Director, Operational Test & Evaluation

Science and Technology Strategic Plan

January 2021

Foreword

I know from personal experience that there are three imperatives in combat: 1) believe in yourself, your fellow warriors, and your training; 2) believe in your mission and commanders; and 3) believe in your equipment and weapons. Operational and live fire test and evaluation (OT&E and LFT&E) focus on this third imperative by providing independent and objective assessments of the equipment and weapons employed by our soldiers, sailors, marines, airmen, and guardians. As the National Defense Strategy notes, "We cannot expect success fighting tomorrow's conflicts with yesterday's weapons or equipment." With our adversaries' technological advances and broad investments, the security environment is increasingly complex. The office of the Director, Operational Test and Evaluation (DOT&E) must keep stride, and we must do this both by modernizing T&E assessment tools, infrastructure, and expertise, and by transforming our T&E concept of operations (CONOPS): the *ways* in which we test, evaluate results, and access technical expertise.

To meet these needs, I present the DOT&E Science and Technology (S&T) Strategic Plan. With this plan, I intend to set the pace for moving OT&E and LFT&E capabilities, processes, and talent into the future. Its framework establishes a vision for success in the key focus areas I have been championing for several years, and includes DOT&E-specific initiatives to advance these goals:

Software and Cybersecurity T&E – The T&E community will modernize assessments of and improve confidence in the operational effectiveness, suitability, and survivability of software intensive systems, with particular attention given to ensuring cybersecurity.

Next-Generation T&E Capabilities – The T&E community will embrace next-generation T&E capabilities to more effectively and efficiently conduct rigorous, operationally realistic T&E of emerging weapons systems that will face increasingly demanding adversarial environments.

Integrated T&E Lifecycle – The T&E community will execute efficient, integrated T&E programs that effectively leverage developmental, operational, and live fire testing across the system lifecycle, while preserving independent evaluations for stakeholder organizations.

Digital Transformation – The T&E community will use integrated digital processes to transform the way we do business, improve acquisition outcomes, and operate at the speed of relevance.

Workforce Expertise and Partnerships – DOT&E and the larger T&E community will have the scientific and technical knowledge, skills, and abilities to achieve their missions.

It is my desire that this strategy will serve as a way to plan collectively for the future as an OT&E/LFT&E team and that it provides a North Star to guide you into the future.

Robert F. Behler
Director, Operational Test & Evaluation

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Introduction: The Need for a DOT&E Science and Technology Strategy

The role of the Director, Operational Test and Evaluation (DOT&E) within the Department of Defense (DoD) is to ensure adequate and systematic test and evaluation (T&E) of warfighting and business systems across a range of realistic operating conditions. DOT&E provides the independent and unvarnished truth about systems' operational capabilities to DoD leaders and to Congress. Operational and live fire test and evaluation (OT&E and LFT&E) determine whether a system is combat-credible, operationally suitable, and survivable. We allow warfighters to believe in their equipment, weapons, and training.

From the DOT&E perspective, the 2018 National Defense Strategy (NDS) mandate for greater lethality and readiness means having the right assessment tools, infrastructure, and processes, as well as sufficient financial and human resources. That, in turn, means transforming the way we conduct testing, evaluate results, and access technical talent.

The T&E community must ensure that OT&E and LFT&E are comprehensive enough to properly assess a system's mission effectiveness, suitability, and survivability in the face of adversarial attacks. Advancements in science and technology (S&T) profoundly impact the Department's mission, affecting how peace is maintained and how conflicts are managed via the introduction of new defensive and offensive capabilities. S&T advancements also afford us the opportunity to improve the T&E methods, tools, and ranges needed for thorough assessments of new capabilities – *if* we think strategically and plan now for S&T insertions. DOT&E intends to set the pace for the T&E community in identifying future T&E needs and how they can be fulfilled by current and future S&T development; and developing a roadmap for bringing those S&T capabilities to the T&E community in an effective, useful, and timely manner.

This strategy provides a framework for addressing key priorities within the context of science and technology, and with the purpose of coordinating and aligning DOT&E's efforts to those priorities.

Strategic Drivers

> *"The security environment is … affected by rapid technological advancements and the changing character of war."*
> *2018 National Defense Strategy, p 3*

National Defense Strategy

The 2018 NDS calls for expanding the competitive battlespace by pursuing a number of goals within three lines of effort:

1. Build a More Lethal Force
2. Strengthen Alliances and Attract New Partners
3. Reform the Department for Greater Performance and Affordability

Within these lines of effort, several goals – in particular *modernize key capabilities; cultivate workforce talent; deliver performance at the speed of relevance*; and *streamline rapid, iterative approaches from*

development to fielding – drive DOT&E's mission. As DOT&E moves to improve, modernize, and transform the way the Department conducts OT&E, the organization continues to use these NDS goals as its foundational guidance.

Science and Technology

S&T advances, in particular transformative, emerging technologies, will drive DOT&E's mission in three ways.

- **Warfighting Capabilities**: With new, advanced warfighting capabilities under development and emerging technologies soon to join the acquisition pipeline, the OT&E community must prepare to test those capabilities in new ways that haven't been considered until recently. For example, we do not have an adequate method for holistically testing space-based technologies in an operational setting without launching them into orbit and subjecting them to simulated threat environments. These limitations stress the DoD's ability to conduct OT&E in an operationally realistic environment, and drive the need to ensure that test ranges, system instrumentation, and T&E methods and processes are adequate to support our OT&E/LFT&E mission with confidence.

