



# *Simulation and Emulation in Support of Operational Networks: “ALWAYS ON”*

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# CURRENT GAP IN M&S AND EMULATION



**EFFECTIVE OPERATIONAL NETWORKS CRITICALLY UNDERPIN ARMY MISSION SUCCESS**

**THE NETWORK IS THE ARMY'S NUMBER ONE MODERNIZATION PRIORITY**

➤ **Gap:**

- Continuous availability of authoritative Network models, data, representative architectures and metrics for use across the life cycle from Concept Design to Development, to Test and Evaluation, to Training and Mission Rehearsal is missing

➤ **Current Situation:**

- Individual efforts being done in stove-pipe manner provide limited and /or inconsistent data and feedback about Operational Networks, impacting the Warfighter now

➤ **Critical Need:**

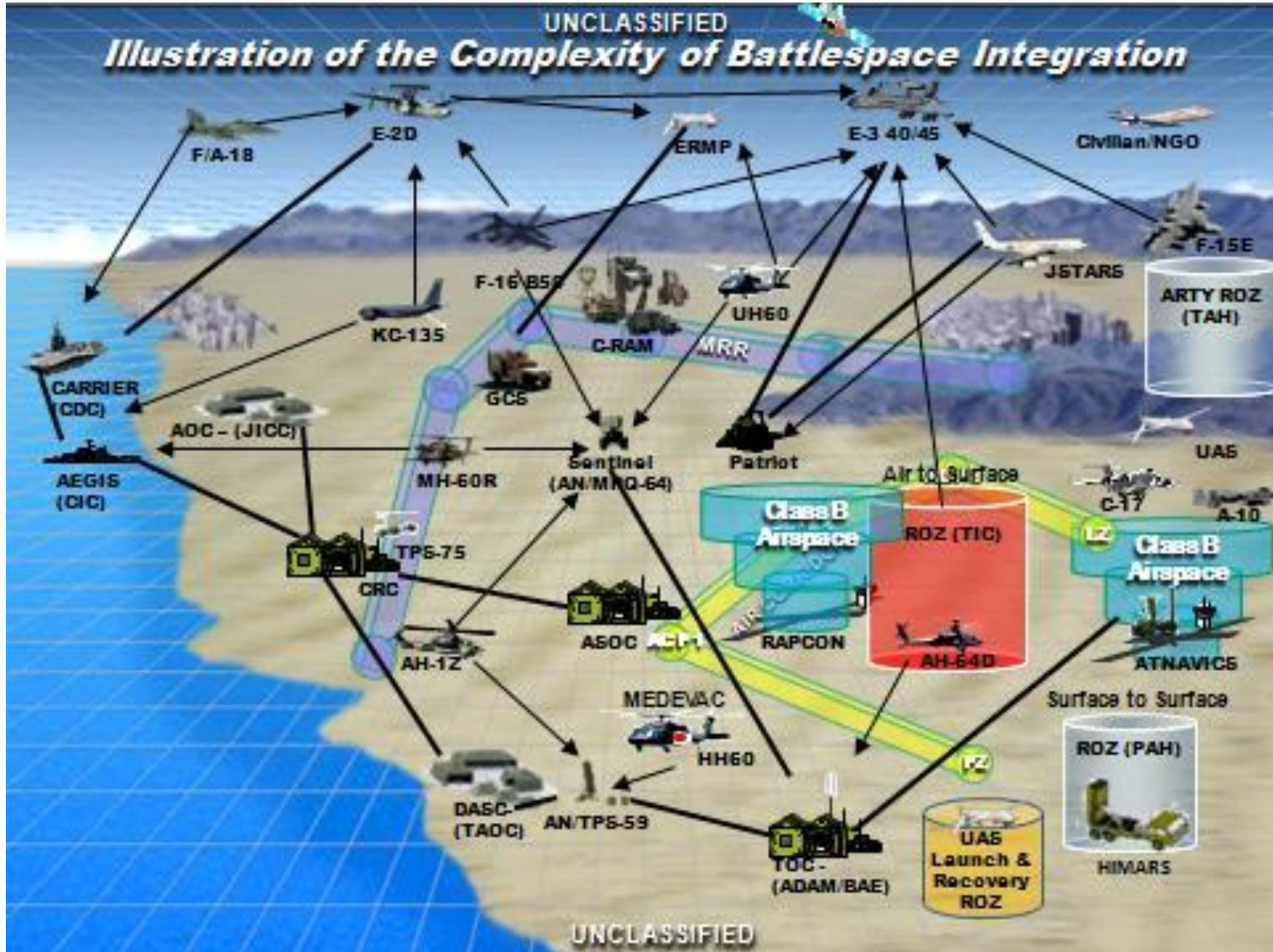
- Authoritative Persistent Integrated Environment for Analysis, Research, Design, Test, Evaluation, Training and Experimentation on Operational Networks

**JOINT NETWORK EMULATION (JNE): "ALWAYS ON"**





# RELEVANT OPERATIONAL CONTEXT FOR JNE: The Integrated Battlespace at a Joint and Coalition Level





# VISION: SYSTEM OF SYSTEMS ENVIRONMENT FOR JNE

**“Always On”: Establishing a Continuous Authoritative Network LVC Environment for Development, Test, and Training of Operational Networks & Netcentric Systems: Providing a Common Pedigree of Data Available to All Users**

Persistent Distributed Infrastructure

Common Core Environment



HPC assets for Continual Capability Based RDT&E for Network & warfighter system Performance, Interoperability, Effectiveness, and Suitability

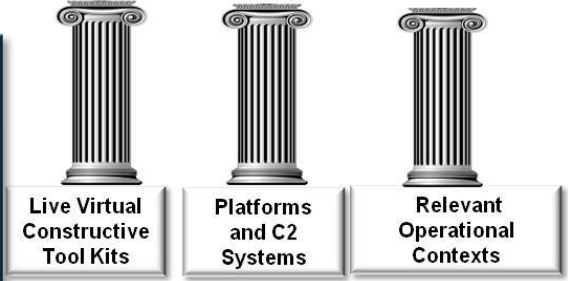


Distributed Common Components



Supported locally and available remotely

- Use Cases:
- Network & System Development
  - Warfighting Experimentation
  - Training & Mission Rehearsal
  - Operational Planning
  - Concept/ Capabilities Development

