



Always On-On Demand: Supporting the Development, Test, and Training of Operational Networks & Net-Centric Systems

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Always On-On Demand Introduction

Always On–On Demand is:

- The Integration of Existing Live, Virtual, and Constructive Systems, Tools, and Technologies Developed Over the Past 15+ Years ...
- To Create a Persistent Capability to Represent the Realistic, Relevant Technical / Operational Synthetic Environment Necessary...
- To Address Technology and Process Capability Needs, Issues, and Gaps Associated with Operational Networks and Net-Centric Systems ...
- Available On Demand

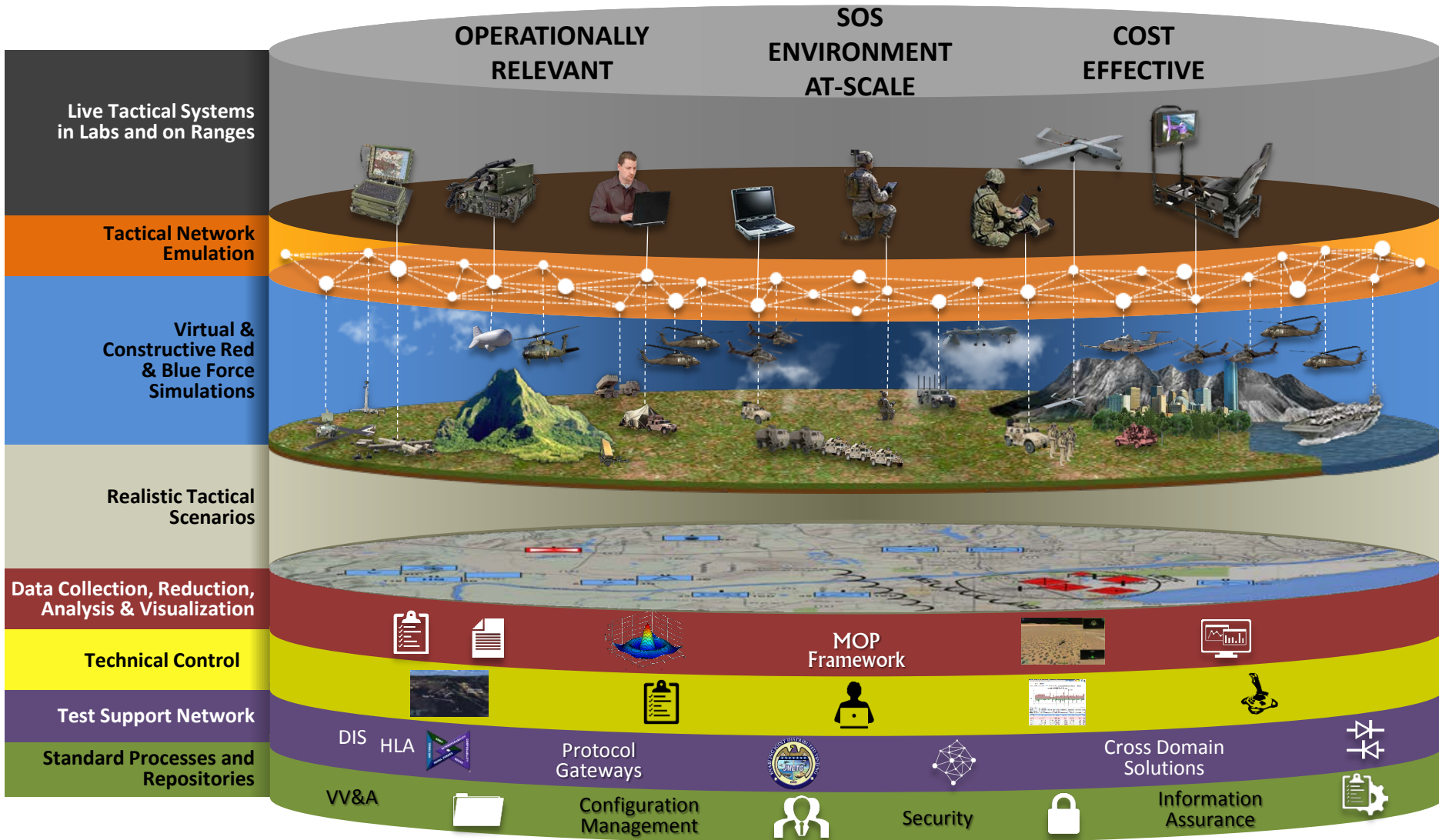
Always On–On Demand Goal:

