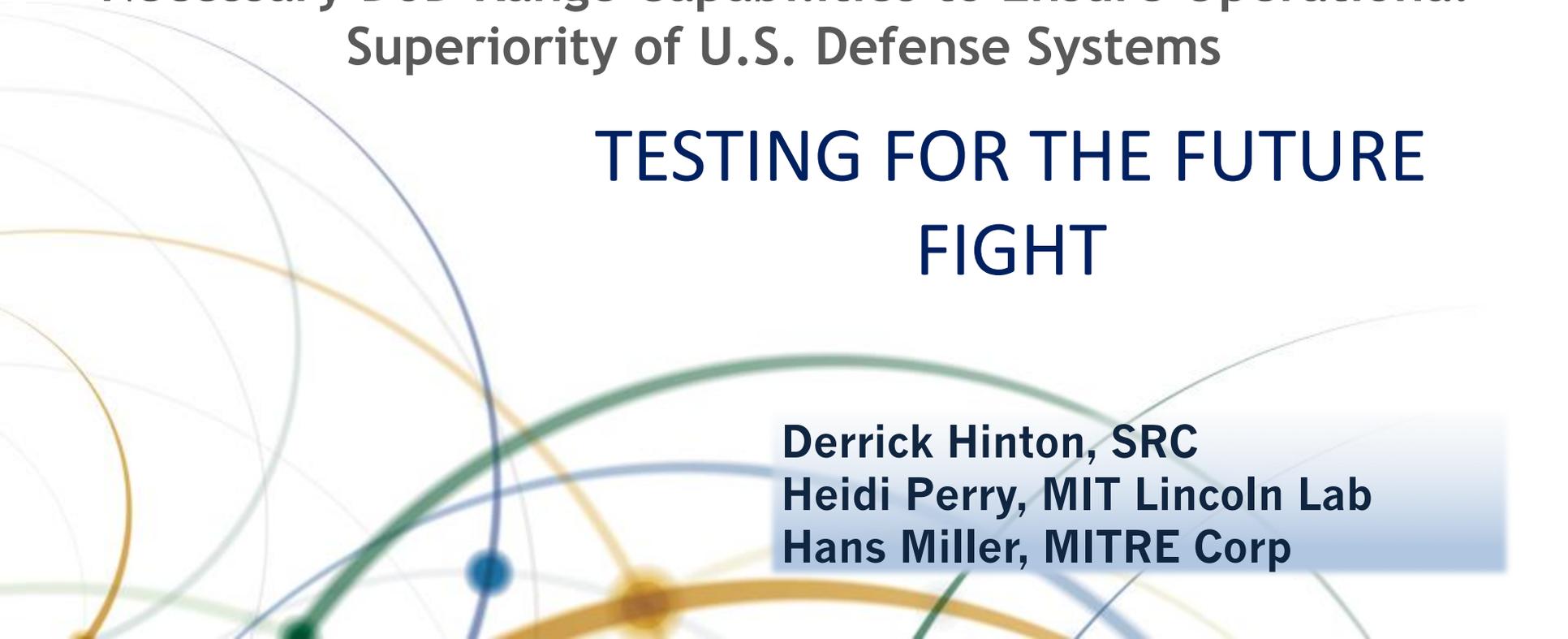


# Necessary DoD Range Capabilities to Ensure Operational Superiority of U.S. Defense Systems

## TESTING FOR THE FUTURE FIGHT



**Derrick Hinton, SRC**  
**Heidi Perry, MIT Lincoln Lab**  
**Hans Miller, MITRE Corp**

# NECESSARY DOD RANGE CAPABILITIES TO ENSURE OPERATIONAL SUPERIORITY OF U.S. DEFENSE SYSTEMS

## Phase 1 Study Objective - Unclassified

Assess **the physical and technical suitability of DoD's ranges, infrastructures, and tools** used for test and evaluation of military systems' **operational effectiveness, suitability, survivability, and lethality** across all domains in the 2025-2035 timeframe

# NECESSARY DOD RANGE CAPABILITIES TO ENSURE OPERATIONAL SUPERIORITY OF U.S. DEFENSE SYSTEMS

## Key Challenges Raised

- Developing new testing capabilities
- Limited space and encroachment
- Integration
- Modeling & simulation
- Measurement and data
- Digital infrastructure
- Cybersecurity
- Workforce
- Financial challenges

# Key Findings - Major Themes

- A. Future combat will demand **connected kill chains** in a **joint all-domain operations** (JADO) environment;
- B. **Digital technologies** are dramatically reshaping the nature, practice, and infrastructure of test; and
- C. **Speed-to-field** is today's measure of operational relevance.

