Improving Distributed Test & Evaluation with JMETC & TENA

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MRTFB OVERSIGHT / T&E INFRASTRUCTURE

- **Plan for and assess the adequacy** of the MRTFB to provide adequate testing in support of the development, acquisition, fielding, and sustainment of defense systems
- Support the Department’s objective of ensuring **compliance with DoDD 7000.14-R**
- **Review proposed significant changes** to T&E facilities and resources of the MRTFB before they are implemented by the DoD Components
- **Issue guidance** to the DoD Components, through the USD(AT&L), with respect to MRTFB planning
- Maintain an **awareness of other T&E facilities and resources**, within and **outside** the DoD, and their impacts on DoD requirements
- Serve as **Executive Agent for Cyber Test Ranges**

STRATEGIC PLAN

- **Complete a strategic plan for T&E not less often than once every 2 fiscal years**

BUDGET CERTIFICATION

- **Submit report to the SECDEF containing the comments of the Director concerning all such proposed budgets, together with the Director’s certification as to whether such proposed budgets are adequate**

PROGRAMS

- Administer the **CTEIP** (Central Test and Evaluation Investment Program) and **T&E/S&T Program**

CAPABILITIES

- Manage and operate the **JMETC** (Joint Mission Environment Test Capability) Multiple Independent Levels of Security (MILS) Network and the Regional Service Delivery Points (RSDP) cloud computing environments
- Manage and operate the **NCR** (National Cyber Range) (IAW RMD 407A1, Issue #1, Title: Cyber, Jan 12, 2015) to provide cyber test capability and capacity for the T&E Community
Why Are We Here?
Distributed T&E Supports Systems Engineering (SE)

Feedback

- User Requirements & CONOPs
- System Requirements & Architecture
- Component Design
- Component Integration & Test
- System Integration & Test
- System Demonstration & Validation
- OT&E Validation
- Early T&E Involvement
- Component Level Testing
- Procure, Fabricate & Assemble Parts
- Early Operational Assessment

Integrated T&E Related Activity

Component Characterization

T&E and SE “dynamic tension” needed to achieve best results!

T&E Integral to System Reliability Program & Overall Performance Verification

L. Weiss 2009
T&E at a Crossroads

- **Live-Virtual-Constructive distributed T&E mitigates today’s biggest testing limitations:**
  - We aren’t challenging current generation acquisition systems with complex enough test environments
  - We have limited high priority / low availability assets to go around
  - Testing with multiple security levels / boundaries is too resource-intensive to be viable
  - Information Assurance & Cybersecurity is equal parts necessary and frustrating
  - “Traditional” T&E model not relevant in an agile acquisition world

- **The Problem: Distributed T&E is still “hard” so it isn’t a critical part of every program’s day-to-day test activities**
  - Connecting disparate lab & range networks needs to be easier & faster
  - Effort needs to shift from environment construction and test execution to improving data analysis capabilities
  - Cooperation & collaboration between facilities needs to be the norm rather than the exception

- **Vision: We must make distributed T&E routine**
  - **Before JMETC:** Months / Years to plan, execute, & analyze
  - **With JMETC Now:** Weeks / Months to plan, execute, & analyze
  - **Our Need:** Hours / Days to plan, execute, & analyze

*T&E risks irrelevance if we don’t address these limitations*
Vision: Agile T&E Infrastructure that supports acquisition
Example Assets Available Through Distributed T&E Infrastructure

The right interface makes this environment available

- **Army**
- **Air Force**
- **Navy**
- **Marines**
- **Joint**
- **Industry**
- **Corporate Network**

- Ft. Lewis: EPG
- Ft Huachuca: JITC
- Redstone (3): DTCC, GMAN, SED
- Charleston (2): IPC, MEF-MEU
- Ft. Hood: CTSF, WPAFB: SIMAF
- Bethpage: NG BAMS
- Ft. Monmouth: JOIN
- Dugway Proving Ground
- Nellis AFB: CAOC-N/ASOC
- Whiteman: B-2
- Boeing-St. Louis: CIDS, LabNet
- Redstone (3): DTCC, GMAN, SED
- Greenville: Rivet Joint
- Ft. Worth: AFEWES
- Ft Hood: CTSF, TBMCS
- Kirtland AFB: SDOCC
- Tinker AFB: AWACS
- WSMR: IRCC
- Atlanta: GTRI
- Ft. Huachuca: JIC
- Raytheon Tucson
- NGC: Triton
- LMCO: Global Vision Network
- LMCO: Global Vision Network
- Orlando: National Cyber Range
- Melbourne: JSTARS
Joint Mission Environment Test Capability (JMETC) Program