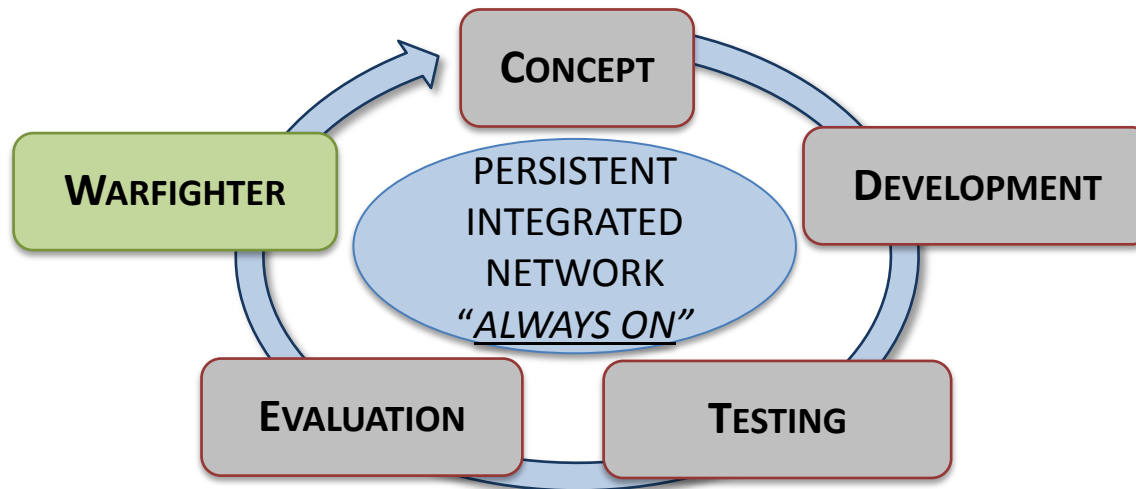


- Core Enabling Technologies:
- Cloud Computing and Virtualization
  - High Performance Computing
  - Mature LVC Tools & Environments
  - High Fidelity Models
  - Robust connectivity among Army installations



# VALUE PROPOSITION

- **Critical Need :** A persistent relevant operational context representing Army Operational Network environments that is always available
- **Why Now:** Not starting from scratch – building a persistent LVC environment that leverages available capabilities at the Army laboratories, acquisition, testing, and combat development communities
- **Approach:** Starting with core JNE capability (demonstrated in NIE 13.1) and evolving it via an incremental build process in collaboration with Army stakeholders, with each build “rolled out” at Field Test events such as the Network Integration Evaluations (NIE)
- **Product:** Always On: A persistent LVC environment representing Army (and eventually Joint and Coalition) operational networks



