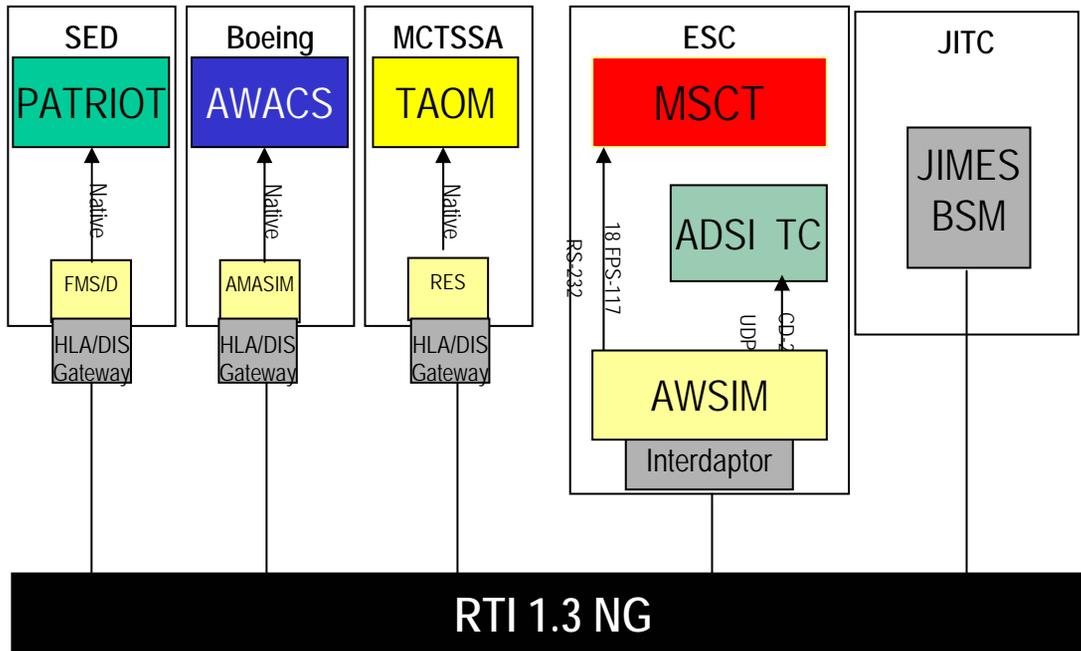
# Technical Track Pilot

## Technical Framework Applied to Joint TST Testbed



- Efforts underway to adapt key elements of testbed to the JDEP technical framework
  - Limited resources
  - Limited access to system code
  - Maximum use of commercial products
- Product is lessons learned on
  - Technical issues and products
  - Value to testbed

# 02 MSCT Event



- Led by AF ESC
- Supplement current simulation approach with selected HWIL representations of Blue BMC3 systems to
  - Reduce risk
  - Validate simulations
  - Add operators to support quantified operational benefits