- Provide a Cost Effective, Routinely Available, and Realistic Representation of the Full SoS Operational Environment –
- Where Developers Can Build Better Solutions Faster
- Where Project Managers and Testers Can:
 - Examine Software Earlier in the Development Process and
 - Identify and Resolve Integration and Interoperability Issues **Prior to** Formal Operational Test and Fielding to Soldiers





Live-Virtual-Constructive Distributed Environment



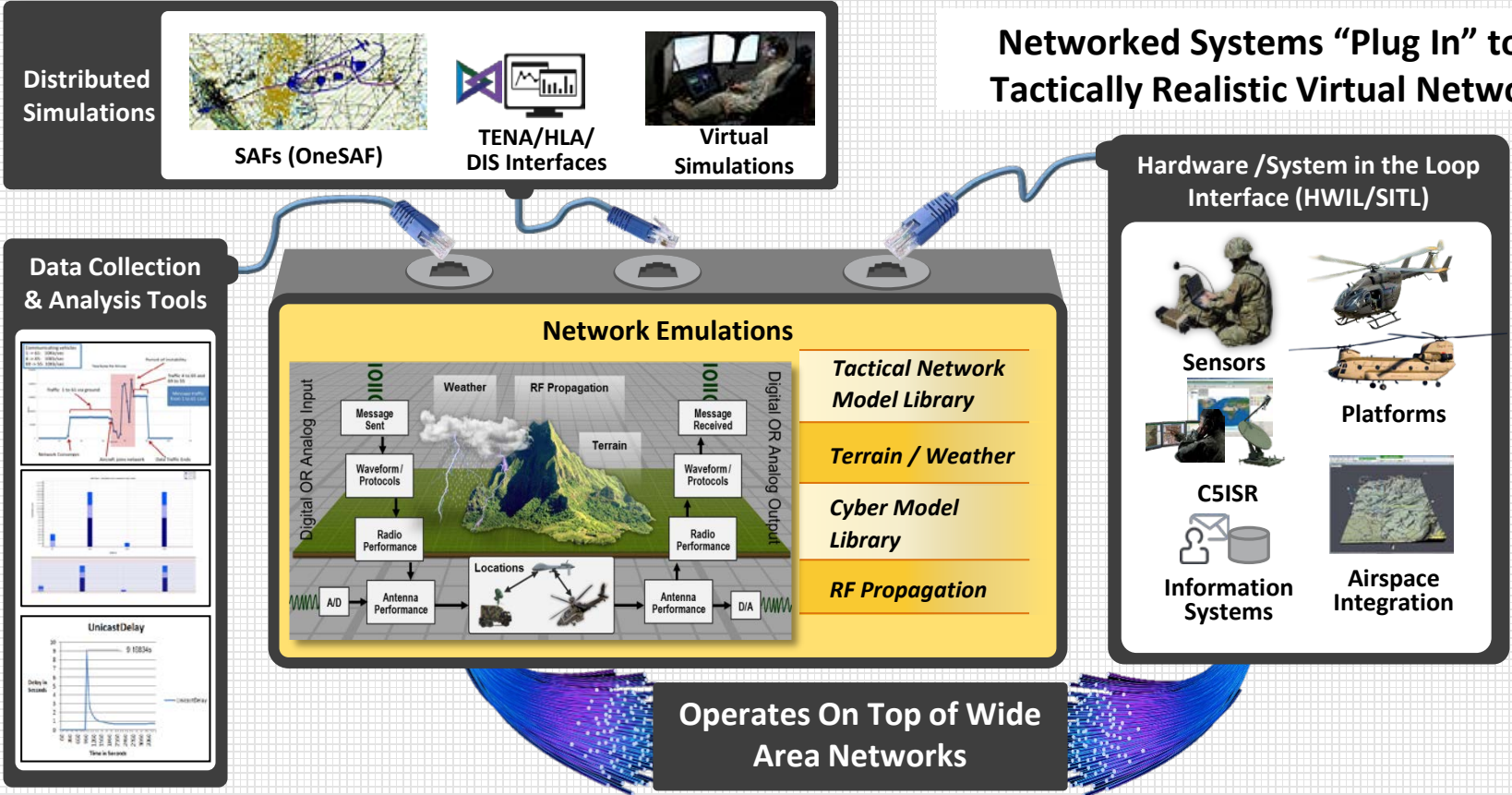
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Core Enabler: Network Emulation