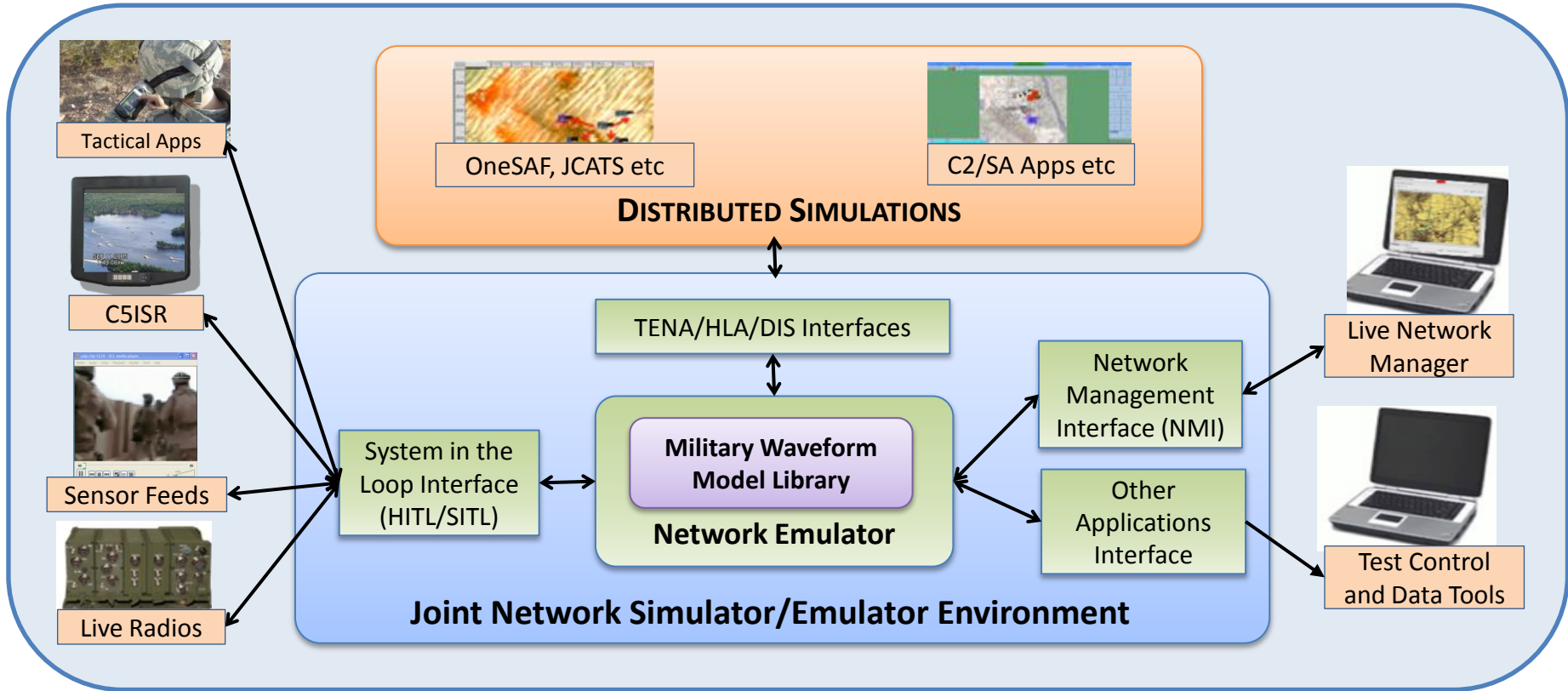
**“ALWAYS ON” SUPPORTS ALL PHASES OF NETCENTRIC SYSTEM DEVELOPMENT**





# JNE "ALWAYS ON" BACKBONE:

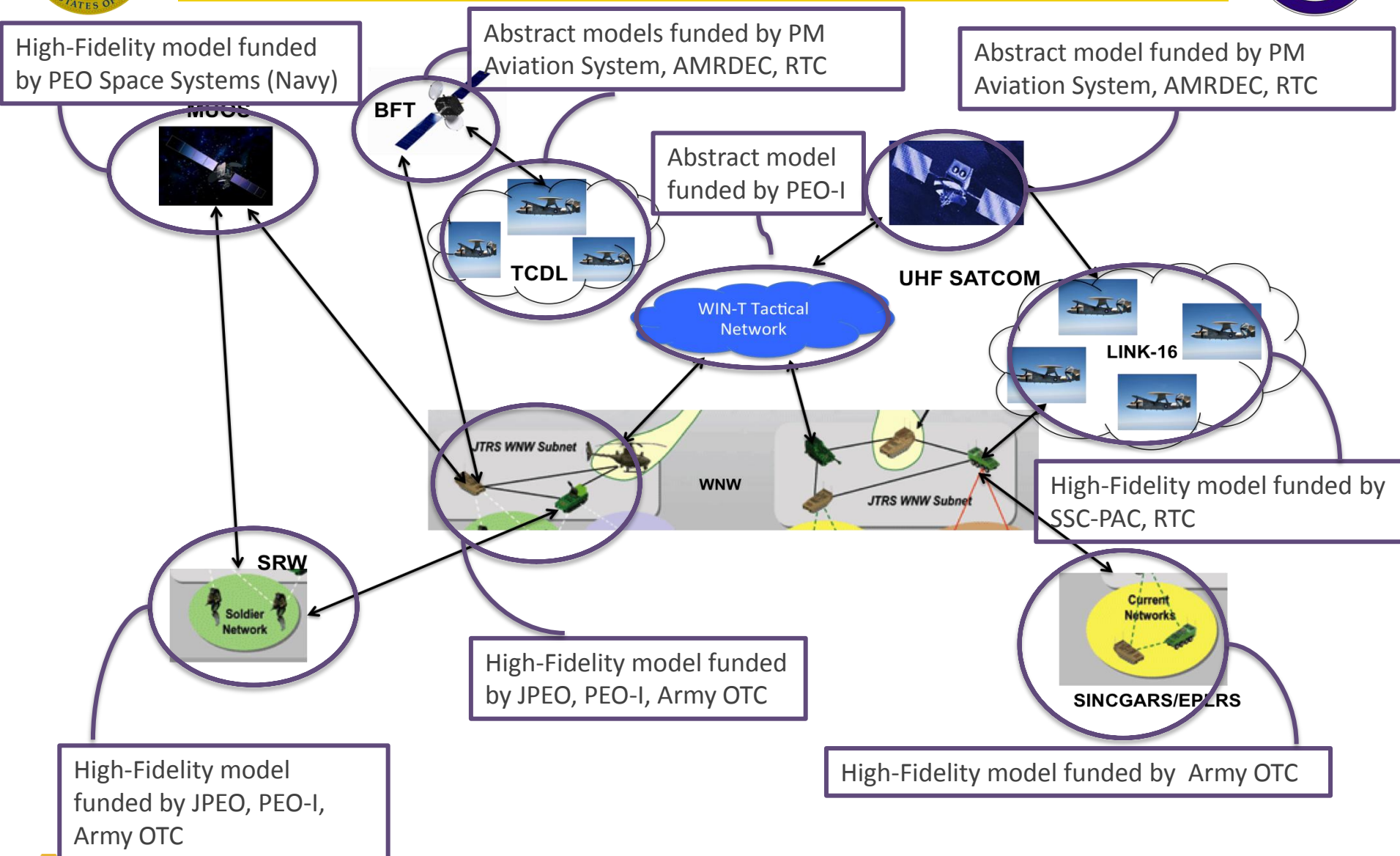
## Live-Virtual-Constructive Framework That Exists Today



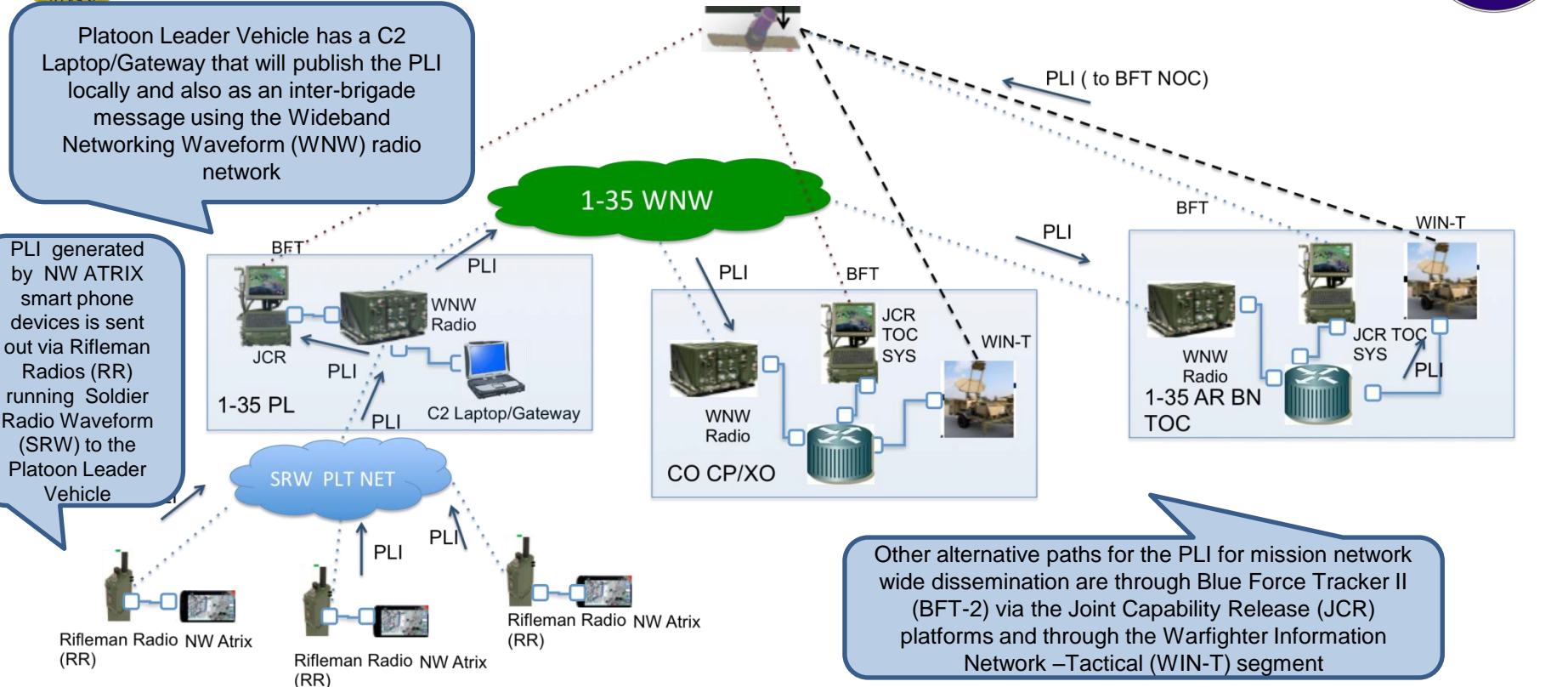
*leveraging a set of capabilities that has been developed over the past 15 years by a partnership activity between the acquisition, testing, and combat development communities*



# DOD-WIDE EXISTING JNE MODELS, NETWORKS AND COMMUNICATIONS PATHWAYS



# TESTING INTEROPERABILITY USING JNE: END TO END NETWORK PERFORMANCE



- PLI is generated by several systems (NW app on ATRIX smartphones, JCR hosts) and traverses over several LTNE segments (such as the SRW Rifleman Radio Network, and the WNW radio network) and key UTNE segments (BFT-2 and WIN-T) for dissemination through the entire mission network
- JNE uses a mix of LVC assets to execute the end-end PLI mission thread for data and interoperability testing across the end-end network
- Extensible for NIE test planning, NIE test scaling, warfighter training and mission network planning

