



# Preparing the Test Infrastructure for a Cyber World



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# The Complexity of Our World Continues to Grow at a Rapid Pace



## ● Personal communication services

- ▶ Smart phones with high bandwidth connectivity
- ▶ Mobile applications
- ▶ Social networking
- ▶ On-demand video
- ▶ Cloud Services
- ▶ All access, all the time



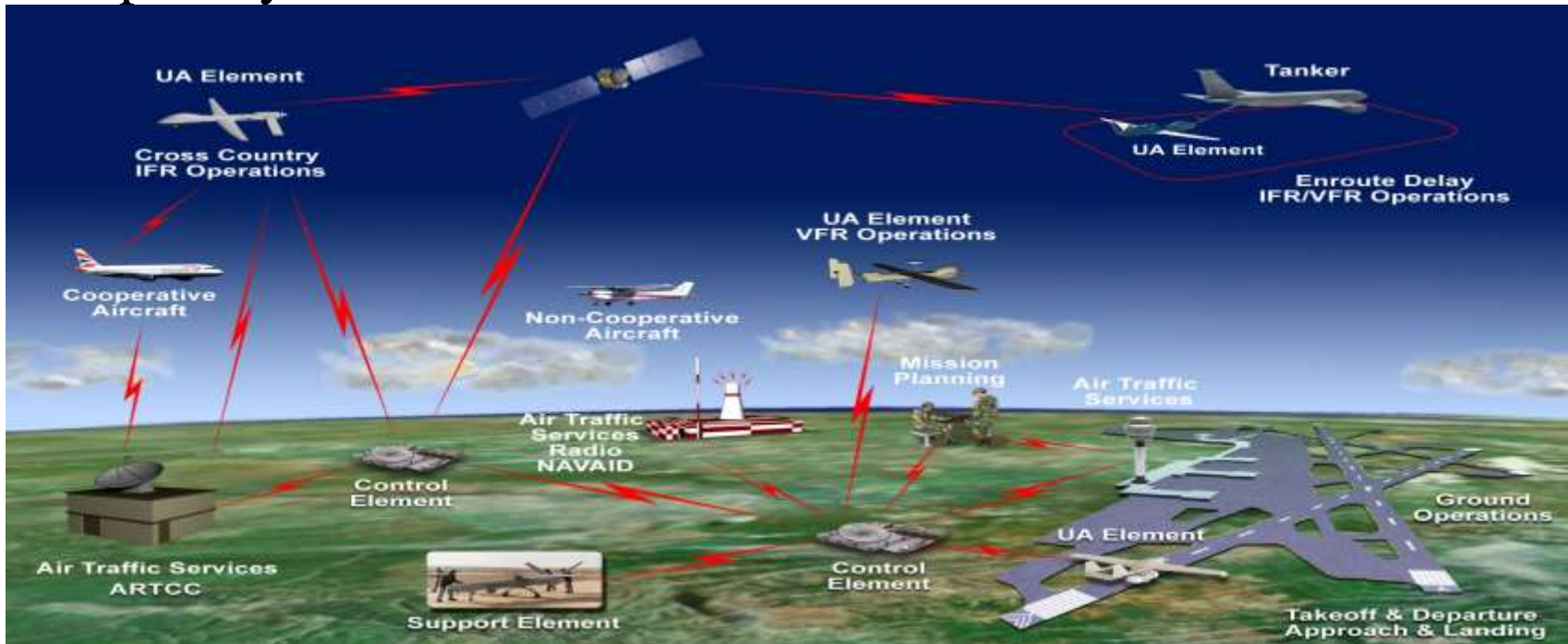
## ● Business/Commercial services

- ▶ Distributed communications/services now standard business practices
  - Amazon, McDonald's, Pizza Hut, etc.
- ▶ Secure (encrypted) banking/financial services
  - Online banking, credit cards
- ▶ Cloud computing
  - Scalability, redundancy, ease of access



# DoD Weapon Systems are Following Suit

- Warfighting capabilities are increasingly dependent on more than individual platform performance
  - ▶ Total system effectiveness spans multiple individual weapon platforms
- Complex system interactions