The Ability to Emulate the Tactical Network at Scale in Real-Time and Integrate with Live Hardware and Software is a Primary Enabling Technology



Always On-On Demand will leverage Multiple Network Emulation Tools to Efficiently and Effectively Support Multiple User Requirements





Always On-On Demand Value Added

- Always On–On Demand will Integrate with the Acquisition Process to:
 - Dramatically Reduce Development Time and Cost for Emerging Net-centric Systems
 - Improve Test Quality, Thoroughness and Reduce Test Integration Time for Net-centric Systems
- Always On–On Demand will Provide Cost Avoidance and Saving by:
 - Providing a Realistic At-Scale Tactical System-of-Systems Environment without Requiring Large Numbers of Live Systems and Operators
 - Aiding Tactical System Consolidation by Informing Researchers, Developers and Buyers on the Common Operating Environment and the Tactical Systems that Operate within It
 - Modernize Faster in Order to Divest Earlier in Costly Legacy Systems
- Always On–On Demand will Enable the Army to:
 - Conduct Experimentation and Testing for Conditions not Achievable at Ranges due to Safety, Security, Limited Test Assets or Space Available
 - Efficiently and Effectively Procure Modern Capabilities that will Enable Our Soldiers
 - Support Smaller More Effective Fighting Forces Worldwide

“We need an agile system that rapidly develops, purchases and fields innovative solutions for our Soldiers...”

—Army Secretary John M. McHugh

(Army Modernization Plan 2012)