- **Adversarial Capabilities and Threats:** Just as our warfighting capabilities advance, so do those of our adversaries. Our adversaries are increasingly integrating emerging technologies into their own warfighting capabilities; the rapid evolution of these capabilities means that our own threat models and simulators must keep pace to ensure that operational testing is conducted against representative and realistically emulated threats. By strengthening DOT&E's partnership and knowledge sharing with the defense intelligence enterprise, the OT&E/LFT&E community will maintain awareness of current adversary capabilities and ensure that realistic "Red Team" threats are integrated into the operational test environment.

- **Tools and Methods:** As S&T advances, DOT&E must harness new capabilities in test design, execution monitoring, and data analysis to improve the effectiveness and efficiency of OT&E and LFT&E. While we continue to make strides in bringing analytical rigor to T&E of traditional weapons systems, there will be challenges from new weapons systems enabled by emerging technologies, such as systems incorporating artificial intelligence (AI) that learn over time. But these same technologies may have the potential to transform our tools and methods, in effect our capabilities and concept of operations (CONOPS), if we stay alert to new S&T trends, and maintain sufficient flexibility to adopt new approaches quickly.

T&E Complexity

Finally, as warfighting capabilities become increasingly complex at the individual platform level (due to exponential increases in software-driven functionality), and as these platforms become increasingly networked by wide-bandwidth multi-link command-and-control systems, operational T&E becomes correspondingly complex. The ability to evaluate these capabilities in their entirety under operationally realistic conditions is difficult. In addition, the integration of emerging technologies into already complex systems further complicates OT&E and LFT&E, as the community looks to ensure testing in a

realistic operating environment against realistic threats while dealing with uncertainty in T&E of novel technologies. Dealing with these levels of complexity, deciding what exactly is the "system under test," and ensuring that T&E is done adequately under increasing fiscal constraints will likely drive a greater reliance on virtual and constructive modeling and simulation (M&S) environments. The T&E community will need to respond by developing methods for not only dealing with M&S-based evaluations, but also with the verification and validation (V&V) of those very systems.

Science and Technology Topics

DOT&E's top S&T areas of interest focus on the challenges and opportunities highlighted above. The table below summarizes them and the strategic framework in the following section presents specific goals and objectives for overcoming these challenges.

Table 1. Challenges and Opportunities within S&T Topics

S&T Topics	Challenges and Opportunities
Advanced Instrumentation Technologies	Advancements in device physics, such as innovative materials, sensor capabilities, time-space-position information for high-speed systems or for systems in GPS-denied environments, and novel power harvesting techniques will enable the next generation of T&E instrumentation technologies. DOT&E is strengthening its partnerships with the developmental T&E community to leverage instrumentation efforts that will benefit operational test as well.
Cyber Science	Cyber Science encompasses the range of cyber engineering, investigation, and diagnostic security. For the T&E community, cyber science is vitally important to ensuring the effectiveness, suitability, survivability, and lethality of weapons systems, which are now designed to be highly dependent on software systems. Having a greater insight into the warfare systems' software enables DOT&E to have an in-depth knowledge of how cyber risks may impact mission capabilities.
Information and Communications Technologies (ICT)	ICT is an umbrella term that includes any communication device, encompassing radio, television, cell phones, computer and network hardware, and satellite systems, as well as their various services and appliances, such as video conferencing and distance learning. IT, the use of computers to store, retrieve, transmit, and manipulate data or *information,* is considered to be a subset of *information* and communications *technology* (ICT).
Data Science	Data Science encompasses the range of disciplines around the collection, manipulation, storage, and analysis of data. The OT&E community sits upon a vast amount of historical weapons systems data that presents the opportunity of not only learning from and informing new programs of record, but also sharing and analyzing T&E data to improve our ability to identify, quantify, prioritize, and estimate DoD system vulnerabilities. Advanced data analytics capabilities of large data sets, in particular, have the potential of reducing T&E cost, time, and operational risk by identifying the highest risks in lethality and survivability during the test design phase, and by accelerating the evaluation phase.

Emerging and Disruptive Technologies	The field of emerging and disruptive technologies encompasses those new, innovative technologies that have the potential to drastically change the way a society, organization, or industry functions. There are several categories of emerging and disruptive technologies; those of particular importance to the operational T&E community include: • *Autonomous Systems and Artificial Intelligence* – Autonomous systems with artificial intelligence are capable of performing automated functions that typically would require human intelligence to complete, and they have the potential to "learn" from their surroundings to improve future performance. These systems provide faster situational awareness, decision making, and precise maneuvers while reducing battlefield troop numbers to keep warfighters safe. The Department is increasingly integrating autonomous systems into warfighting, which presents a T&E challenge when the system may react in different ways, producing different results, during each test run. At the same time, DOT&E has the opportunity to leverage AI capabilities in designing tests and analyzing results. • *Directed Energy* – Directed energy weapons use highly focused energy, such as laser, microwaves, and particle beams to defend against threats with great precision and low collateral damage. These weapons do, however, present challenges to the operational T&E community in that they may require new targets and a way to protect unintended targets such as satellites overhead. • *Hypersonics* – Hypersonic weapons have the ability to travel over five times the speed of sound and offer precision maneuverability, making them harder to track than traditional missiles. From an operational T&E perspective, hypersonic systems will require large test ranges and better instrumentation to ensure an operationally realistic environment and adequate evaluation capabilities. • *Quantum Sciences* – Still an upcoming field of science, quantum computing, quantum sensing, and quantum networks pose both potential threats and opportunities for secure communications; precise position, navigation, and timing capabilities; and advanced analytics. From a T&E perspective, the OT&E community is monitoring progress to understand how to test quantum capabilities, as well as how they might be leveraged to improve OT&E itself. • *Additive Manufacturing* – With the advent of 3D printing, opportunities to reduce production costs for tools and system components mean that systems are increasingly flexible in design with shorter development cycles and maintenance times. Concept models and prototypes can be rapidly produced to test design concepts. From an operational T&E perspective, additive manufacturing drives the need to prepare for operational test more quickly than before, given the potential for shorter development cycles.
Human-System Interaction Science	The Human System Interaction (HSI) field looks at how humans interact with systems, and how those systems are designed to integrate human capabilities, reactions, and limitations. This field is an integral part of the approach to warfighting system development and acquisition. The HSI challenge within the operational T&E community is that if it is overlooked during system design and development, it impedes system effectiveness and suitability. Specific performance and workload metrics, surveys, and interviews are often necessary during OT&E to understand and circumvent problems that may occur.