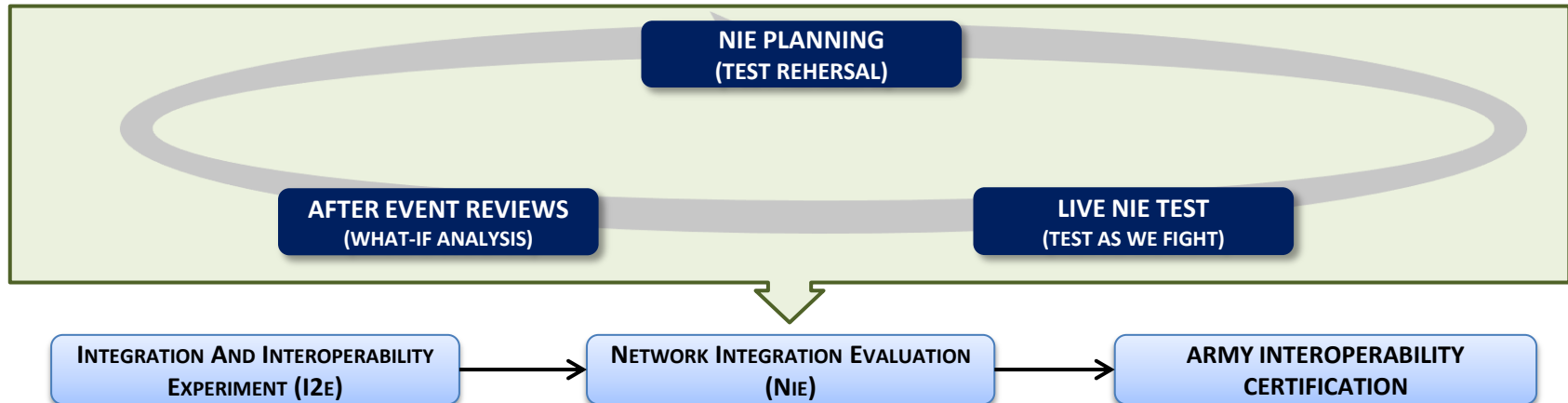




# JNE “ALWAYS ON” VALUE ADDED TO NIE



- ✓ NIE Pre-Planning and Test Rehearsal:
  - ✓ Lab-based risk reduction for live test events (pre-screen readiness)
  - ✓ Cost reduction for ‘on the ground’ pre-test activities (e.g network configurations, ...)
- ✓ Live NIE Test “Test As We Fight”:
  - ✓ Realistic network loading in a Relevant Operational Context with complex live maneuvers
  - ✓ Assessing the impacts of scaling the networks
  - ✓ Validating routing and reconfiguration designs
- ✓ After Event Review and “What If” Analyses:
  - ✓ Assessment of NIE results and lessons learned
  - ✓ Test plan design and refinement for next NIE through lab-based experimentation





# JNE “ALWAYS ON” FOUNDATION OF CAPABILITIES



- ✓ Scalable, real-time, network models with options for fidelity (conceptual, emulation, or abstract) that can be invoked depending on use cases (e.g. SRW, WNW, WIN-T, etc)
- ✓ High fidelity RF effects (e.g., urban terrain)
- ✓ System-in-the-loop (“SIL”) with live radios (e.g. GMR, HMS, etc)
- ✓ Software-in-the-loop with live battlefield applications (e.g. IBEX, FCBC2, etc)
- ✓ Interface with live network managers (e.g. JENM)
- ✓ Interface with instrumentation and data collection tools used on live networks (e.g. OASIS)
- ✓ Interface with external simulation tools (e.g. OneSAF)
- ✓ Representation of Multi-level Security
- ✓ Relevant Operational Contexts for TRL assessments

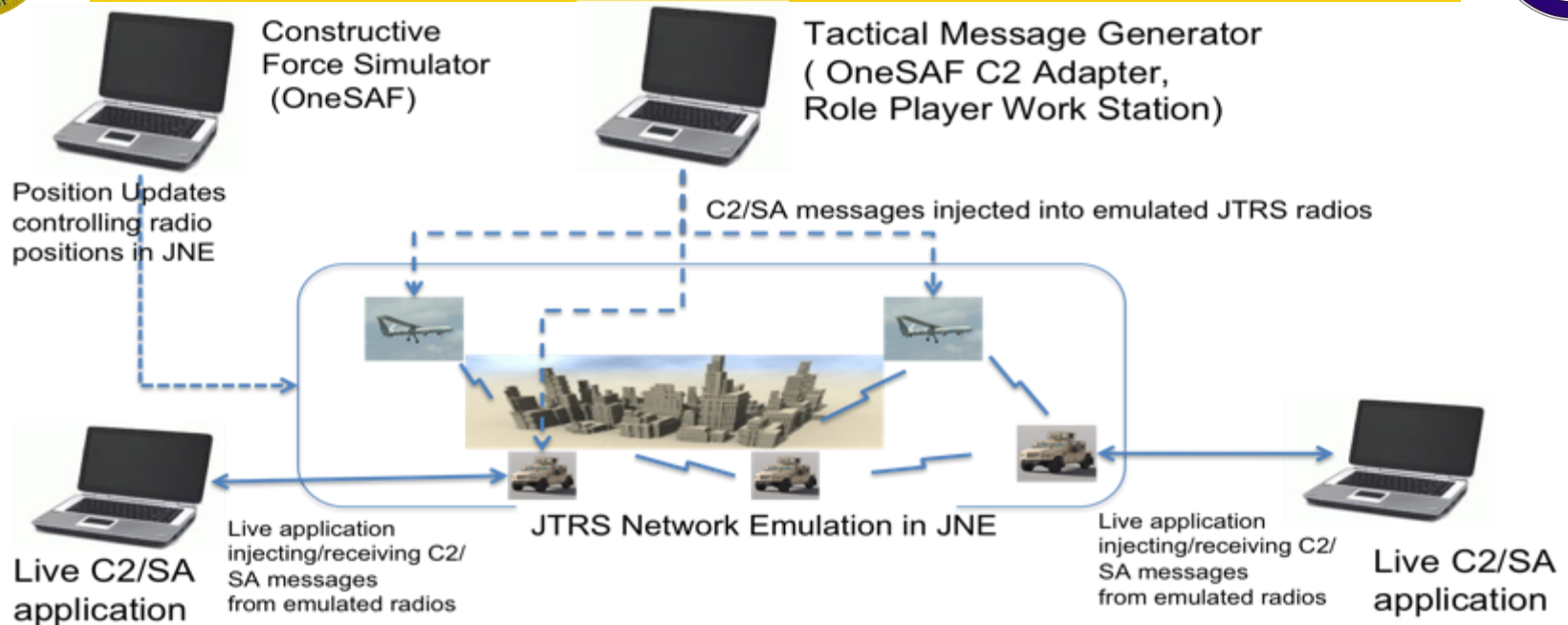


- ✓ Operational Networks test bed environment capable of evaluating systems and system of systems effectiveness, current & future capabilities, as-is and to-be architectures
- ✓ Fast, agile, low risk integration of technology & operations for integration and test events such as NIE
- ✓ Repeatable, relevant, end-to-end test environment capable of executing larger than single thread scenarios
- ✓ Distributed Networked Live-Virtual-Constructive technologies environment reducing the need to ship equipment and relocate key personnel
- ✓ Leveraging the strengths and tool suites of each participating location, promoting collaboration and reuse of test assets across T&E, Planning, Analysis, Acquisition, Training, Cyber





