Necessary DoD Range Capabilities to Ensure Operational Superiority of U.S. Defense Systems
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.
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.
Key Challenges Raised

- Developing new testing capabilities
- Limited space and encroachment
- Integration
- Modeling & simulation

- Measurement and data
- Digital infrastructure
- Cybersecurity
- Workforce
- Financial challenges
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.
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

- **Mission Threads to Include:**
  - Disruptive Tech
  - Threats
  - Exercises
  - Cross-Domain Solutions

- **Unique Capability Testing:**
  - Hypersonics
  - Space
  - EW

- **New requirements**
  - Emergent behavior

- **TEST DEV OPS**
  - New capability evaluation metrics

- **TEST LIKE YOU FIGHT**
  - Physical
  - Digital

- **DoD Data Engineering Center**
  - Data architecture
  - Data standards
  - Interoperability
  - Multi-level security
  - Domain-specific data

- **Model Repository**
  - Operational Models
  - Performance Models
  - Environmental Conditions
  - Sensors
  - Phenomenology
  - Threat Conditions
  - Human-Cognitive Models

- **On demand computational power**

- **Connectivity to other ranges**
Recommendation 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.
A new organizational construct embodied in a joint program office is recommended to manage the framework for testing kill chains across systems and technologies. This office could:

- Lead an effort across Joint Staff elements to define representative multi-domain use cases and to prioritize MDO and kill chain tests and associated test resources;
- Provide inputs to prototypes, programs, and services on needed future developments based on MDO test results (Continuous “TestDevOps”)
- Provide and advocate for funding to support execution of multi-domain test events and sustainment of capabilities needed to execute those events;
- 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.
Example: The Joint Simulation Environment

The JSE is a high-fidelity simulation environment for operational testing.

It addresses a recognized need, in the JSF and other programs, for test operations unsuitable for open air ranges.

Future programs should not have to build their own JSE late in the program lifecycle.

Need persistent M&S environment suitable for continuous “TestDevOps”

Source: NAVAIR Public Release 2017-1012
A New Paradigm for Integrating Testing with Simulation
A DoD joint program office should:

- Establish a shared, accessible, and secure M&S and data ecosystem. Integrated live test and M&S should be planned from early concept development to support the system life cycle. (Recommendation 4-1)

- Adopt and promulgate approaches for standardization, architectural design, and security efforts to address data interoperability, sharing, and transmission challenges posed by the complexity of next generation systems.

- Determine how to develop and maintain a protected data, model, and analysis repository for testing. Increase the interconnectivity of test ranges, and ensure the development of data protocols for the real-time transfer of data at multiple classification levels. (Recommendation 4-2)
T&E infrastructure development is often state-of-the-art with innovative capabilities that may not align with expenditure guidelines.

Recommendation 5-2: The Office of the Secretary of Defense (OSD) should either allow an exemption or set shallower expenditure benchmarks for the first 2 years of test modernization programs. This will reflect realistic expense curves for the technologies and projects needed to test next generation programs and complex integration.

Conclusion 5-1: New mechanisms and funding limits for applying minor military construction are necessary for responsive T&E activities.
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;
- Offer **flexibility in funding authorities**;
- **Simplify resource allocation, financial management, and acquisition processes** that impede rapid and efficient funding of ranges and infrastructure;
- Ensure **appropriate cost control through a rate board**.
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

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The PDF of the report is available to download at

NAP.edu/26181