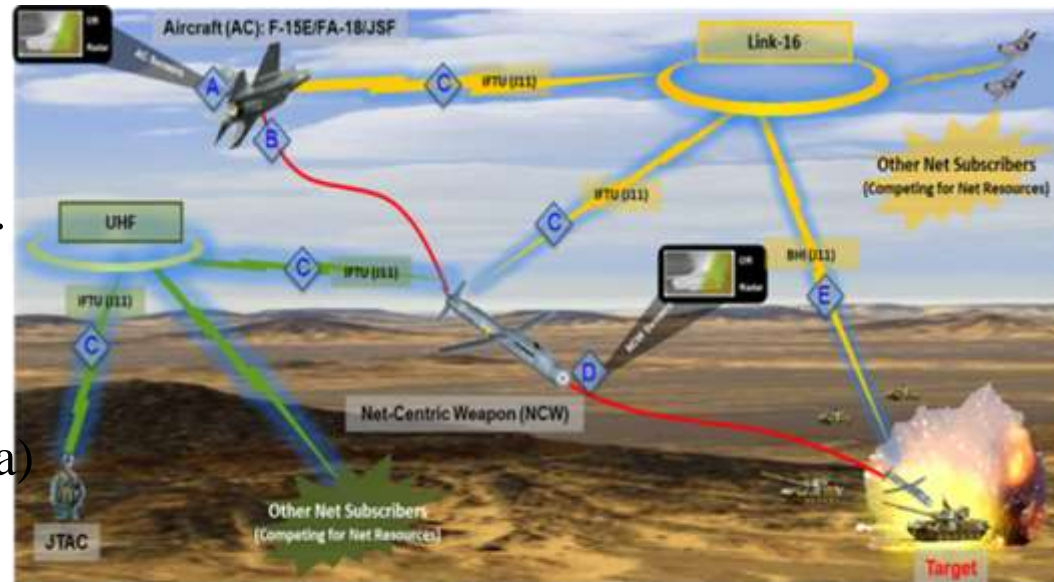
- Communications/data networks are critical-----and so is the security of those networks



# DoD Weapon Systems are Following Suit



- System of Systems capabilities being fielded
  - ▶ Capabilities are part of a bigger network (BMDS, NIFC, GCCS-J)
  - ▶ Joint Coalition Interoperability (NATO, foreign partners)
- Data Sharing
  - ▶ TSPI, platform health, Situational awareness, etc.
- Data-on-demand
  - ▶ Video (high bandwidth)
  - ▶ Sensor data (IP/packet data)
- Data fusion
  - ▶ On the platform (HFI, F-35, IRCM, etc.)
  - ▶ Between platforms (IADS, BMDS, MUM-T, etc.)



*Increased Weapons Effectiveness----Increased System Vulnerability*



# Vulnerabilities Come with the Technology



- System of systems and distributed capability offer great benefits
  - ▶ Sum of the whole is greater than the individual parts
  - ▶ Improved scalability of the system
  - ▶ Reduced cost of the capability
  - ▶ Reduced reliance on a single developer
  - ▶ System redundancy
- But also bring the potential to make us vulnerable
  - ▶ Multiple access points
  - ▶ Suboptimal policies authorized to facilitate communications
  - ▶ False sense of security to the operators
  - ▶ Exponentially more scenarios/use cases
  - ▶ Complex audit trails

Infrastructure and Test Strategies Needed to Minimize These Vulnerabilities



# T&E Community Must Keep Pace



- T&E must be able to support these same concepts
  - ▶ High bandwidth connectivity
  - ▶ Mobile applications and cloud services
  - ▶ Data sharing
  - ▶ Data On-demand
  - ▶ All access, all the time
- As weapons get smarter and more connected, the pressures to the T&E infrastructure increase
  - ▶ Limited resources to upgrade fiber and backhaul systems
  - ▶ More data generated, but less spectrum to operate in
  - ▶ Limited range space to operate distributed test CONOPS
  - ▶ Multiple levels of data classification within test
  - ▶ Enormous expense/security risk of running open air tests



# TRMC Organization

Under Secretary of Defense for Acquisition, Technology & Logistics  
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*Mr. Stephen Welby*

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Deputy Director, T&E Range Oversight (MRTFB)  
*Bruce Bailey*

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George Rumford*

Deputy Director, Test Capabilities Development and CTEIP  
*Chris Paust*

Deputy Director, Interoperability and Cyber Test Capabilities  
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Chip Ferguson*

*Effective April 1, 2011, the DASD(DT&E) serves concurrently as Director, TRMC*



# What is CTEIP?

- CTEIP is the Department's corporate investment vehicle for modernizing DoD test infrastructure
  - ▶ 40% of DoD's test infrastructure improvement and modernization investment
  - ▶ Addresses modernization projects that are too big for a single Service
  - ▶ Ensures requirements solve multi-Service needs
  - ▶ Develops integrated solutions across the spectrum of T&E capabilities i.e. cyber, nuclear effects, materials testing, telemetry, etc.
  - ▶ Develops Common Range Instrumentation which benefits many platforms - not just focused on a single System Under Test
  - ▶ Reduces range and service duplication
- Basic CTEIP Criteria
  - ▶ Multi-Service benefit
  - ▶ Developmental (not procurement)
  - ▶ Use Mature Technologies (TRL-6)
  - ▶ Service/Agency life-cycle ownership agreements