Modeling and Simulation	The operational T&E community frequently uses M&S when capabilities cannot be fully tested because of cost, risk, or safety. For example, destructive testing can be very expensive especially for sophisticated weapons systems; testing our systems against an inadequate number of near-peer adversary defensive systems runs the risk of an over optimistic assessment of system operational effectiveness; and testing lethal weapons in large scale exercises raises safety issues associated with collateral damage. In these cases, M&S "fills in the gaps" by providing models of almost any aspect of the T&E spectrum: the threats, the environment, the systems undergoing test, and the effects of the threats against the system. One challenge is that to use M&S, we need to trust it. To address that challenge, the OT&E community conducts verification, validation, and accreditation (VV&A) of M&S capabilities used during operational and live fire T&E. However, the VV&A process currently relies on subject matter experts (SMEs) looking at data and making a judgement call. While SMEs are vital to the VV&A process, the OT&E community needs to rely more on quantitative analysis and robust methods to efficiently and effectively conduct the M&S VV&A.

Strategic Vision and Framework

Figure 1 illustrates an overall DOT&E Strategic S&T Framework for addressing the strategic drivers and the S&T challenges and opportunities just described. This framework focuses on five key areas, which are described in greater detail in the remainder of this document.

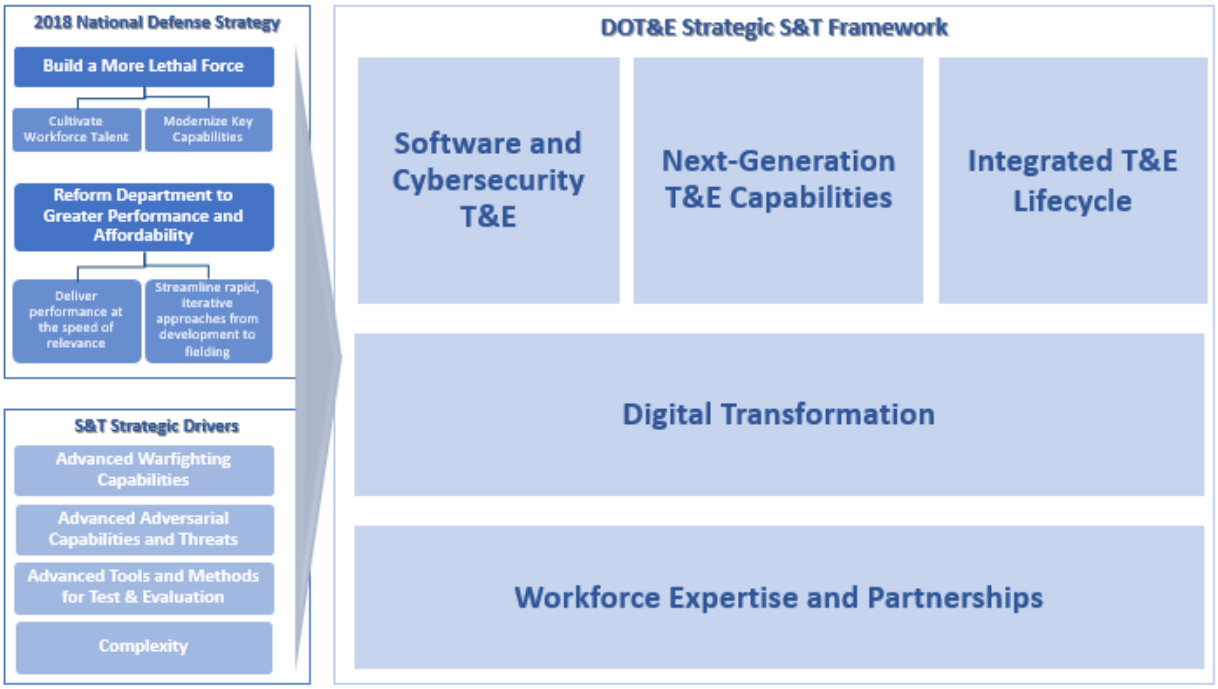

Figure 1. DOT&E's Strategic S&T Framework

Strategic S&T Framework

The S&T framework provides a mechanism to focus the OT&E and LFT&E community, and specifically the DOT&E organization, to work toward addressing S&T challenges across the T&E enterprise. At the enterprise level, the envisioned end states, goals, and objectives are defined for each focus area and provide a guide for the community by describing what is needed to be successful in the focus areas. For DOT&E specifically, key initiatives and activities are identified that state specific actions the organization can take as one stakeholder in the T&E enterprise to work toward the success of each focus area.

Envisioned End States

From the beginning of his tenure, the Director has set a consistent vision for the future of the operational T&E community.

Software and Cybersecurity T&E – The T&E community will modernize assessments of and improve confidence in the operational effectiveness, suitability, and survivability of software intensive systems, with particular attention given to ensuring cybersecurity.

Next-Generation T&E Capabilities – The T&E community will embrace next-generation T&E capabilities to more effectively and efficiently conduct rigorous, operationally realistic T&E of emerging weapons systems that will face increasingly demanding adversarial environments.

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Workforce Expertise and Partnerships – DOT&E and the larger T&E community will have the scientific and technical knowledge, skills, and abilities to achieve their missions.

