



HWIL and ISTF Facilities Connection to Traditional National Cyber Ranges (NCR)

**ITEA System of Systems in a 3rd Offset Environment
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George J. Rumford

Deputy Director, Major Initiatives and Technical Analysis

T&E/S&T Program Manager

george.j.rumford.civ@mail.mil

Technology Offsets

Nuclear

Precision

Speed



Major Initiatives & Technical Analyses (MITA)



- **Hypersonics**
- **Autonomy**
- **Spectrum**
- **Interoperability**
- **Cyber**
- **Big Data / Knowledge Management**



T&E/S&T Program

Test Technology Areas



- **High Speed Systems**
- **Unmanned & Autonomous Systems**
- **Directed Energy**
- **Electronic Warfare**
- **Cyberspace**
- **C4I and Software Intensive Systems**
- **Spectrum Efficiencies**
- **Advanced Instrumentation**



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Test Resource Categories



- **Digital Modeling & Simulation**
- **Measurement Facilities**
- **System Integration Laboratories**
- **Hardware-in-the-Loop Laboratories**
- **Installed Systems Test Facilities**
- **Open-Air Ranges**



Test Resource Categories



- **Digital Modeling & Simulation (DMS)**
- **Measurement Facilities (MF)**
- **System Integration Laboratories (SIL)**
- **Hardware-in-the-Loop Laboratories (HWIL)**
- **Installed Systems Test Facilities (ISTF)**
- **Open-Air Ranges (OAR)**

**Cognitive/Machine
Learning Systems**

Virtualized Systems

What about Software?

**Knowledge Management
Systems**

**Software Intensive
Systems**



Test Resource Categories Revisited



- **Digital Modeling & Simulation (DMS)**
- **Measurement Facilities (MF)**
- **System Integration Laboratories (SIL)**
- **Software Testbed (STB)**
- **Hardware-in-the-Loop Laboratories (HWIL)**
- **Installed Systems Test Facilities (ISTF)**
- **Open-Air Ranges (OAR)**



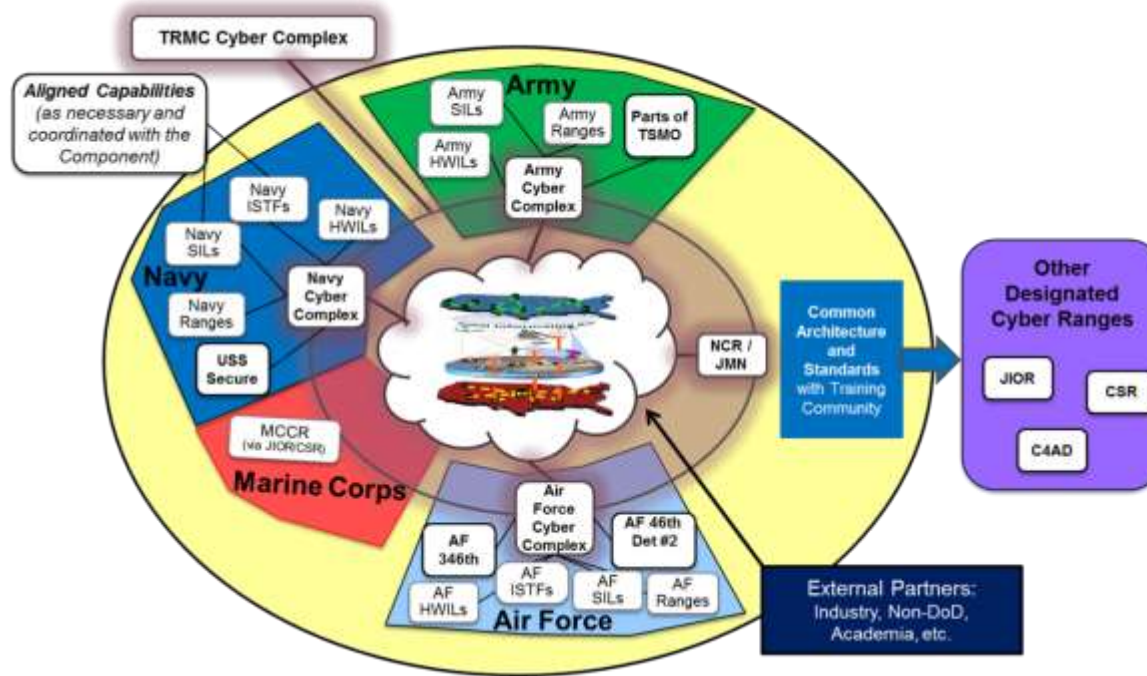
Software Testbed (STB)