# Central Test & Evaluation Investment Program (CTEIP)



**Mission: Develop or Improve Major Test Capabilities that have multi-Service Utility**

• Established by Congress in FY91

## ➤ Long-Term multi-Service Investments

## ➤ Near-Term Investments

### Joint Improvement & Modernization (JIM)

#### JIM-Core

- 3-5 year requirement horizon
- EMD of major multi-Service test capabilities
- Development, not procurement
- Services & Agencies budget for O&M

#### JIM-EW

- Special DoD area of emphasis
- EMD of electronic warfare (EW) test capabilities
- Assess aircraft performance against complex new threats.
- Service budget for O&M

#### JIM-Hypersonics

- Special DoD area of emphasis
- EMD of hypersonic ground test capabilities
- Focus on hypersonic cruise & boost glide missiles
- Service budget for O&M

#### Resource Enhancement Project (REP)

- 1-2 year horizon
- EMD of instrumentation to address near term OT shortfalls
- Coordinated with DOT&E

#### Threat Systems Project (TSP)

- 1-2 year horizon
- Address shortfalls in threat systems representation
- Coordinated with DOT&E

Bi-annual multi-Service T&E Reliance Nomination Process

Multiple DoD EW studies

DoD Approved Roadmap

Annual review of OT shortfalls

Annual review of threat needs

**Requirements Drivers**

**26 JIM, 8 EW, 23 Hypersonics, 14 REP, 12 TSP = 83 Projects**



# Who are the Beneficiaries?



## Service Test and Evaluation Ranges and Facilities

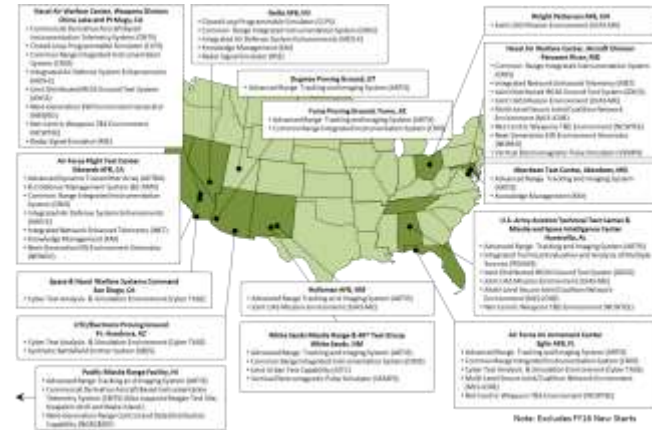
- Modeling and Simulation Facilities
- Hardware in the Loop Laboratories
- Installed System Test Facilities
- Open Air Ranges

## DoD Acquisition Programs and Weapons Systems

- Aircraft: TSPI, telemetry, data collection, etc.
- Helicopters: IRCM and UAV control
- Missiles: Air-to-Air, Air-to-Ground, etc.
- Hypersonics: Boost Glide, Hypersonic Cruise
- Ships/Subs: Cyber T&E and Torpedo M&S

## DT&E, DOT&E, MDA, & DISA

- Support T&E strategies in TEMP's
- Develops threat simulators





# CTEIP Investment Areas



- **EW Infrastructure Investment Program**
- **Cyber and Test Security**
- **Big Data Analytics**
- **Accurate Time-Space-Position Information**
- **Spectrum Efficient Technology**
- **Infrared Countermeasures**
- **Hypersonic Systems T&E**
- **Net-centric Weapons T&E**
- **Nuclear Effects T&E**
- **Performance Measurement Systems**