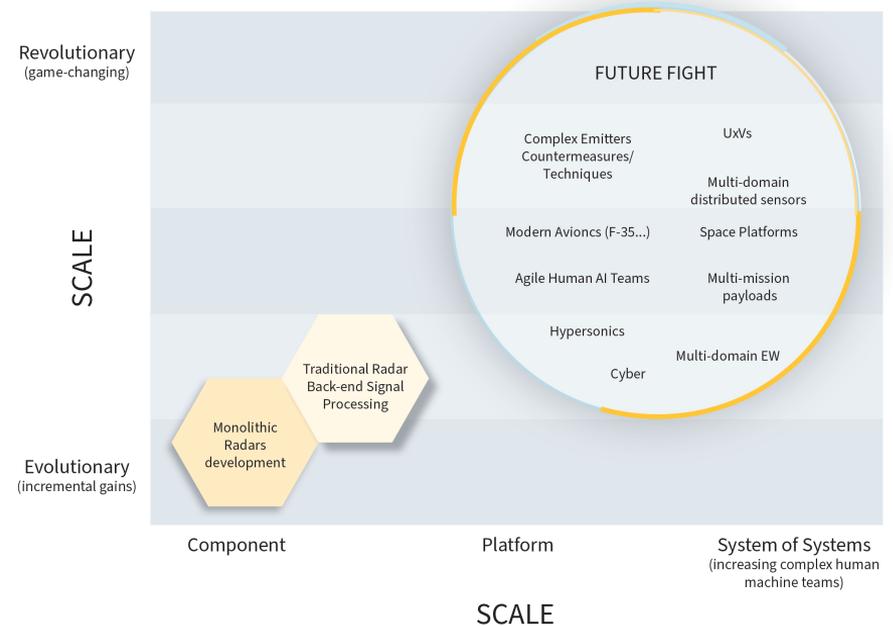
Aggressive action is required by the DoD otherwise the test ranges will be physically and technically inadequate to address the future fight

# Recommendation Themes

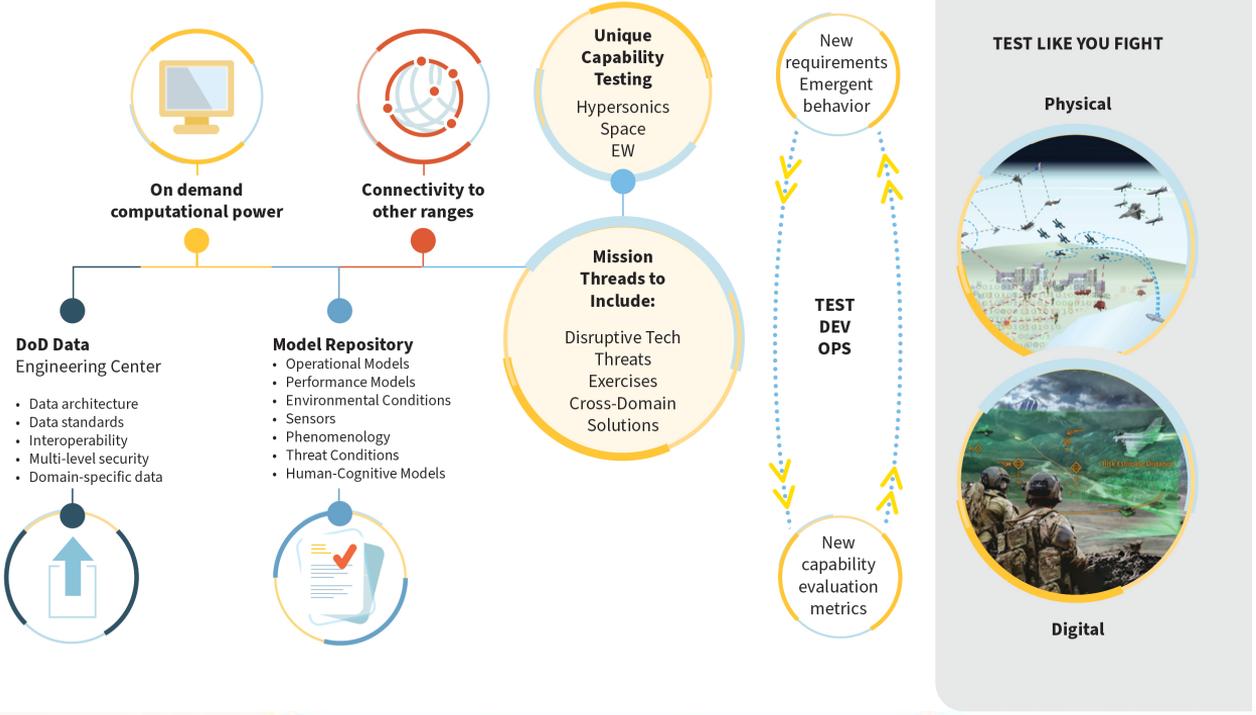
1. Develop the “range of the future” to **test complete kill chains in JADO environments**.
2. Restructure the range capability requirements process for **continuous modernization and sustainment**.
3. Bootstrap a **new range operating system for ubiquitous M&S** throughout the weapon system development and test life-cycle.
4. Create the **“TestDevOps” digital infrastructure** for future operational test and seamless range enterprise interoperability.
5. Reinvent the range enterprise **funding model for responsiveness, effectiveness, and flexibility**.