Goals, Objectives, Key Initiatives, and Activities

The following sections describe the enterprise (or OT&E/LFT&E community)-level goals and objectives within each focus area, in addition to key initiatives and activities identified by DOT&E that can be undertaken over the course of the next 5-year strategic planning cycle to address the focus area goals and objectives. These are taken from the DOT&E organizational perspective and largely require partnerships across stakeholder communities to successfully complete.

Focus Area 1: Software and Cybersecurity T&E

"Software and networks drive the Department's warfighting, training, and business capabilities. Almost every weapon in the warfighter's arsenal is software-defined, and we are likelier to "improve" system lethality by installing new software than by modifying hardware. As always, accurate, trusted, timely information is the discriminator on the battlefield, but now all of it – data, voice, video – traverses a digital medium of some kind. This dependence on software and networks makes cybersecurity T&E

absolutely essential: A system cannot be deemed combat-credible and survivable without understanding its cybersecurity posture."

– DOT&E FY 2019 Annual Report, p i

Focus Area 1. Software and Cyber T&E **Goal**: Increase understanding of and confidence in the operational effectiveness, suitability, and survivability of software intensive systems, with particular attention given to assuring cybersecurity	
Objectives	**DOT&E Key Initiatives and Activities**
1.1 Mission Effects - Improve enumeration of mission effects and operational consequences of potential cybersecurity compromises	*1.1.1 MBCRA* - Embrace mission-based cyber risk assessments (MBCRA). *1.1.2 Emphasis* – Place more emphasis on mitigate, recover, and assessment of operators' tactics, techniques, and procedures (TTPs). *1.1.3 Cyber Parameters* – Increase use of cyber effects as independent variables in OT design matrix for assessing effectiveness and suitability.
1.2 Threat - Improve emulation of cyber threat	*1.2.1 Automated Tools* – Promote automated and semi-automated tools to allow Cyber Testers to focus their skill sets on non-automatable tasks. *1.2.2 Talent Access* – Increase access to premier cyber talent and tools.
1.3 Rigor - Improve engineering rigor in (the art of) cybersecurity testing	*1.3.1 Software and Cybersecurity Tech Watch* – Evolve cybersecurity requirements to keep pace with and reflect new risks (e.g., evolving threats, expansion in attack surfaces) to be considered in cybersecurity testing. *1.3.2 Test Coverage Standards* – Develop standards for, and require the application of, test coverage mechanisms to understand the adequacy with which cybersecurity risks are considered/assessed. *1.3.3 Software & Cyber Technical Baseline* – Develop standards for a software and cybersecurity technical baseline, which is informed by data generated earlier in the acquisition lifecycle, and processes to require its use in assessing the readiness for cybersecurity operational testing.
1.4 Software Cyber Anomalous Detection (SCAD) - Mature processes to continuously test and monitor software systems in operations to contribute to a body of evidence that can be used to manage system configuration to counter vulnerabilities at tactically relevant speeds	*1.4.1 Anomalous Detection Capabilities Requirements* – Better articulate and bolster requirements for software/cyber anomalous detection capabilities. *1.4.2 Anomalous Detection Capabilities Test Emphasis* – Emphasize test of software/cyber anomalous detection capabilities in mitigation requirements.

1.5 Software Goodness-- Improve DOT&E ability to identify and articulate enterprise trends in the operational effectiveness, suitability, and survivability of software intensive and cyber physical systems; be able to answer the question: "How good is your software?"	*1.5.1 Use Cases* – Develop use cases forming basis of decision-making requirements, design visualizations intended to support, and define data required to operationalize. *1.5.2 Strategy* – Develop strategy to support the compilation of necessary data. *1*.5.3 *Prototype the Capability* – Develop pilots to instantiate a variety of use cases, assess utility, and evolve an implementation strategy.

Focus Area 2: Next-Generation T&E Capabilities

"The quality of OT&E and LFT&E depends substantially on the tools and infrastructure available. In particular, we cannot know a system's operational performance – lethality, survivability, suitability to mission – without running it through environments and scenarios that mirror what it would encounter during real-world use." In addition, the "accelerating pace of emergent technologies will challenge T&E in new ways. The DOD has placed a renewed emphasis on advancing the capabilities of weapon systems using a range of new technologies, including hypersonic capabilities, directed energy, autonomy and artificial intelligence, and quantum systems. The T&E community must be prepared to evaluate these new systems and characterize their operational performance across a range of potential concepts of operations."

– DOT&E FY 2018 Annual Report, p ii and DOT&E FY 2019 Annual Report, p ii

Focus Area 2. Next-Generation T&E Capabilities **Goal**: Make use of S&T advances to reduce OT&E/LFT&E cost, time, and operational risk and ensure OT&E/LFT&E is operationally realistic	
Objectives	**DOT&E Key Initiatives and Activities**
2.1 Advancing, Evolving, and Emerging Technology – Prepare the operational T&E community for T&E of advancing, evolving, and emerging technologies	*2.1.1 Tech Watch* – Develop and execute a repeatable, enduring approach to maintain awareness of, analyze T&E challenges associated with, and plan for T&E of advancing, evolving, and emerging technologies (such as AI-enabled systems and hypersonic weapons). *2.1.2 T&E Concepts for Emerging Tech* – Develop T&E concepts and publish guidance for emerging technologies for which existing concepts are not defensible; work closely with the broader T&E community, including the Joint Artificial Intelligence Center (JAIC), to socialize these concepts. *2.1.3 Adversary Use of Emerging Tech* – Advocate and partner with defense intelligence enterprise to ensure understanding of adversaries' ability to use advancing, evolving, and emerging technologies is built into red threat models.