# Long-term view of federation components for SIAP

## Utilities

*Fed Manager*

Viewer

*Data Collector*

Scenario Generator

## Environment

Electromagnetic

Physical

Atmospheric

Terrain

Sea State

## Simulations

*Blue/Threat Systems*

*Sensors*

*Platform Movement*

*Digital mission computers*

Weapons

*Networks*

*Link 16/11/etc.*

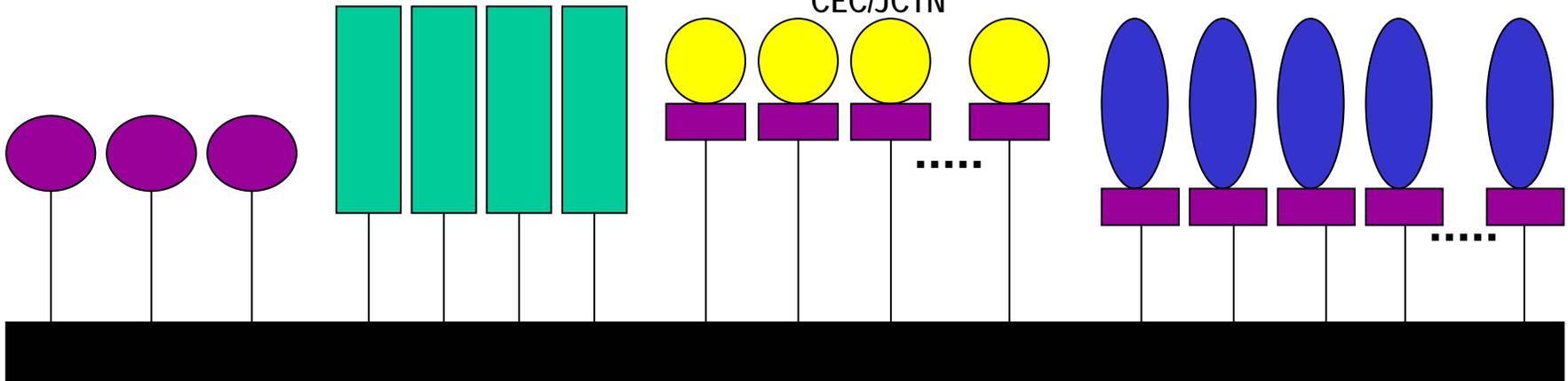
CEC/JCTN

## HWIL

Blue Systems

mission computers

*enhanced inputs and outputs*

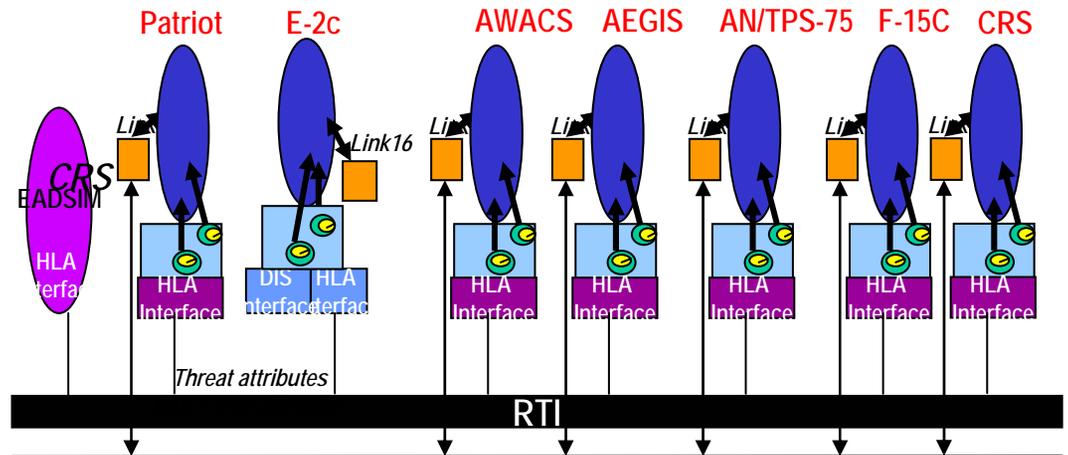
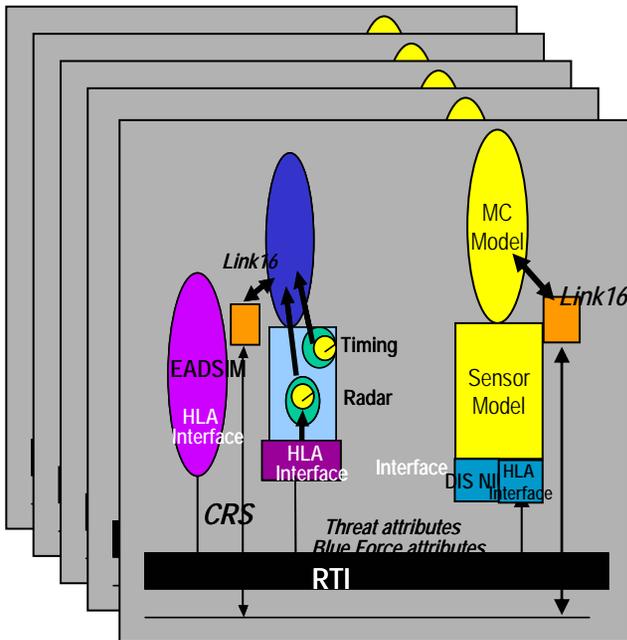


# SIAP Federations to Address Effects of Sensor Data Registration and Time Synchronization Biases

## On Individual Systems

AWACS  
 AEGIS  
 AN/TPS-75  
 F15-E  
 CRC

## ...and On System of Systems



With both HWIL and digital systems representations