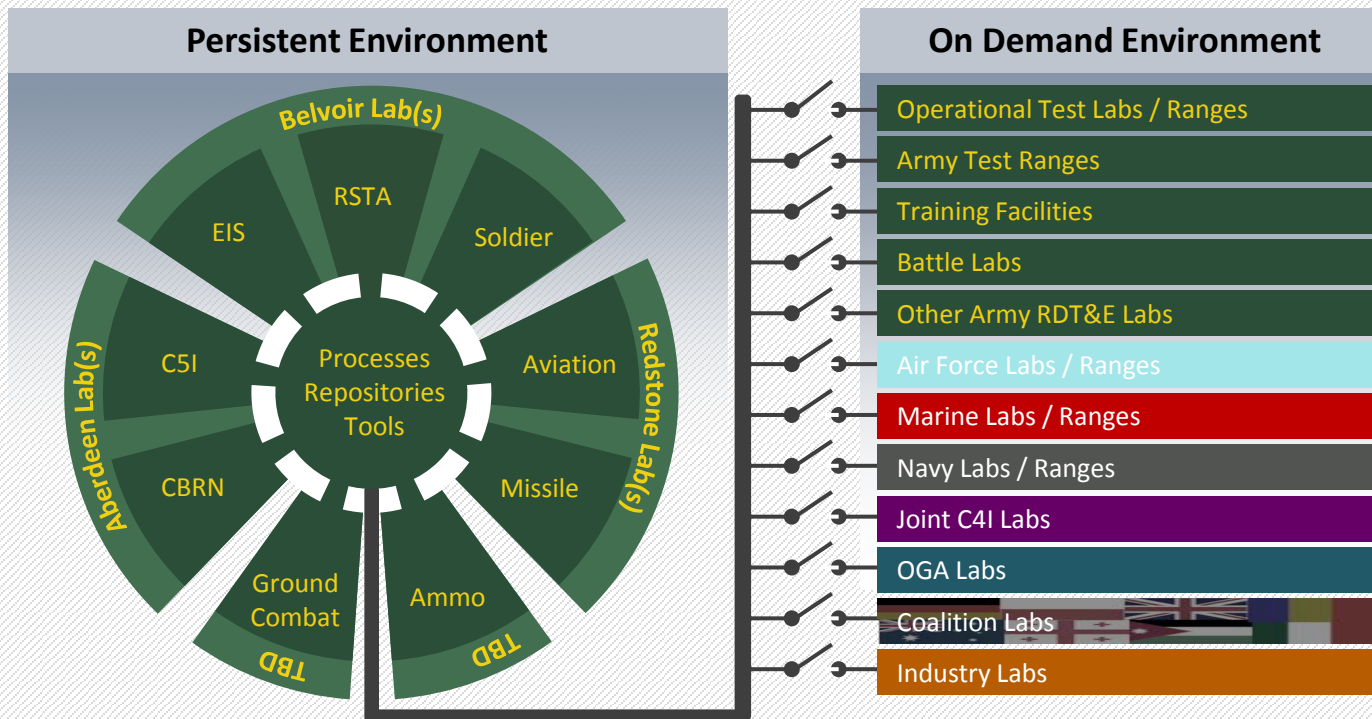




Always On-On Demand Enterprise

The Enterprise consists of a Core Set of LVC Labs that Represent an Entire Army System of Systems Environment

The Enterprise will Include Laboratories for Operational Testing and Training Including select Joint C2 Systems



The Enterprise will provide interfaces for inclusion of Air Force, Navy, Joint, and Coalition C2 and Information Systems

Always On-On Demand Persistent Environment will be built on Standard Processes, Tools, and Repositories

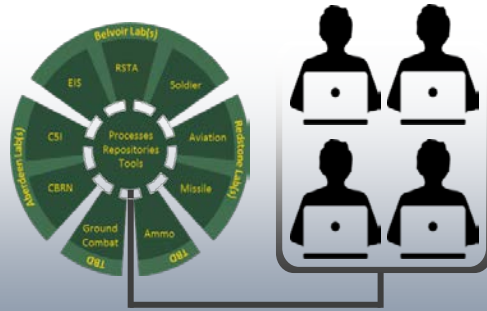
Always On-On Demand will provide Interfaces for other RDT&E and Industry Labs to integrate and use for Experimentation, Development and Developmental Testing

Reliable Repeatable Processes and Environments to Support Developers, Testers, Trainers and Buyers