- Distributed Testing (Events, Tools, etc.)
- JMETC Secret Network (JSN)
- Test & Training Enabling Architecture (TENA)
  - TENA Object Models
  - TENA Web Services
  - TENA Software Repository
  - TENA Tools
- Big Data / Knowledge Management Initiative
- National Cyber Range Complex (NCRC)
  - National Cyber Range (NCR)
  - Regional Service Delivery Points (RSDPs)
  - NCR Expansion (Service Sites)
- JMETC MILS Network (JMN)
- Executive Agent (EA) for Cyber Test Ranges
Distributed T&E Ingredients Supporting the Vision

- **Connectivity: “Persistent MILS Network”**
  - Common network practices & procedures that reduce test execution risk
  - Shared Cross Domain Solutions (CDS) that reduce cost to use & maintain
  - Proactive monitoring & troubleshooting when things gone wrong

- **Analysis Capabilities: “Bring Big Data Analytics to T&E”**
  - Connections to physically disparate data sources
  - Automated analysis and reporting capabilities
  - Empower analysts to ask questions they never thought possible to ask

- **Information Assurance / Cybersecurity: “Balancing security & mission”**
  - Pre-negotiated security agreements with reciprocity across disparate domains
  - Common Risk Management Framework (RMF) Overlay for RDT&E Networks
  - Shared software certifications for common tools

- **Subject Matter Expertise: “JMETC is its people”**
  - Seasoned team with decades of hands-on distributed T&E experience
  - “Walking Encyclopedias” of available test assets & best practices
JMETC Benefits Acquisition Programs, Testers, & Evaluators

• Enables early verification that systems work in a Joint Environment
  • Test whether systems work well together

• Supports all aspects of testing
  • Rapid acquisition, Developmental Test, Operational Test, Interoperability Certification, Net-Ready Key Performance Parameters testing, Joint Mission Capability Portfolio testing

• Helps find problems early in acquisition – when they are less costly to fix
  • Customers have run as many as 20 independent test runs in a day and fixed interoperability issues overnight

• Reduces acquisition time and cost
  • Readily-available, persistent connectivity with standing network security agreements
  • Common integration software for linking sites
  • Accredited test tools for distributed testing

• Support to Acquisition Programs
  • Expertise to integrate distributed test facilities

**JMETC is identified in T&E Master Plans (TEMPs) as the distributed infrastructure to be used to conduct Joint testing**
JMETC SECRET Network (JSN) Site Map

- Functional JSN Locations: 46 (access to 79 labs/facilities)
- Planned JSN Locations: 9
- Connection Points to Other Networks: 5

- Leverages the SECRET Defense Research and Engineering Network (SDREN) for connectivity
- Operates at SECRET classification, available 24/7
- Continuous monitoring, troubleshooting, and optimization of the end-to-end network infrastructure
- Capable of supporting numerous simultaneous test events

As of 21 Aug 2017

DISTRIBUTION A. Approved for public release: distribution unlimited.
JMETC Uses TENA as its Distributed Test Architecture

<table>
<thead>
<tr>
<th>Systems Under Test</th>
<th>Joint Operational Scenarios</th>
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### Integrated Test Resources

<table>
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<tr>
<th>Virtual Prototype</th>
<th>Hardware in the Loop</th>
<th>Installed Systems Test Facility</th>
<th>Range</th>
<th>Environment Generator</th>
<th>Threat Systems</th>
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**JMETC Infrastructure on DREN**

*Relevance: TENA: Test and Training Enabling Architecture*
Enterprise Software Ingredients Supporting the Vision

● **System Integration Tools: “LVC Interoperability is our mission”**
  ● Software that reduces test setup & design costs in a mixed architecture environment
  ● Cross Domain Solutions that bridge classification levels and/or security boundaries
  ● Adapters that enable communication without changing existing systems’ behaviors

● **Common Tools: “Build once, use everywhere”**
  ● Community tools readily available for download and use
  ● Event Planning tools that simplify event integration and setup
  ● Event Management tools that enable total awareness
  ● Post-Test Event Analysis tools that embrace big data analytics techniques