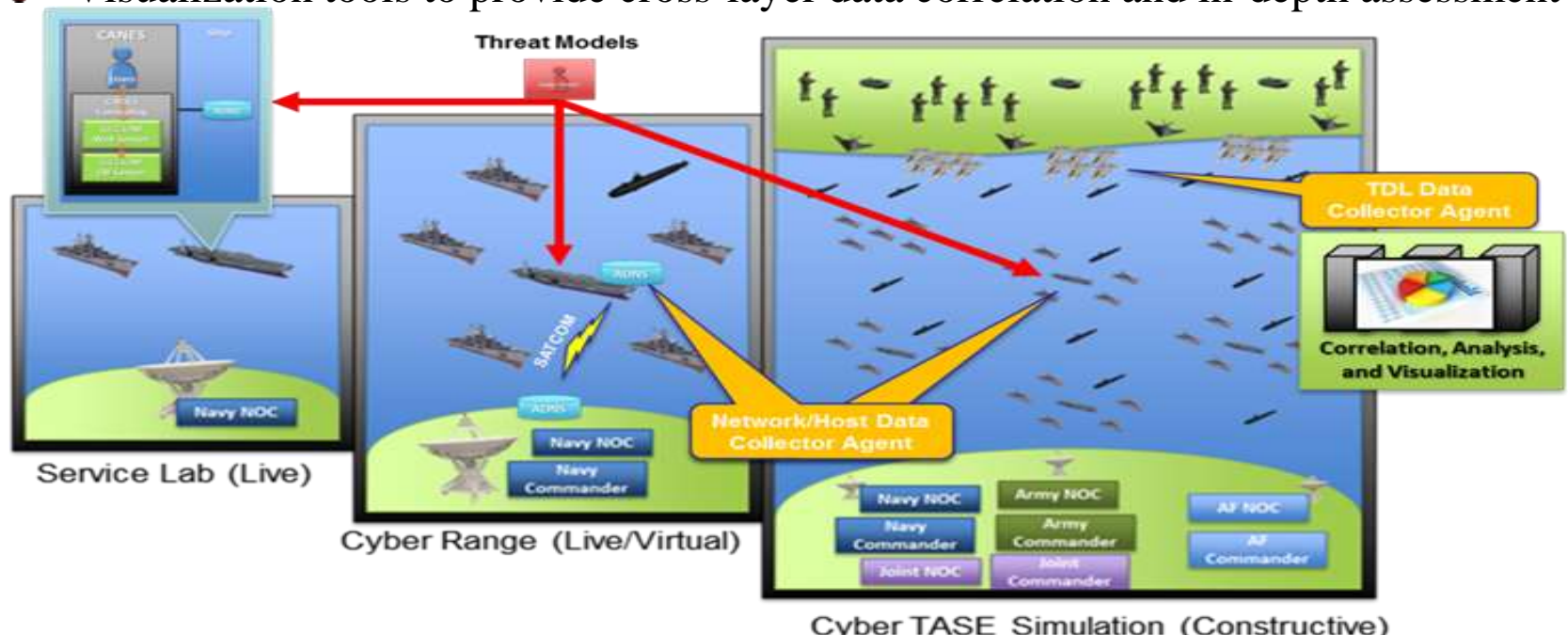
➤ **80+ projects grouped into common Investment Areas that help enable the Enterprise Solution Approach**



# Cyber Test Analysis and Simulation Environment (CyberTASE)



- Large-scale, realistic simulation environment to assess and visualize the impact of cyber threats on systems and systems of systems under test
- Adaptation and integration of COTS-based tools
- Quick, repeatable setup of large networks and network entities
- Pre-defined libraries of critical DoD relevant components, networks, and IT systems models
- Near-real time and post test report generation for forensic analysis
- Visualization tools to provide cross-layer data correlation and in-depth assessment



# Common Range Integrated Instrumentation System (CRIIS)

- Next generation TSPI/datalink system for airborne tracking
- Improved accuracy (<.3m) & throughput (4-6x existing capability)
- Supports Legacy and 5th Gen aircraft
- Multiple Independent Level Security (MILS)
- High bandwidth participant to participant datalink to support relay and LVC
- Being fielded on over 190 aircraft over 3 three years at 8 ranges across DoD