# EXAMPLE USE CASES FOR JNE: Live Tactical Application Testing



- Live, virtual or constructive versions of tactical applications can be made to run on top of JNE emulated radios ( WNW, SRW, Legacy...) to assess the performance of the actual applications over a mix of scenarios ( fixed, mobile, urban, etc..)
- Developmental Testing of applications/network managers/analysis tools to be run on the tactical radio networks
- Operational Testing of tactical radio networks
- Stimulate systems under test and Measure “Effect of Scale”

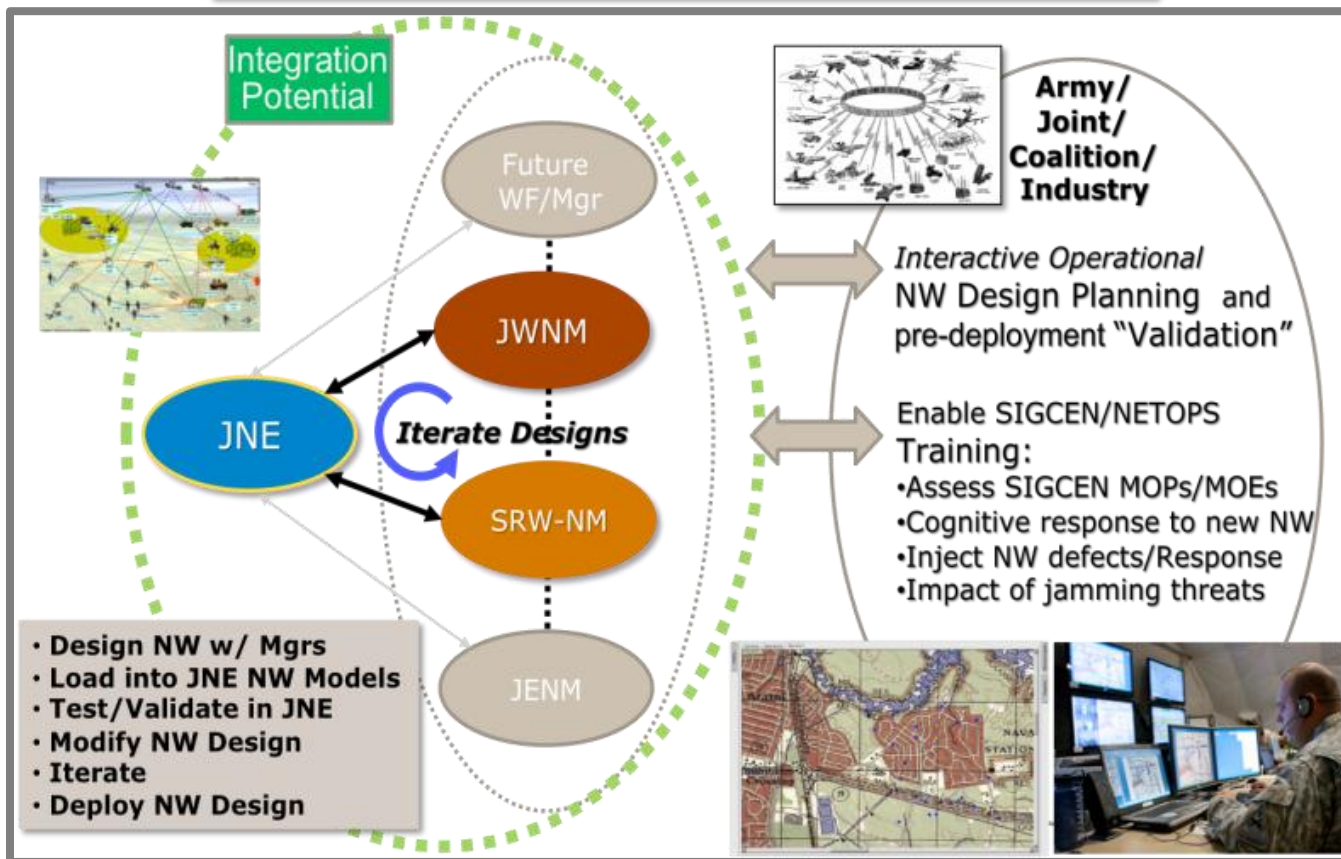




# EXAMPLE USE CASES FOR JNE: Operation Planning/ Network Assessment



- Designing routing environments
- Validate network settings before deployment
- Assist in 'optimal' network configurations
- Dynamic network planning and optimization



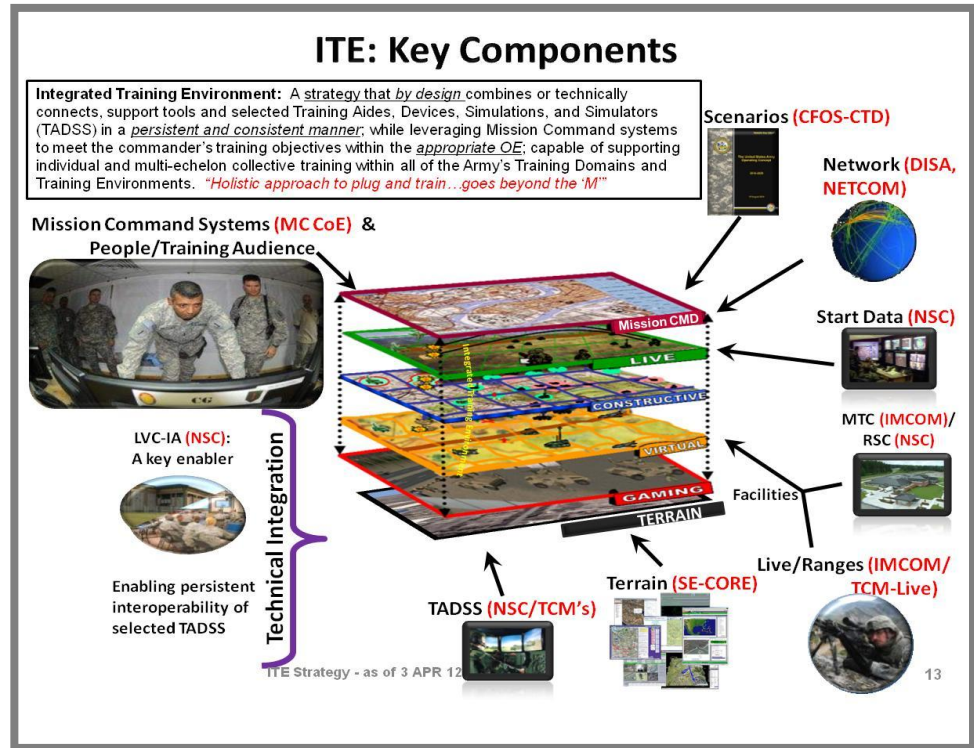


# EXAMPLE USE CASES FOR JNE: Training



JNE Concept is consistent with and supportive of the Training Community

- Train Network Managers
- Force on Force Training
- Train the warfighter on the net-centric systems and related concepts
- Support for units conducting Decisive Action Operations training
- Enables multi-echelon training
- Expands the “live” battle-space
- Expands Battle Staff Training opportunities beyond major training Exercises