	2.1.4 Training – Refine and adapt existing T&E training material and develop new courses to create a comprehensive curriculum focused on conducting T&E of emerging technologies; create and execute a plan to deliver training to the OT&E and LFT&E communities.
2.2 Realistic Environments – Ensure operational T&E takes place under conditions that represent a realistic operational environment, including both blue and red forces	*2.2.1 Modernization* – Partner with the Test Resource Management Center (TRMC) to modernize test ranges with state-of-the-art test instrumentation to collect critical data on the performance of current and future systems facing the most challenging threats. *2.2.2 Scalable M&S Capabilities* – Convince the DoD to invest in models, simulations, and emulators capable of scaling to accommodate multiple platforms, evolving threats, and cognitive threats. *2.2.3 Guidance for M&S* – Partner with USD(R&E) to establish guidance on the use of models of red and blue forces, environments, and operator behavior for T&E.
2.3 Test and Evaluation Methods – Develop, adopt, and promote methods for rigorous and efficient test design, results analysis, and system evaluation	*2.3.1 M&S VV&A* – Advance and implement methods for M&S verification, validation, and accreditation (VV&A) for situations where live tests are limited or impossible. *2.3.2 System Performance* – Advance and implement test design methods that efficiently characterize system performance across operational conditions and incorporate data from diverse sources. *2.3.3 HSI Evaluations* – Advance and implement methods that produce useful and actionable HSI evaluations across the T&E lifecycle; fully integrate HSI evaluations into test planning. *2.3.4 Accelerated Evaluation* – Advance and implement analytical approaches to improve and accelerate evaluation. *2.3.5 Training* – Refine and adapt existing material and develop new courses to create a comprehensive curriculum in advanced scientific test design and analysis methods; create and execute a plan to deliver training to the OT&E and LFT&E communities.
2.4 Remote T&E – Adopt methods for conducting OT&E via telepresence where applicable and appropriate	*2.4.1 Telepresence Opportunities* – Formalize and evaluate potential telepresence technologies against operational T&E use cases and identify most appropriate opportunities for OT&E telepresence. *2.4.2 Pilot Studies* – Conduct incremental pilot studies to demonstrate feasibility of telepresence technologies.

	2.4.3 Implementation Plan – Develop implementation plan that includes 5-year roadmaps for incorporating telepresence technologies into DOT&E business processes, DOT&E guidance for conducting OT&E with telepresence technologies, identified capabilities to be developed or procured, funding lines, and budget justification narratives. *2.4.4 Communication* – Communicate and socialize need for telepresence technologies with industry to increase awareness of the topic and to encourage industry's development for the DoD's needs.

Focus Area 3: Integrated T&E Lifecycle

"Combined testing encourages developmental and operational testers to collaboratively plan and execute test events whenever possible to support their independent T&E goals and use resources efficiently. By performing operationally representative T&E early and often in the acquisition process, developers will identify performance shortfalls and cyber vulnerabilities when they are significantly cheaper and easier to fix."

– DOT&E FY 2018 Annual Report, p ii

Focus Area 3. Integrated T&E Lifecycle **Goal**: Improve approaches to integrate testing and data collection across the full system lifecycle	
Objectives	**DOT&E Key Initiatives and Activities**
3.1 Shifting Left – Incorporate operationally relevant T&E activities earlier in the acquisition process to identify problems earlier, improve production readiness, and shorten the acquisition timeline	*3.1.1 5000.89 Guidance* – Partner with Developmental Test, Evaluation & Assessment (DTE&A) to create shared guidance on what information is contained in the Integrated Decision Support Key identified in the DoDI 5000.89. *3.1.2 Study* – Review T&E phases across the acquisition cycle, their value added, and the reason for their cost and schedule. Apply a new, mission-based approach to T&E to highlight the differences, risks, and benefits and change T&E plan guidance based on the outcome. Coordinate with Services and T&E stakeholders. Develop efforts to advance data collection and model-test-model efforts to advance the quality, and reduce time/cost to execute certain phases of test. *3.1.3 Integrated Testing Memo* – Partner with USD(R&E) to issue a joint memo on integrated testing that clarifies that: (1) integrated testing focuses on capabilities that affect mission outcomes; (2) both developmental and operational testers should participate in the execution of integrated test activities; (3) test goals should evolve with the maturity of the system and integrated testing should incorporate mission relevance appropriately based on the phase of testing; and (4) all testing

	should be seen on a continuum – where test strategies are sequentially updated and refined based on previous test outcomes. *3.1.4 5000.89 Companion Guide* – Partner with DTE&A to publish a companion guide to the DoDI 5000.89 for planning integrated test events and evaluating systems based on data from integrated test. *3.1.5 Early Involvement and Feedback* – Eliminate requirements that are ill-formed, untestable, or do not support or evaluate the mission of the system under test by working with USD(A&S) and the Joint Staff to become involved early in the requirements development and design phases by attending analysis of alternatives meetings, early requirements meetings, early preliminary design reviews (PDR), and design reviews with vendors. Establish feedback loops that enable DOT&E to communicate and implement OT&E/LFT&E findings into future system design requirements, TTPs, etc. *3.1.6 Post-Fielding Monitoring* – Partner with the T&E Executive Leadership and USD(A&S) to develop mechanisms for monitoring system performance after fielding.
3.2 Integrated Test Design Methodologies – Ensure that programs adopt integrated T&E approaches where individual test events build upon each other and support the data requirements for multiple stakeholders simultaneously	*3.2.1 Method Adaptation* – Adapt Bayesian and sequential methods for test planning, execution, and evaluation to avoid redundancies; encourage programs to implement these methods as part of an efficient test strategy. *3.2.2 HSI Guidance* – Publish guidance on incorporating HSI evaluations throughout a program's testing lifecycle to identify problems prior to IOT&E and promote user acceptance. *3.2.3 Pilot Programs for New Methods* – Work with the Services to identify a set of pilot programs to implement Bayesian and sequential methods and demonstrate their value. *3.2.4 Test Data* – Ensure that programs are collecting, maintaining, and sharing test data in accordance with the DoD Data Strategy to facilitate integrated T&E approaches. *3.2.5 Training* – Develop new training curriculum on sequential methods in T&E; create and execute a plan to deliver training to OT&E and LFT&E communities.