- **Autonomy Software Testing**
- **Cyber Testing**
- **Interoperability Testing**
- **Big Data / Knowledge Management Evaluation Capabilities**



Cyber Test and Evaluation Infrastructure (CT&EI)



The CT&EI is composed of existing non-kinetic Cyber test capabilities integrated with representations of kinetic and C2 systems (e.g., hardware-in-the-loop (HWIL) facilities, system integration labs (SILs), and software-in-the-loop (SWIL) facilities) via network connectivity, enabling testing those systems in a realistic combat, including cyber and interoperability, environment. We have to integrate these existing facilities in a cyber environment with low risk of damage.



HWIL and ISTF Facilities Connection to Traditional National Cyber Ranges (NCR)



- **Virtualization of the Battlespace**
 - Blue, Red, Tactical Networks, Users, etc.
- **Networked, Multi-Level Security Environment**
 - Isolation and sanitization capabilities
- **Large-scale, Distributed Synchronization**
- **Stimulation Capabilities**
- **Data Collection / Extraction Capabilities**
- **Core Architecture / Terminology / Processes**
- **Support Tools**
 - Planning, Evaluation, Test Control, Visualization, etc.



T&E/S&T Program

Cyberspace Test Technology (CTT) Domains



1. Cyber-Physical Systems

Kinetic systems, cyber-physical networks, embedded systems, computer systems with a dedicated function within a larger mechanical or electrical system, often with real-time computing constraints

2. Tactical Edge Networks

Information systems & connectivity supporting tactical edge communications and distributed operations – includes line-of-sight and beyond-line-of-sight data links, and other networked systems in the battlespace

3. Enterprise Information Systems

Broad scope of unified communications and integration of telecommunications, computers, necessary enterprise software, middleware, storage, and audio-visual systems which enable users to access, store, transmit, and manipulate information



The T&E/S&T Challenge

Virtualization of Warfighting Capabilities



Hypervisors/Emulators for Kinetic Systems & Cyber-Physical Networks

Rapid creation of high-fidelity replications of systems for use in a cyber-test environment

Elements of this technology challenge include:

Arbitrary Simulation / Emulation / Virtualization

Tools to create a high fidelity simulation, emulation, or virtualization of a cyber device as a black box regardless of central processing unit, chipset, or other hardware considerations

Virtual Traffic Generation

Tools to create high fidelity inputs (both digital and simulated analog) for simulated, emulated, and virtualized cyber-physical systems that are under test

Cyber-physical Attack Simulators

Tools to simulate the impact of a cyber-attack on cyber-physical systems, including the capability to reproduce, simulate, or emulate the entire cyber-physical system in a high fidelity manner, representing an entire platform or a function or element of the platform



Summary



- **TRMC is focused on advancing the T&E Landscape with coordinated investments & development efforts**
 - Hypersonics
 - Autonomy
 - Spectrum
 - Interoperability
 - Cyber
 - Big Data / Knowledge Management
- **Existing Test Resources (HWILs, ISTFs, OARs) are essential to the Cyber T&E Infrastructure**

Technology Challenge: Rapid Virtualization of Warfighting Capabilities