● **Collaboration Tools: “The sum is better than the parts”**
  ● Community-wide and DoD-only event collaboration
  ● Community-wide and DoD-only source code collaboration

● **Cloud Services: “Embrace Testing as a Service (TaaS)”**
  ● Immersive constructive environments available “on demand”
  ● Re-hosted acquisition system software readily available for use (e.g. JSF system software)
  ● Reduce local software footprint to mitigate Information Assurance headaches
Test and Training Enabling Architecture (TENA) at a Glance

- What does TENA enable?
  - Interoperability between inter- and intra-range assets
  - Elimination of proprietary interfaces to range instrumentation
  - Efficient incremental upgrades to test and training capabilities
  - Integration of Live, Virtual, and Constructive assets (locally or distributed)
  - Sharing and reuse of common capabilities across existing and new investments

- What is included in the TENA architecture?
  - Customizable “data contracts” that standardize repeatable information exchange
  - Interoperability-enabling, auto-code generated software libraries
  - A core set of tools that address common test and training requirements
  - Collaboration mechanisms that facilitate sharing and reuse

- TENA has a plan for continued evolution and funding to execute this plan
Worldwide Use of TENA

TENA is used in
13 countries outside the US
How TRMC Supports T&E: Notional Test Walkthrough

TRMC Subject Matter Expertise (SME) supports entire process

1. Test Planning & Requirements Definition
2. Test Design
3. Event Construction, Setup and Rehearsal

Pre-Test

TENA Repository

TENA Object Models

Test

TENA Tools & Utilities

JMETC / NCR Test Support

Test Execution

Post-Test

5. Analysis & Reporting

TRMC Big Data Initiative
JMETC Current Focus Areas

- Investigating Information Assurance / Cybersecurity Services that would be value-added to the community
  - Examples: TRMC software certifications, TRMC AO support, ATO / ISA assistance

- Transitioning MLS-JCNE Cross Domain Solutions into JMETC SYSCON capabilities

- Considering how to bring distributed T&E into areas with limited network infrastructure and/or a single event need

- Researching where automation can lead to efficiencies
  - Example: Ports-Protocol Verification Test Application

- Reinstituting formal Post-Event User Feedback
  - Examples: Post-Event Survey; Infrastructure After Action Review as-needed

- Continually identifying areas where we can do things faster and/or cheaper
TENA SDA Current Focus Areas

- Supporting capabilities development at ranges & labs
- Enabling TENA use in TRMC CTEIP and T&E S&T projects
- Expanding a GOTS library of range systems adapters
- Standardizing instrumentation remote monitoring and control
- Updating Object Models to better mix Virtual-Constructive with Live
- Improving enterprise tools & utilities
- Enhancing TENA Website Services
- Prototyping Enterprise Software Sharing Repository
- Exploring Software as a Service (SaaS) in the cloud
- Preparing for an enterprise Knowledge Management / Big Data Analytics capability
- Developing a “common language” for cyber T&E and training
The JMETC / TENA team is available to offer advice and assist any organization looking to use TENA

- Advice on overall design approach and trade-offs to consider
- Recommended Object Models to reuse
- Recommendations on how to design new Object Models
- Implementation / Code Designs Reviews
- Awareness of similar systems and lessons learned
- Hands-on Training classes on TENA capabilities
- Contract language to help ensure TENA-enabled solutions
- Network connectivity to CONUS & OCONUS labs / ranges / facilities
- Distributed event subject matter expertise

Need Assistance?
E-mail request to: feedback@trmc.osd.mil
Summary

- **Vision**: An agile Test & Evaluation Infrastructure that support acquisition requirements
  - Robust, Immersive, Easy-to-Construct Live-Virtual-Constructive Test Environments
  - Agility that supports rapid acquisition & experimentation along with traditional DT / OT

- TENA provides the architecture and enterprise software foundation to achieve the vision

- JMETC provides the network and LVC expertise to achieve the vision

- The JMETC / TENA SDA Team is here to help
  - TENA Upgrade support offer
  - Distributed Test Event Subject Matter Experts (SMEs)
  - Knowledge Management and Big Data Analytics support
  - Information Assurance / Cybersecurity assistance
JMETC Points of Contact

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