## Configuration 4 Pod for Legacy Aircraft



## Configuration 5 Internal Mount Liquid Cooled for 5<sup>th</sup> Gen Aircraft



## Configuration 6 Internal Mount Air Cooled for Legacy Aircraft



### Threshold Platforms

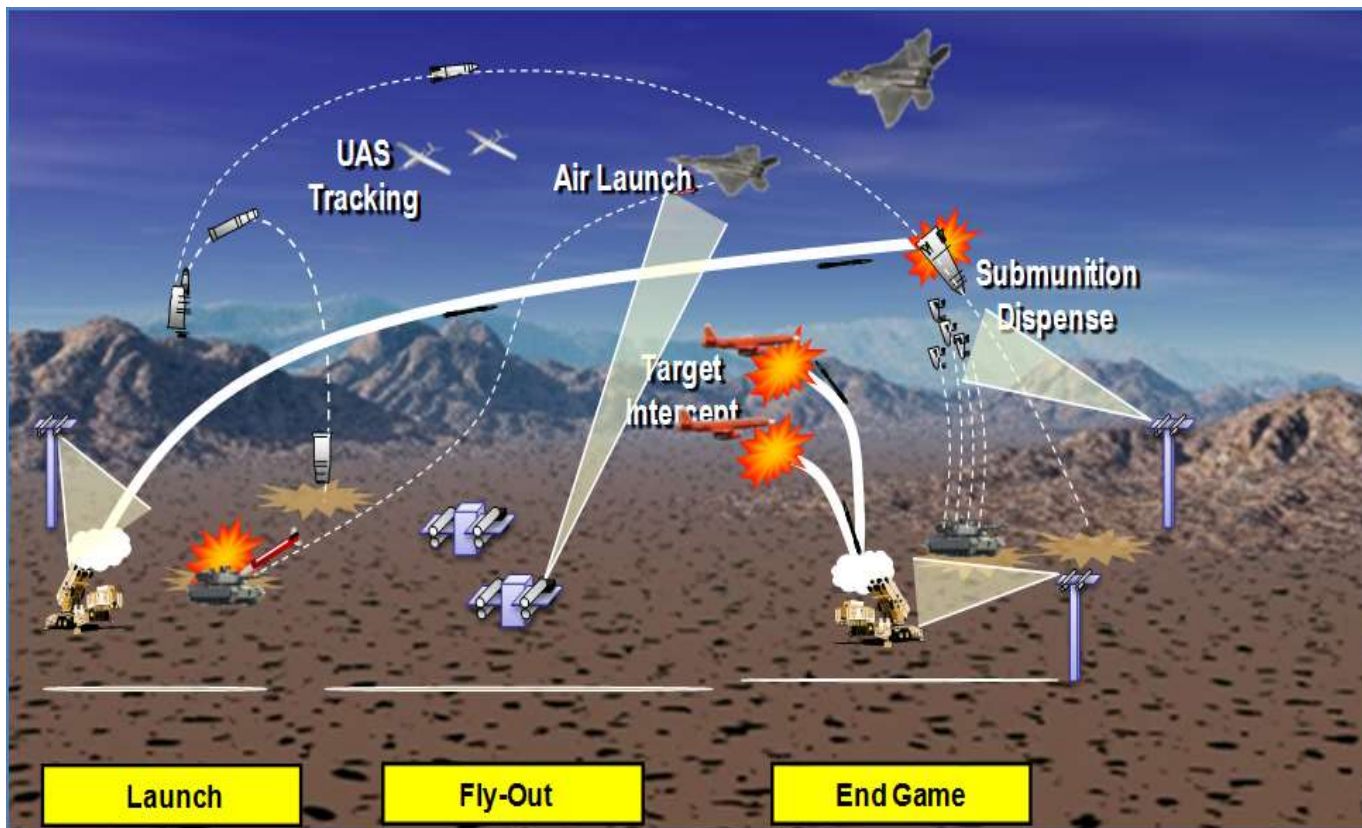


### 5<sup>th</sup> Generation Aircraft

### Legacy Aircraft

# Advanced Range Tracking and Imaging System (ARTIS)

- Optical tracking and imaging system to replace aging Kineto Tracking Mounts (KTMs)
- Ground network of systems to observe and record performance of missiles, UASs, and aircraft during launch, fly-out, and end game phases of DT and OT.
  - ▶ Close-In system for high dynamic, short range (0-5 km) events (tower mounted)
  - ▶ Fly-out system for larger payload, mid-range (5-50 km) operations
- 2 weeks of unattended remote operations





# Summary

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- **T&E infrastructure must keep pace with the changing world**
  - ▶ Technologies are growing at an exponential pace
  - ▶ These technologies are being adopted by and incorporated in our weapons systems
  - ▶ System of systems testing will continue to stress the test infrastructure
- **CTEIP has an important role in developing that test infrastructure**
  - ▶ The Department's corporate investment vehicle for T&E
  - ▶ Represent a significant share of the total T&E investment for the Services
  - ▶ Address requirements that span the Services
  - ▶ Flexible and harmonized with Service I&M developments
  - ▶ Provide a trusted infrastructure to support distributed testing
- **Collaboration is key**
  - ▶ A collective understanding of capability gaps that support development of common cyber T&E capabilities is needed
  - ▶ Specialized one-off solutions should be the exception, not the norm
  - ▶ T&E test capabilities – cyber or not – need to be cyber hardened