Focus Area 4: Digital Transformation

"The Department needs a strategy that incorporates software testbeds, software and hardware-in-the-loop facilities, anechoic chambers, open-air simulators, threat emulators, effects-based M&S, and open-air facilities. Open-air facilities need the ability to incorporate aspects of the virtual and constructive simulations to improve operational realism and span the full operational environment. As we develop infrastructure, particularly in the cyber and space domains, we must leverage virtual and constructive

test environments … [S]uch an approach would drive the materiel developers to design for survivability to the cyber threat, it would enable a more robust and quantified review of the system vulnerabilities and vulnerability mitigation features, and would enable a more phased or building block approach to survivability evaluation that includes component, sub-system, system, and full-up system-level testing."

– DOT&E FY 2017 Annual Report, p ii-iii

Focus Area 4. Digital Transformation **Goal**: Establish the strategic foundation needed to advance digital engineering in OT&E and LFT&E, enabling streamlined, automated, model-centric OT&E and LFT&E processes	
Objectives	**DOT&E Key Initiatives and Activities**
4.1 Digital Engineering - Use digital technology to transform testing of software-intensive and cyber physical systems in development from linear, serial processes to iterative, incremental processes that build a body of evidence over time usable for operational assessments and evaluations	*4.1.1 OT&E Digital Engineering (DE) Requirements and Business Case - Establish the OT&E requirements for DE processes and infrastructure, and partner with USD(R&E) (Engineering, Policy and Systems (EPS), TRMC) to ensure those requirements are addressed.* *4.1.2 Model-Based and Automated Approaches* – Encourage programs to adopt model-based approaches and/or automated test tools when appropriate. *4.1.3 Data Practices, Intra and Inter* - Support the development of ontologies and taxonomies to enable data exchange and define requirements for authoritative data to support end-to-end digital tool chains, implement common data practices to support data sharing and reuse across the T&E enterprise, and promote reuse of early test data to inform later test designs and evaluations. *4.1.4 Guidance* – Issue relevant OT&E DE guidance (e.g., determining fitness of automated test tools, best practices for using digital engineering in OT&E, lessons learned for using digital engineering in OT&E).
4.2. Full Spectrum Survivability - Institutionalize the adequate assessment of the full spectrum of survivability (comms kill, mobility kill, firepower kill, catastrophic kill) early in LFT&E through rapid provisioning of an adequately representative digital environment and mission-based scenarios	*4.2.1 Use Cases* – Develop use cases that can be used to characterize the functionality of the system; scope and develop early functional requirements. *4.2.2 Strategic Approach* – Partner with right organizations (High Performance Computing Modernization Office (HPCMO), TRMC, Joint Technical Coordination Group for Munitions Effectiveness (JTCG-ME), etc.) to develop strategic approach and roadmap.
4.3. Digital Test and Evaluation Master Plan (TEMP) - Develop a Digital Engineering TEMP, reducing TEMP development time, and increasing	*4.3.1 Strategic Approach* – Partner with DTE&A and TRMC to develop a strategic approach and roadmap toward a DE-based TEMP.

utility of the TEMP through a fully integrated DE processes	*4.3.2 Use Cases* – Develop use cases that can be used to characterize the functionality of the system; scope and develop early functional requirements. *4.3.3 Integration with OSD's Digital Engineering Processes* – Integrate TEMP requirements with Department's digital engineering processes, enabling capabilities identified in roadmap (e.g., digital configuration, requirements continuity from design to delivery, real-time visibility of tasks and deliverables against requirements, model-based assessment of risks, quantified uncertainties using digitally available Major Range Test and Facility Base (MRTFB) and performance data, analytics to determine next best course of action).

Focus Area 5: Workforce Expertise and Partnerships

"…[C]redible T&E requires the right personnel to plan, execute, and analyze the tests. As OTAs [operational test agencies] maintain a skilled workforce through relevant training opportunities, knowledge is needed for systems that incorporate emerging technologies."

– DOT&E FY 2018 Annual Report, p iii

Focus Area 5. Workforce Expertise and Partnerships **Goal**: Deepen and expand in-house scientific and technical expertise and access to technical talent to ensure a workforce that is capable of leveraging S&T advancements to better conduct OT&E and LFT&E	
Objectives	**DOT&E Key Initiatives and Activities**
5.1 Workforce Expertise – Deliver needed in-house expertise and create a pipeline of incoming workforce with the knowledge, skills, and abilities in advanced S&T areas to meet the demands of the future T&E mission	*5.1.1 Workforce Analysis* – Conduct workforce analysis to (1) identify current and future military and civilian personnel skillsets and unique expertise requirements; (2) assess current workforce skillsets and gaps in expertise; (3) identify needed in-house expertise and training to be fulfilled; and (4) develop future hiring and training objectives to fill those needs. *5.1.2 Training Curriculum* – Refine, adapt, and develop new training curriculum in specific technical areas – including cybersecurity, AI, machine learning (ML), data analytics, M&S development, and advanced scientific test design and analysis methods; create and execute plan to deliver training to workforce; ensure DOT&E Action Officer (AO) participation in training opportunities such as Defense and Aerospace Test and Analysis Workshops (DATAWorks). *5.1.3 Rotational and Detail Assignments* – Create additional detailee and rotational assignment opportunities within