Excerpt 28 June 2102 Briefing to M&S CoC: COL Anthony Krogh, Director NSC

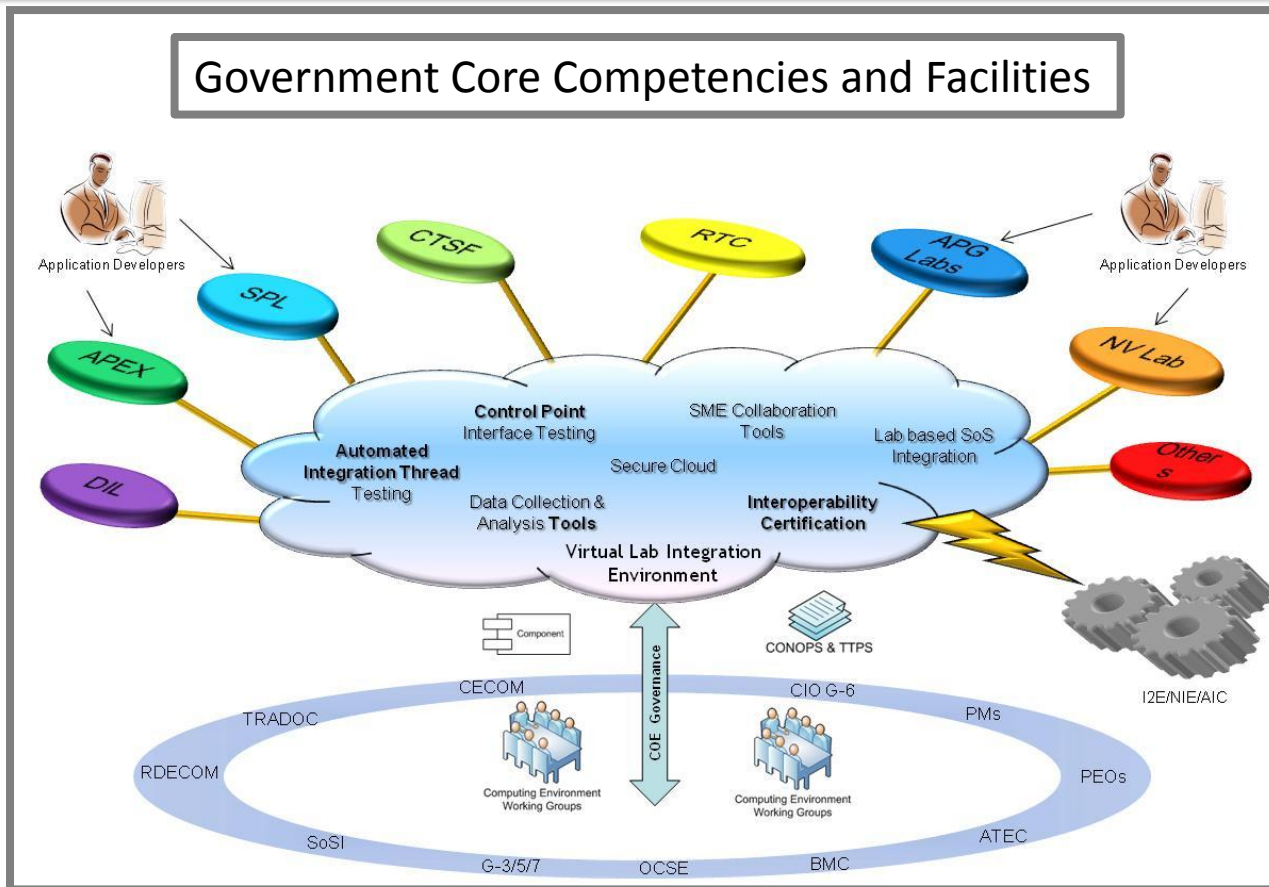




# EXAMPLE USE CASES FOR JNE: Materiel Development and Integration



- Virtual Development and Integration Environment
- Capability for development teams to iteratively test and refine the interoperability of their systems with other systems
- Enabling a Build-Test-Build Process at a Systems and System of Systems level