# The Envisioned Future of Operational T&E Addresses:

- Novel weapons and domains
- Multi-domain operations and kill chains
- Modeling & simulation
- Data sharing, repositories, and accessibility
- Funding and acquisition
- Encroachment Mitigation



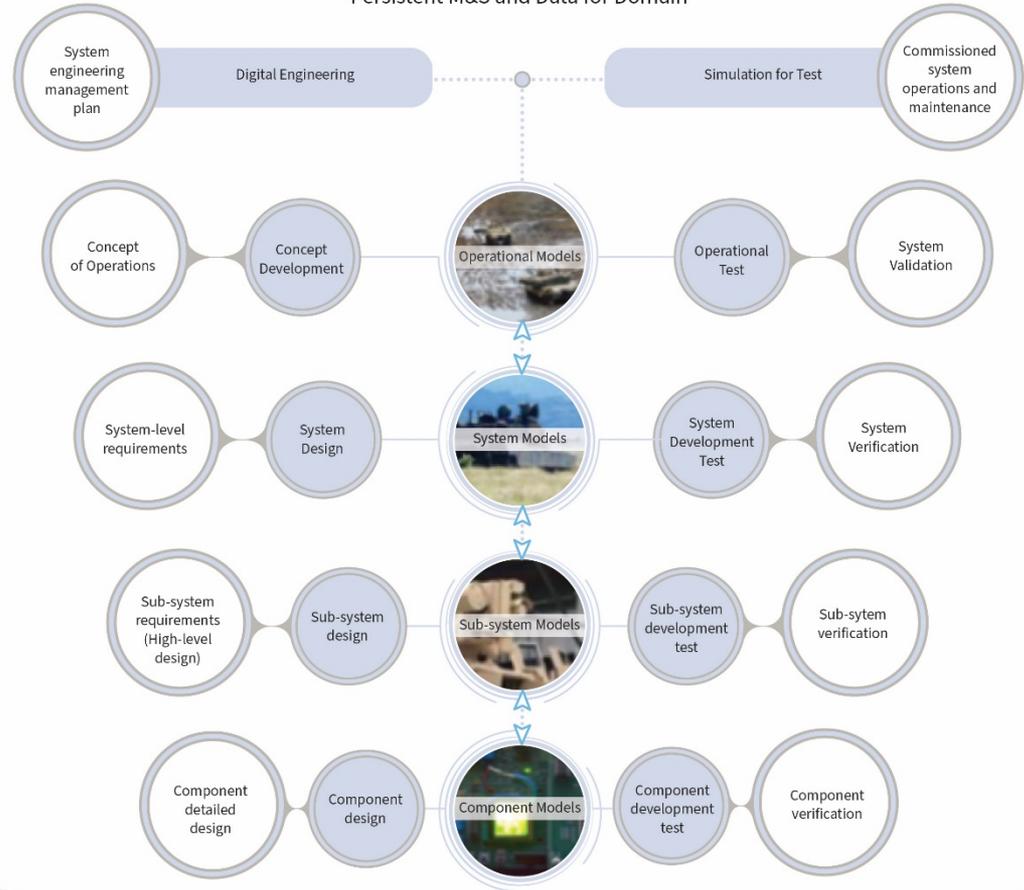
# Notional Concept of the Test Range of the Future



# A New Paradigm for Integrating Testing with Simulation

## M&S IN SYSTEM LIFECYCLE EMERGING PRACTICE

Persistent M&S and Data for Domain



Implementation hardware and software (Coding and Test)

# Theme 1 Recommendation

## Kill chains & JADO environments

3-1: To enable a range of the future that is capable of testing **kill chains and multi-domain operations (MDOs)** that can integrate effects across National Defense Strategy **modernization areas**, the Secretary of Defense should address the need to enable the DoD ranges to **provide regular venues to “test as we fight”** for acquisition and prototyping programs in a joint multi-domain battlespace of integrated systems.