	DOT&E to build understanding, awareness, and advocacy of the DOT&E mission with partnership organizations; create plan to communicate, advertise, and recruit staff into these assignments. *5.1.4 Recruitment* – Identify avenues for recruitment of future workforce (e.g., internships, universities, service academies) that builds fundamental awareness of and enthusiasm for working on the challenges faced by the OT&E community.
5.2 SME Partnerships – Build partnerships with and create reachback mechanisms to access SMEs within key universities, research organizations, and industry to fill knowledge gaps for identified technical areas	*5.2.1 Reachback Needs Assessment* – Conduct assessment to identify additional SME reachback expertise needs (e.g., digital engineering, human factors, artificial intelligence); identify sources of that expertise; and create mechanisms (e.g., interagency agreements) to readily access those SMEs. *5.2.2 Partnership Engagement Campaign* – Develop and execute DOT&E-wide coordinated engagement campaign to build fundamental awareness of and enthusiasm within the private sector to work on the challenges faced by the OT&E community.
5.3 Federal and Coalition Partnerships – Cultivate and maintain partnerships with key federal and international partners to share lessons learned, ensure operational assessments fulfill requirements and meet guidance, and leverage mutual areas of interest in T&E investments	*5.3.1 Internal DoD Partners* – Strengthen current partnerships with USD(A&S), USD(R&E), including DTE&A and TRMC, and explore additional/new partnerships that should be formed within the DoD to advance the DOT&E S&T strategic goals. *5.3.2 Defense Intelligence Enterprise* – Through the T&E Threat Resource Activity (TETRA), set up an enduring mechanism that identifies and feeds cross-DOT&E threat model requirements to the defense intelligence enterprise, tracks ongoing work, and collaboratively solves challenges to ensure red threat system models are tailored to T&E needs. *5.3.3 Government Labs* – Identify current DOT&E-funded work within each DoD Service laboratory, Defense Advanced Research Projects Agency (DARPA), and other R&D organizations; identify specific points of contact at each organization; set up recurring meetings to discuss mutual issues, track ongoing work, and feed new requirements to build tools for the OT&E/LFT&E mission. *5.3.4 Federal OT&E Partners* – Explore partnerships with federal partners who have T&E missions to address mutual goals and to exchange lessons learned and best practices in statistical test design and analysis techniques. *5.3.5 Coalition Partners* –Identify opportunities and develop mechanisms to leverage our foreign partners' OT&E ranges; expertise; and advanced tools, methods, and techniques that may advance DOT&E capabilities.

Implementation

The appendix that follows provides recommended key initiatives that encompass DOT&E tactical actions to work toward achieving the outcomes and objectives outlined in the above strategic framework. It is recommended that DOT&E form implementation teams for each priority to lead and execute the key initiatives. A notional timeline for executing these teams includes:

- ***June 2021: Team Stand Up***
  Stand up one or more teams for each Focus Area with representatives that include stakeholders from each DOT&E Deputate, as well as others with equities in the priority. This will require careful communication to stakeholders, including setting the context, benefits, and ultimate impacts of executing the key initiatives.
- ***September 2021: Milestones Developed***
  Each team creates and decides on milestones to be accomplished over the course of 5 years that will enable the OT&E community to work toward achieving the DOT&E S&T Strategic Plan Vision.
- **FY22 1st Quarter: Execution**
  By the first quarter of FY22, teams should begin executing against the key initiatives under each objective.
- ***Monthly 2022 - 2026: Team Meetings***
  Each team should decide on and carry out a regularly occurring meeting schedule that decides on paths and activities to meet milestones, examine progress toward those milestones, discuss issues or challenges, and decide on courses of action to overcome challenges.
- ***Quarterly 2022 - 2026: Leadership Status Reports***
  Each team should meet regularly with DOT&E leadership to provide status updates and receive additional inputs or direction.

Closing

"Testing is the conscience of acquisition."

– Former Secretary of Defense, William Perry

The test and evaluation community holds a critical role in providing operationally relevant and effective combat capability to the warfighter. To ensure that we fulfill this mission and the NDS mandate to deliver more lethal and more resilient capabilities at the "speed of relevance," we must improve, modernize, and transform the way the Department conducts OT&E. Implementing the principles of this strategy enables this by producing actionable information earlier in, and regularly throughout, the acquisition process. By doing so, we will be able to mitigate program risk, enable sound decisions by the acquisition community, and give the commander and the warfighter a full understanding of what capability they have and how best to use it.

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Appendix A. Strategic Framework, Goals, Objectives Overview