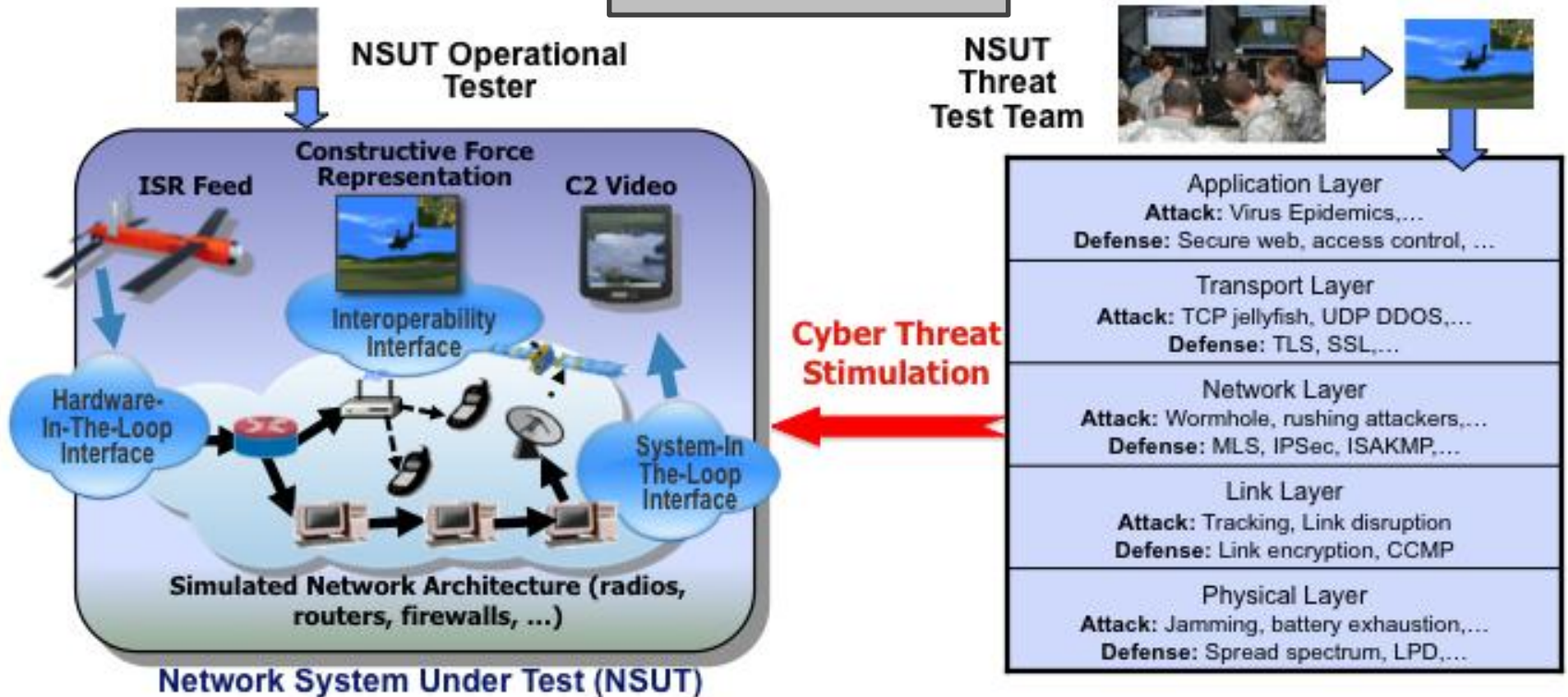




# EXAMPLE USE CASE FOR JNE: Battlefield Cyber Threat Analysis

- Test Resource Management Center (“TRMC”) Science & Technology Program has funded the development of a LVC cyber threat simulation & stimulation capability called **StealthNet**
- ATEC and TSMO: Technology transition partners for integration with JNE

STEALTHNET OV-1



**Enabling Test & Evaluation of Mission Assurance Under Full-Spectrum Cyber Operations**

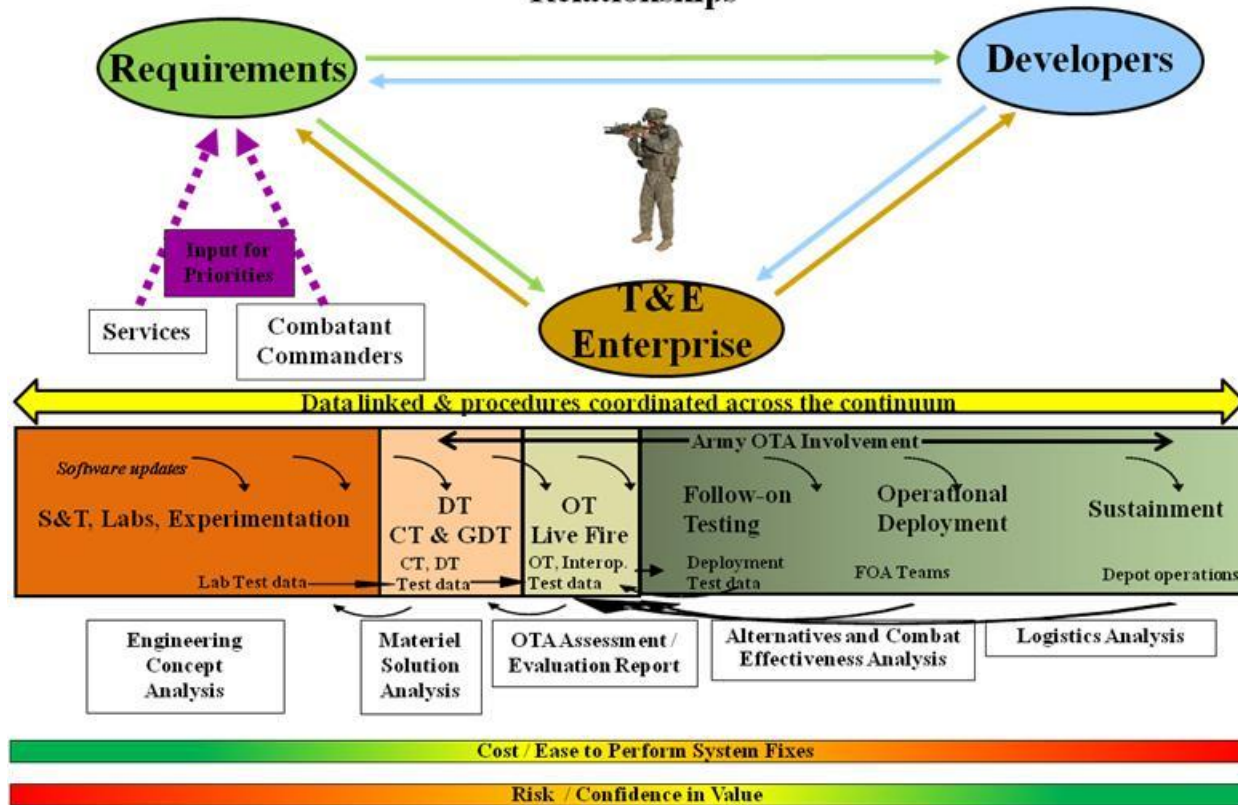




# JNE "ALWAYS ON: CONSISTENT WITH THE ARMY T&E ENTERPRISE STRATEGIC PLAN 2013



## T&E Enterprise Roles & Relationships



*“Always On” Establishes a Continuous Authoritative Network LVC Environment for Development, Test, and Training of Operational Networks & Netcentric Systems: Providing a Common Pedigree of Data Available to All Users*