# Example Drivers Behind Multi-Domain Focus

“Everybody is going to have access to the weapons we have...the trick is, how do we put that together in combined arms? To be able to integrate it all together so that 1) our weapons will be better, and 2)we’ll know how to integrate and fight together.”

- Hon. Robert Behler, former Dir of Operational Test and Evaluation

“With continued advancement of technologies and capabilities, the need to establish an appropriate balance of human control over AI will drive the Observe, Orient, Decide, Act (OODA) loops to meet requirements, maintain a competitive advantage, and ensure human responsibility and safety.” - Space Connectivity for combat 2040

Need to understand how systems will be used together

# Barriers

## **Common Understanding of Multi-Domain Requirements -**

Can't represent everything, what is included and what is not?

Focused T&E investment challenges by various definitions and views of what this is and should be

## **Current test forces largely aligned to weapon system**

Kill chains are assessed on a programmatic level rather than within an MDO context (Cooke)

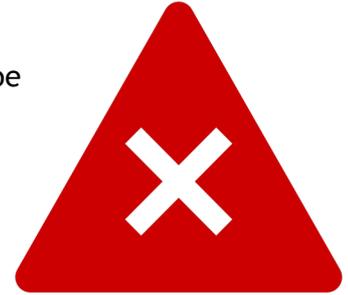
## **Specific program needs historically drive test resource decisions**

Need for Multi-Domain Test Forces (Cate)

## **Strategic Funding Programs (e.g. CTEIP) are focused on development**

Need for means to support sustained funding of multi-domain exercises and environment for test aligned to multi-domain threads and requirements

## **Data and security across ranges is difficult**



- a. Reside in DOT&E and report to a committee chaired by the DOT&E and consists of representatives from the Joint Staff, COCOMs, the Services, and R&E;
- b. Establish clear definitions for “multi-domain operations” and “cyber-physical systems”;
- c. Lead an effort across Joint Staff elements to define representative multi-domain use cases as well as OT&E objectives and range testing requirements;
- d. Work with COCOMs on operational community needs for test information/results to inform operations;
- e. Work with technology prototype efforts, e.g. JCTDs, to understand and inform test objectives related to the integration of new technology to enable rapid capability integration;
- f. Provide inputs to programs and services on needed future developments based on MDO test results;
- g. Provide and advocate for funding to support execution of multi-domain test events and sustainment of capabilities needed to execute those events;
- h. Assist with the prioritization of MDO and kill chain tests and associated test resources; and
- i. Establish a shared, accessible, and secure modeling and simulation (M&S) and data ecosystem to drive integrated development and testing across the life cycles of multiple supporting programs.

3-2: To ensure the ability to validate the survivability of DoD weapon systems against a realistic operational threat environment across air, sea, land, space, and spectrum domains, the DoD should **identify and prioritize bands** that cover U.S. military operational and test requirements which should be **protected from sell-off** to preserve these capabilities.

3-3: TRMC should **assess current and projected commercial radio frequency communications technologies** and spectrum allocations for secure, agile, high-bandwidth operational test needs. In addition, TRMC should determine the feasibility of developing **new large-scale enclosed testing facilities** combined with **expanded modeling and simulation** to support EM spectrum activities not suitable for open-air testing.

T&E infrastructure development is often state-of-the art with innovative capabilities that may not align with expenditure guidelines.

Modernization in the past was tied to individual programs of record - Funding needs to support classes of technologies

Conclusion 5-2: There exists a need for the Department of Defense to **pilot new process and authorities for funding ranges and infrastructure** to make them simpler, more responsive, and more effective.

- Create a **working capital fund** to cover operational, recapitalization, modernization and sustainment costs of ranges

# Phase 2 Study - Classified

Objective is to assess:

- Threat and threat countermeasures replication
- Capacity for advanced weapons and new technologies
- Modeling and simulation range of the future
- Topics that could not be assessed in Phase 1

***Study kicked off 11 August 2021***

The PDF of the report is  
available to download at

NAP.edu

