Net-centric Weapons Test and Evaluation Environment (NCWTEE)

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System-of-Systems Engineering Workshop

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• What is NCWTEE:
  – NCWTEE implements realistically-limited (bandwidth/segment/line-of-sight) data link behaviors to assess performance of net-enabled weapons

• Why the warfighter needs NCWTEE:
  – In current operations, multiple users share the same data link ‘space’
  – However, as a result of current technology and resources, current system of system testing assumes away the degradations resulting from sharing this data link space
  – Weapon system effectiveness therefore remains an unknown until the warfighter is actually engaged in the battle space, particularly when multiple weapons are employed
  – NCWTEE mitigates this issue by giving testers the ability to add interference into the test environment, thus making it more realistic and more representative of the modern battle space
Net-centric Weapon (NCW) CONOPS

Aircraft (AC): F-15E/FA-18/JSF

UHF

Link-16

Net-Centric Weapon (NCW)

Other Net Subscribers (Competing for Net Resources)

JTAC

A

B

C

D

E

Distribution Statement A:

Asynchronous Update

Strike Aircraft Acquires Target

Strike Aircraft Releases Weapon

In-flight Target Updates (IFTU) to Weapon

Weapon Acquires & Guides to Target

Weapon End-game & Bomb Hit Indication (BHI)
How is Link 16 Used in Battle?

Distribution Statement A:
How Do We Test It?

Live RF Link 16

Net
10
9
8
7
6
5
4
3
2
1
0
NCWTEE Brings the Combat Environment To Test

In Combat, Messages May or May Not be Tx/Rx Due to:
- Line-of-sight
- Timeslot Buffering / Bandwidth
- Transmit Range
- Multiple messages / timeslot
- etc

NCWTEE implements realistically-limited (bandwidth/segment/line-of-sight) data link behaviors to assess the performance of multiple net-enabled weapons

Distribution Statement A:
Interoperability

• Three Levels of Interoperability Testing
  – Correlate to the OSI Reference Model
• Application Layer - Current Distributed Test Ops
  – How well do the systems interact at the data message level?
  – Typically uses Deterministic Communication Methods (JREAP-C)
• Transport Layer - NCWTEE Distributed Test Ops
  – How robust are the systems when using the operational transport methods – TDMA, etc
• Operational Layer - NCWTEE Distributed Test Ops
  – How does the system operate within the constraints of the GIG?
  – Multiple Systems, Multiple Weapons, Contention Access, Limited Bandwidth at the tactical edge
  – Loosely Correlates to Joint Test

OSI - Open System Interconnection
JREAP – Joint Range Extension Application Protocol
Description

- Distributed engineering-level capability to assess NCW SoS kill-chain performance due to communication behavior and sensor impacts

Key Characteristics

- Scalable mix of statistical and engineering level Link-16 and UHF distributed network behavior emulations that can represent complex RF environments and emulate waveform behavior with varying fidelity
- Scene generation capability that provides sensor models with common hi-fidelity Imaging Infrared (I2R) stimulation

Develops Three (3) Core Capabilities

1. **Link-16 Emulation (Aircraft to Weapons Communications)**
   - Real-time distributed engineering level Link-16 emulation to augment current JRE approach
   - Develops emulated Link-16 network environment and integrates Link-16 terminal emulations
   - Uses distributed architecture (JMETC)
   - Integrated with contractor provided platform simulations

2. **Tactical Radio / CNR Emulation (JTAC to Weapon Communications)**
   - Real-time distributed engineering level Combat Net Radio emulation to augment current JRE approach
   - Develops emulated Tactical Radio network environment and integrates Tactical Radio terminal emulations
   - Uses distributed architecture (JMETC)
   - Integrated with contractor provided platform simulations

3. **Scene Generation (Sensor Simulation/Stimulation)**
   - Real-time local scene generation providing distributed synchronized scenes to digital sensor models or hardware
   - Develops distributed architecture enhancements for scene generation node communication
     - Pre-event source data
     - Real-time target TSPI (TENA)
   - Leverages existing CTEIP capability (JDIGS TENA LROM)
   - Integrated with contractor provided platform simulations

NCWTEE Leverages Best-of-Breed Advances in GOTS/COTS Capabilities

Distribution Statement A:
Link-16 Desktop Analysis

Link 16 Characterization Example from Enhanced Solution Phase

- Operational Latency (Over-the-Air)
- NCWTEE Latency (test network and computer processing latency)
  - Centralized Approach (Single Server – Distributed Processing)
  - Decentralized Approach (Distributed Servers at each site – Local Processing)

Distributed Test Latency is NOT a factor for NCWTEE
Project Scope / Representative Interfaces

EMANE based Node with Link 16 & CNR Modules

Green – Existing
Yellow – Modified/upgraded
Red – Need to be Developed

Net Centric Weapons T&E Environment
NCWTEE Deliverables

### Link 16 & Combat Net Radio
- Server Stack & Networking Equip to Link to JMETC
- RF Behavior Engine
  - Line-of-sight
  - Timeslot Buffering / Bandwidth
  - Transmit Range
  - Antenna Patterns, Etc
  - F-35 & Net Weapon sim for V&V
  - F-18 / F-15 sims already exist

### Scene Generation
- Scene Generators (Workstation with high-end graphics cards)
- IIR Interface to Software Seeker
- Networking Equip to Link to JMETC
- Weapon models for V&V

### Data Link DRFM Technology (DLDT)
- 6 Data Link DRFMs (3 DLDTs)

* Software Only
**Link 16/CNR Emulation VV&A**

- **VV&A Goal**: Demonstrate NCWTEE Link 16/CNR Emulation represents L16/CNR Open Air Environment
  - TDMA, Terrain, Attenuation, RF effects, etc.
  - Distributed environment
- **Process**
  - Initialize Lab and NCWTEE environments with operationally representative NDL, OPTASKLINK and CCIF data files
  - Leverage RF effects and lab data (Message validity and TDMA)
  - Output comparisons drive reassessment, reprioritization and correction, as needed

**Impact**: Emulates net-enabled weapon message and standard messages from any number of Link 16/CNR entities

- Validation – accurate representation of real world
- Verification – accurate representation of NCWTEE conceptual description and specs
VV&A Goal

• Weapon environment VV&A’d for the purpose of testing systems supporting planning data flow
  – Supports Developmental Test
  – Supports Operational Test
Summary

- NCWTEE supports early testing
  - System of System components
- NCWTEE adds realistic battlespace environment
- NCWTEE reduces risk prior to open air testing