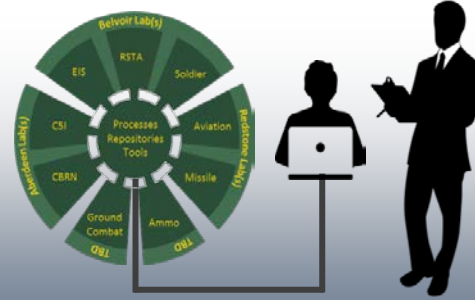




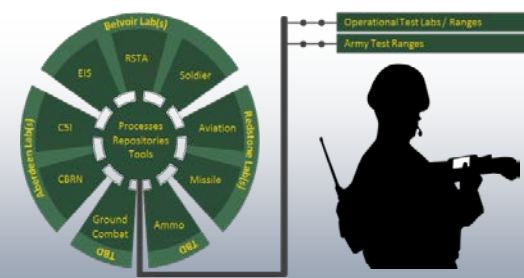
Always On-On Demand Environments



Development & Experimentation Environment



Developmental Test Environment



Operational Test Environment

Purpose	<ul style="list-style-type: none"> Research, Development, Experimentation 	<ul style="list-style-type: none"> Developmental Test, LBRR, Cyber Hardening 	<ul style="list-style-type: none"> Operational Test, NIE Integration & Rehearsal, NIE Environment Augmentation
Users	<ul style="list-style-type: none"> Industry, RDECs, Battelabs 	<ul style="list-style-type: none"> Developmental Testers 	<ul style="list-style-type: none"> Operational Testers
Persistency	<ul style="list-style-type: none"> Persistent Environment  	<ul style="list-style-type: none"> Persistent Environment  	<ul style="list-style-type: none"> On Demand Environment 
Accessibility	<ul style="list-style-type: none"> Easily Accessible  	<ul style="list-style-type: none"> Requires PM Sponsorship  	<ul style="list-style-type: none"> Systems Designated for Fielding 
Tactical Systems	<ul style="list-style-type: none"> Most Recent Approved Capability Set, All Fielded Network Enabled Tactical Systems and Prototype Systems 	<ul style="list-style-type: none"> Most Recent Approved Capability Set, All Fielded Network Enabled Tactical Systems and New PM Sponsored SUTs 	<ul style="list-style-type: none"> Most Recent Approved Capability Set, All Fielded Network Enabled Tactical Systems and SUTs Ready for Fielding
Configuration Management	<ul style="list-style-type: none"> Lenient New Systems Integration Architecture Documented Prior to Entry  	<ul style="list-style-type: none"> Tolerant SUT Integration Architecture Documentation Verified  	<ul style="list-style-type: none"> Strict Documented Baseline of Tactical SoS Architecture 
Other Benefits	<ul style="list-style-type: none"> Inclusive Access to SoS Environment Fosters Innovative Solutions 	<ul style="list-style-type: none"> Early Access to Operational Users Allow Early User Feedback and Earlier Training Package Development 	<ul style="list-style-type: none"> Live Operational Test Environments can be Scaled to Realistic Size and Complexity

Systems Under Test – Technology Readiness 4+ Systems Under Test-Technology Readiness 6+ Systems Under Test-Technology Readiness 8+

A Separate Cyber Environment is also Possible; Allowing Constant Cyber T&E without Infecting the Other Three Environments



Always On-On Demand Bottom Line

- Always On-On Demand brings together best-of-breed modeling and simulation capabilities integrated with live tactical systems to create a **realistic network operational environment at Brigade-level scale**
- **Substantial cost savings and value added** has been demonstrated in the “On Demand Environment for Networks and Net-centric systems” (ODENN) Event 14 conducted with Bold Quest 14.2 and the JTE

ODENN E14 Operational Representation

- Brigade-size operations and fires
 - Over 550 tactical radio emulations with realistic traffic loading
 - Over 40 Rotary Wing vignettes including an Air Assault mission
 - Over 100 Fires missions including 155mm Howitzers and HIMARS
- Robust air and missile defense fight
 - Over 200 Theater Ballistic Missile and Cruise Missile launches
 - Over 170 simulated Patriot engagements
 - Dozens of Air-to-Air sorties with Blue Acft interacting with an Air Operations Ctr (AOC)

Cost if Live Systems were used: >\$800M

ODENN E14 Technical Framework

- 12 Tactical systems at 7 sites
- 16 models & simulations applications at 3 sites
- 10 technical control & DCRA applications at 7 sites
- Distributed emulated Tactical network architecture:
 - Satellite (BFT2) and Link 16
 - Terrestrial networks augmented with aerial tiers and unique radio / router architectures at platoon and below level
 - Superimposed over a Warfighter Information Network-Tactical (WIN-T) Increment 1 backbone
 - Tightly Coupled with operational maneuver of forces simulated in OneSAF

ODENN E14 Cost: <\$3.6M

Always On-On Demand can revolutionize the way we do business in developing and testing the Army's Network and Net-centric Systems