# JNE "ALWAYS ON: CONSISTENT WITH THE ARMY AGILE CAPABILITIES LIFE CYCLE PROCESS

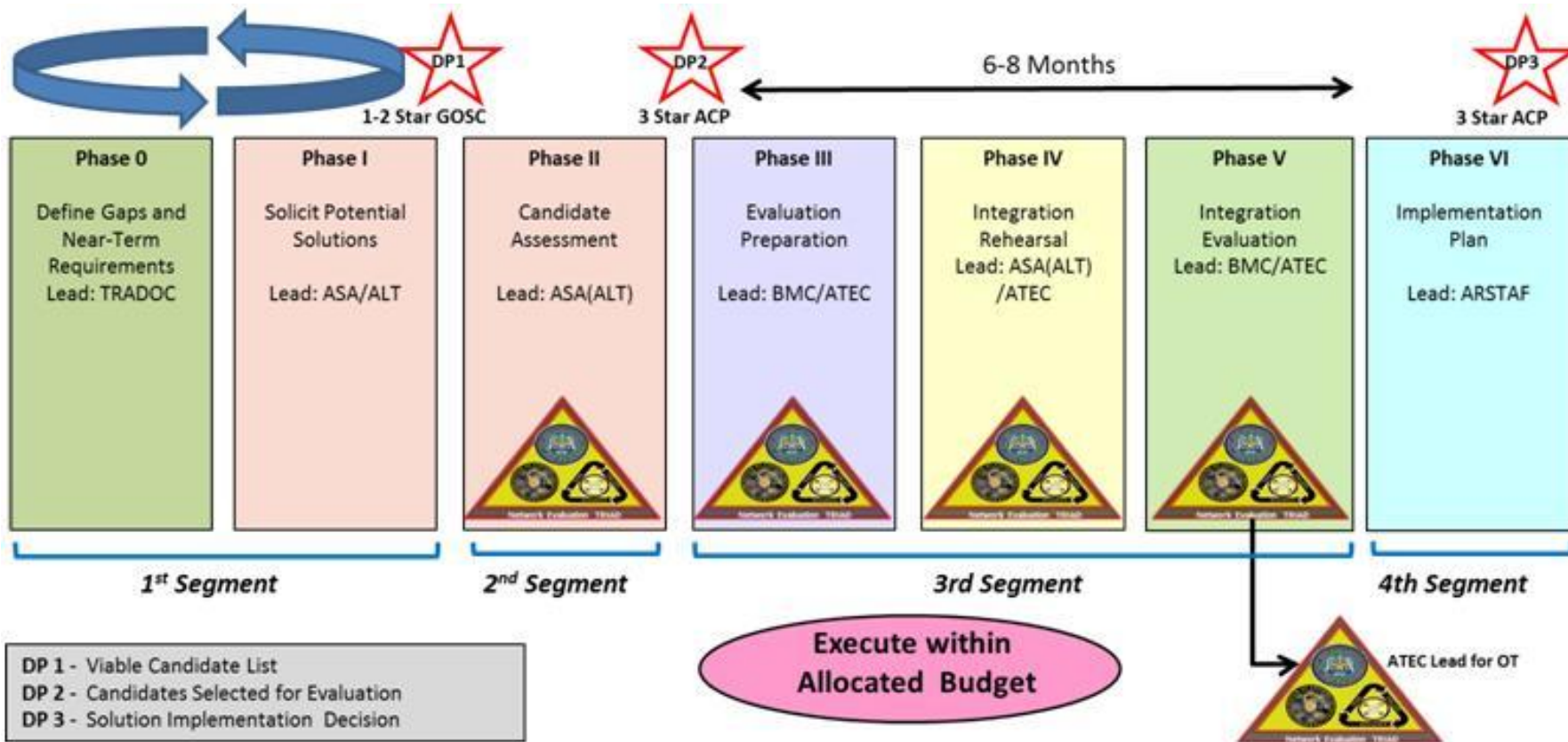


FIGURE 1 FROM SOP: AGILE CAPABILITIES LIFE CYCLE PROCESS 7 AUGUST 2012 FINAL v.1







# Questions?





# DoD AND ARMY-WIDE USE & SUPPORT INTRODUCTION

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ASA(ALT) OCSE “Always On” concept is leveraging a set of capabilities that has been developed over the past 15 years by a partnership activity between the acquisition, testing, and combat development communities

These organizations have worked diligently to make the idea of high resolution, distributed real-time cyber/network simulation and integration a reality.

This initial foundation for the “Always On” JNE is a result of that collaboration and that determination - across many communities - to insure that the networks our soldiers lives depend on are developed, tested and trained to the highest of standards.





# DoD AND ARMY-WIDE USE & SUPPORT (1 OF 2)



- **ATEC**
  - **ATEC G9** (Mr. Don Timian) is a key partner: requirements, resources, funding, re-use of ATEC capabilities
  - **OTC** (Mr. John Diem/Mr. Mike DiGennaro): funding integration of JNE with Army instrumentation & data collection suites; funded development of WNW and SRW related HWIL/SWIL capabilities via BCNIS
  - **EPG** (Mr. Jeff Thomas): working closely with OTC to evolve original STORM architecture and leverage C4 simulation, test control, and DCRA tools
  - **ATEC G9 Threats ICW and PEOSTRI/PM ITTS/TSMO** (Mr. Paul Kelley/ Mr.SkipTornquist/ Mr Dennis Schneider) has selected SNT products for threat and EW environments. Will leverage StealthNet with JNE to assess cyber vulnerabilities of deployed Army netted architectures.–
  - **RTC/AMRDEC** (Dr. Ken Lesueur/Dr Nancy Bucher) funding enhancements to JNE for aerial tier and to employ the environment on its HPC backbone/integration work with aerial tier
- **PM Space Systems** (Mr. Austin Mroczek) funding development of MUOS model & its integration into JNE
- **TRMC NST S&T** (Mr. Gil Torres) funding development of network attack and defense models and its transition to ATEC; PEO STRI





# DoD AND ARMY-WIDE USE & SUPPORT (2 OF 2)



- **JPEO JTRS** (Mr. Greg Adams/Mr. Joe Oleksa) funding model enhancements, network management functions, and use for planning and training during NIEs. Used JNE to plan NIE 12.2 SRW networks and train on network managers. Demonstrating JTRS capabilities via JNE in JPEO JTRS booths (MILCOM, AFCEA, LandWarNet, ..)
- **NETCOM Ft. Huachuca** (Mr Greg Mendez) using real-time modeling capabilities for cyber vulnerability assessment of Army enterprise networks.
- **ASA(ALT) Office of Chief Systems Engineer** (Mr. Terry Edwards / Mr. Leo Smith/Dr. Nancy Bucher) Evaluating use of JNE as the framework for an "always on" systems of systems engineering capability with initial support to Common Operating Environment (COE) development
- **ASA(ALT) System of Systems Integration** (Dr. Dennis Bushmitch/Dr. John Fikus) using earlier version of JNE in the lab; ongoing discussions for use of JNE to give SOSI comprehensive capabilities for NIE risk reduction (LBRR). Planned use in NIE 13.1 for integrated testing.
- **TRADOC, CDID Ft Gordon** (Mr. Shaun Kobert) using previous version extensively in exercises; upgrading to JNE & continues involvement providing current mission profiles and scenarios.
- **AMSAA** (Mr. John Wray): Evaluating use of JNE and StealthNet for analysis





# JNE AREAS OF SUPPORT FOR THE ARMY T&E ENTERPRISE STRATEGIC PLAN 2013

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- Strategic Initiative 1. Standardize & optimize business practices.
  - Sub-task 3. Create certified standards & protocols.
- Strategic Initiative 2. Support integration activities that enable emerging Agile acquisition processes.
  - Sub-task 1. Integrate testing across multiple programs and utilize all available data sources to support evaluations.
  - Sub-task 2. Prepare the Enterprise to test and evaluate emerging technologies.
- Strategic Initiative 3. Identify & implement T&E efficiencies.
  - Sub-task 3. Leverage Modeling and Simulation (M&S) to augment / replace tests and shorten testing.