Always On-On Demand ODENN E14 Prototyping Event

Always On-On Demand Integrated with BQ 14.2 to Augment the Live Field Exercise with Live, Virtual, and Constructive Assets Distributed Across CONUS





ODENN E14 Overall Objectives



- LVC Distributed Environment (LVC-DE) support to facilitate User needs across multiple acquisition activities
- ODENN E14 technical infrastructure baseline – evaluate the baseline LVC capability and business model to support Always On – On Demand objectives
- Integrated LVC-DE development process architecture – identify and base-line critical Integrated LVC-DE processes and business models
- Characterize the key processes representing the “as-is” environment for Always On – On Demand
- Identify and document critical engineering processes to support the definition, development, and execution of Always On – On Demand activities





ODENN E14 Users/Partners



- Joint Staff J6 - Joint Fires Support Lab
- Army IAMD Program Office
- Army PM Aviation Systems/Pd TAIS: TAIS/Enhanced Airspace Sensor Interface (EASI)
- Army PM Terrestrial Sensors and CERDEC NVESD: Base Expeditionary Target Surveillance System Combined (BETSS-C)
- USMC Multi-function Air Operations Center (MAOC)
- ASA(ALT) ODENN:BCT Network Emulation





Unique Features and Technology Advances

(1 of 2)



- **Network Emulation Advancement**
 - Over 550 radios (SRW, WNW, WIN-T, BFT..) in a multi-tier architecture with 4 battalions based on Army's Capability Set 13
 - First ever implementation of multiple synchronized Joint Network Emulator (JNE) simulations geographically distributed
 - **Demonstrates capability to “extend” JNE hardware-in-the-loop interfaces into distributed labs without incurring unrealistic latency effects**
 - Used credible radio communications traffic generator to realistically load network
 - Included communications-effected Standard Common Data Link (S-CDL) emulation for UAV to ground station and manned-unmanned teaming links





Unique Features and Technology Advances

(2 of 2)



- **Testing Net-Centric Systems with Significant Bandwidth Requirements**

- BETSS-C simulation system provided full motion video (FMV) feeds from a simulated raid tower
- Mobile handheld fires application was able to receive FMV feeds and respond with a CFF
- Aviation airborne network challenged by FMV during causality evacuation thread
- Used Measures of Performance (MOP) framework and its associated metrics used to characterize the network performance when challenged with full motion video
- **MoP Framework tested as new analysis technique for SoS Testing**

- **Demonstrating Utility of Simulation-over-Live**

- ODENN and Bold Quest provided simulation-over-live to increase blue and red air tracks from multiple data feeds
- Provided a robust complex test environment that would be cost-prohibitive to reproduce with all live assets
- Used to stimulate Multi-function Air Operations Center (MAOC); Marines examined TTPs and supported training
- Used to test Enhanced Airspace Interface (EASI) track correlation software being horizontally integrated into the Tactical Airspace Integration System (TAIS)
- **Matured simulation-over-live methodology; demonstrated usefulness for cost avoidance, test, rehearsal and training**





ODENN E14 Value Added (1 of 2)

- **Proof of Concept for Large Scale, Distributed Simulation in support of experimentation and test**
 - First-ever implementation of multiple synchronized Joint Network Emulator (JNE) simulations geographically distributed
 - Demonstrated capability to “extend “ JNE hardware-in-the-loop interfaces into distributed labs without incurring unrealistic latency
 - Implementation of LVC-DE infrastructure with Tactical Network Emulation (including Army Aviation), Simulated Intel/RSTA Sensors, and Large Scale IAMD Simulation Assets
- **Demonstrated Ability for Distributed Emulation of a Baseline Tactical Network Architecture**
 - Satellite, Link 16 and Terrestrial Networks Augmented with Aerial Tiers and Unique Radio / Router Architectures at Platoon and Below, Superimposed over a Warfighter Information Network-Tactical (WIN-T) Increment 1 Backbone
- **Matured Simulation-over-Live Methodology - Demonstrated Feasibility and Utility for Cost Avoidance, Test, Rehearsal and Training**
 - Simulation capabilities provided by ODENN enabled USMC MAOC a full concept evaluation





ODENN E14 Value Added (2 of 2)



- **Implemented and Progressed the SoSE&I Measures of Performance (MOP) Framework**
 - Advanced the Framework Along a Path to Provide Structure for Decision-Quality Data
- **Represented Full-scale Environment for Stimulation and Testing of Tactical Systems and Operational Processes, and Augmented Bold Quest Environment**
 - Emulated US Army and USMC firing batteries for Joint Fires Support Joint Mission Threads
 - Simulated Red Aviation, Ground Maneuver, and Ballistic/Cruise Missiles for IAMD
 - Emulated 3 Tier Wireless BCT Network with Comms effects
 - Simulated Blue Air Tracks for Airspace Management/Integration and Clearance of Fires
 - Emulated UAS Data Link including Comms effects for Manned-Unmanned Teaming and Mobile Hand-held Fires Application
 - Emulated BETSS-C Video Data Distribution with Comms Effects for Targeting Vignettes





Always On-On Demand: Next Steps



- Always On-On Demand successfully demonstrated a baseline support capability by providing a realistic, network operational environment - utilizing a robust set of distributed LVC-DE assets and supporting a variety of user based net-centric activities.
- The focus over the next year is to evolve this “as-is” capability by further development of the distributed technologies and business processes required to realize the full Always On-On Demand vision for the “to-be” capability:
 - Continued partnership with the user community to support current development needs requiring net-centric environment support
 - Execute several more events like E14 to continue concept exploration for expanded capability
 - Develop the architecture framework for providing Always On-On Demand as an enterprise capability for the Army and for Joint and Coalition partners





Always On-On Demand Growth

Walk

15.1



Run

15.2



Sprint

16.1



- ODENN Capabilities**
- LVC-DE Environment
 - Tactical Network Emulation
 - MOP Analysis Framework

Persistent Environment

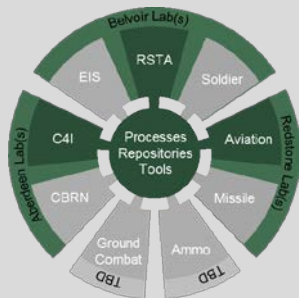


Increase Environment Complexity



Build-Up Engineering Test and Analysis Processes

15.1 Use Cases: Aviation Network & Mission Command Integration and Connection and Feed to Live Intel



15.2 Use Cases: Aviation Network Integration Support and Intel



Operational Test Labs/Ranges

16.1 Candidate Use Cases: AWE16.1, Bold Quest, Air & Missile Defense



Operational Test Labs/Ranges

Air Force Labs/Ranges

Marine Labs/Ranges

Joint Labs/Ranges

A

Problem:

Persistent, Realistic Net-centric Environment Access

B

Problem:

Network Representation at Scale

C

Problem:

SoS Engineering Environment



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STEPS TOWARDS A FINAL SOLUTION



Summary:

Goals for Always On-On Demand



1. Authoritative baseline architecture for use in support of Network test and assessment activities.
2. Authoritative source of models and data to support the LVC-DE environment for system development, experimentation and T&E activities. This includes realistic modeling of the network to include waveform support and potential network effects.
3. Standard business processes for scoping, planning, developing and executing LVC-DE supported activities.
4. General set of enterprise-delivered, net-centric system capabilities to provide consistent support to a variety of users with flexibility to address unique user assessment needs.
5. Business and technical data organized and integrated and supported by authoritative data/repository sources.
6. Processes and tools for identifying, collecting and analyzing performance data and developing reports.
7. Decision-quality information provided to decision makers at all levels.
8. Collaboration capabilities (tools and processes) allowing managers and resources at all levels to communicate, collaborate, discuss, review, submit and resolve issues in a timely and efficient manner.
9. Reduced number of tools and repositories and increased reuse of architecture data which reduces redundant architecture development.





Questions?