Focus Area 1. Software and Cybersecurity T&E Goal: Increase understanding of and confidence in the operational effectiveness, suitability, and survivability of software intensive systems, with particular attention given to assuring cybersecurity	
Enterprise Objectives	**DOT&E Key Initiatives and Activities**
1.1 Mission Effects **-** Improve enumeration of mission effects and operational consequences of potential cybersecurity compromise	**1.1.1 MBCRA** - Embrace mission-based cyber risk assessments (MBCRA). **1.1.2 Emphasis** – Place more emphasis on mitigate, recover, and assessment of operators' TTPs. **1.1.3 Cyber Parameters** – Increase use of cyber effects as independent variables in OT design matrix for assessing effectiveness and suitability.
1.2 Threat **-** Improve emulation of cyber threat	**1.2.1 Automated Tools** – Promote automated and semi-automated tools to allow Cyber Testers to focus their skill sets on non-automatable tasks. **1.2.2 Talent Access** – Increase access to premier cyber talent and tools.
1.3 Rigor **-** Improve engineering rigor in (the art of) cybersecurity testing	**1.3.1 Software and Cybersecurity Tech Watch** – Evolve cybersecurity requirements to keep pace with and reflect new risks (e.g., evolving threats, expansion in attack surfaces) to be considered in cybersecurity testing. **1.3.2 Test Coverage Standards** – Develop standards for, and require the application of, test coverage mechanisms to understand the adequacy with which cybersecurity risks are considered/assessed. **1.3.3 Software & Cyber Technical Baseline** – Develop standards for a software and cybersecurity technical baseline, informed by data generated earlier in the acquisition lifecycle, and processes to require its use in assessing the readiness for cybersecurity operational testing.
1.4 Software Cyber Anomalous Detection (SCAD) **-** Mature processes to continuously test and monitor software systems in operations to contribute to a body of evidence that can be used to manage system configuration to counter vulnerabilities at tactically relevant speeds	**1.4.1 Anomalous Detection Capabilities Requirements** – Better articulate and bolster requirements for software/cyber anomalous detection capabilities. **1.4.2 Anomalous Detection Capabilities Test Emphasis** – Emphasize test of software/cyber anomalous detection capabilities in mitigation requirements.
1.5 Software Goodness-- Improve DOT&E ability to identify and articulate enterprise trends in the operational effectiveness, suitability, and survivability of software intensive and cyber physical systems; be able to answer the question: "How good is your software?"	**1.5.1 Use Cases** – Develop use cases forming basis of decision-making requirements, design visualizations intended to support, and define data required to operationalize. **1.5.2 Strategy** – Develop strategy to support the compilation of necessary data. **1.5.3 Prototype the Capability** – Develop pilots to instantiate a variety of use cases, assess utility, and evolve an implementation strategy.

Focus Area 2. Next-Generation T&E Capabilities Goal: Make use of scientific and technological advancements to reduce OT&E/LFT&E cost, time, and operational risk and ensure OT&E/LFT&E is operationally realistic	
Enterprise Objectives	**DOT&E Key Initiatives and Activities**
2.1 Advancing, Evolving, and Emerging Technology – Prepare the operational T&E community for T&E of advancing, evolving, and emerging technologies	**2.1.1 Tech Watch** – Develop and execute a repeatable, enduring approach to maintain awareness of, analyze T&E challenges associated with, and plan for T&E of advancing, evolving, and emerging technologies (such as AI-enabled systems and hypersonic weapons). **2.1.2 T&E Concepts for Emerging Tech** – Develop T&E concepts and publish guidance for emerging technologies for which existing concepts are not defensible; work closely with the broader T&E community, including the JAIC, to socialize these concepts. **2.1.3 Adversary Use of Emerging Tech** – Advocate and partner with defense intelligence enterprise to ensure understanding of adversaries' ability to use advancing, evolving, and emerging technologies is built into red threat models. **2.1.4 Training** – Refine and adapt existing T&E training material and develop new courses to create a comprehensive curriculum focused on conducting T&E of emerging technologies; create and execute a plan to deliver training to the OT&E and LFT&E communities.
2.2 Realistic Environments – Ensure operational T&E takes place under conditions that represent a realistic operational environment, including both blue and red forces	**2.2.1 Modernization** – Partner with TRMC to modernize test ranges with state-of-the-art test instrumentation to collect critical data on the performance of current and future systems facing the most challenging threats. **2.2.2 Scalable M&S Capabilities** – Convince the DoD to invest in models, simulations, and emulators capable of scaling to accommodate multiple platforms, evolving threats, and cognitive threats. **2.2.3 Guidance for M&S** – Partner with USD(R&E) to establish guidance on the use of models of red and blue forces, environments, and operator behavior for T&E.
2.3 Test and Evaluation Methods – Develop, adopt, and promote methods for rigorous and efficient test design, results analysis, and system evaluation	**2.3.1 M&S VV&A** – Advance and implement methods for M&S VV&A for situations where live tests are limited or impossible. **2.3.2 System Performance** – Advance and implement test design methods that efficiently characterize system performance across operational conditions and incorporate data from diverse sources. **2.3.3 HSI Evaluations** – Advance and implement methods that produce useful and actionable HSI evaluations across the T&E lifecycle; fully integrate HSI evaluations into test planning. **2.3.4 Accelerated Evaluation** – Advance and implement analytical approaches to improve and accelerate evaluation. **2.3.5 Training** – Refine and adapt existing material and develop new courses to create a comprehensive curriculum in advanced scientific test design and analysis methods; create and execute a plan to deliver training to the OT&E and LFT&E communities.
2.4 Remote T&E – Adopt methods for conducting OT&E via telepresence where applicable and appropriate	**2.4.1 Telepresence Opportunities** – Formalize and evaluate potential telepresence technologies against operational T&E use cases and identify most appropriate opportunities for OT&E telepresence. **2.4.2 Pilot Studies** – Conduct incremental pilot studies to demonstrate feasibility of telepresence technologies. **2.4.3 Implementation Plan** – Develop implementation plan that includes 5-year roadmaps for incorporating telepresence technologies into DOT&E business processes, DOT&E guidance for conducting OT&E with telepresence technologies, identified capabilities to be developed or procured, funding lines, and budget justification narratives. **2.4.4 Communication** – Communicate and socialize need for telepresence technologies with industry to increase awareness of the topic and to encourage industry's development for the DoD's needs.

Focus Area 3. Integrated T&E Lifecycle Goal: Improve approaches to integrate testing and data collection across the full system lifecycle	
Enterprise Objectives	**DOT&E Key Initiatives and Activities**
3.1 Shifting Left – Incorporate operationally relevant T&E activities earlier in the acquisition process to identify problems earlier, improve production readiness, and shorten the acquisition timeline	**3.1.1 5000.89 Guidance –** Partner with DTE&A to create shared guidance on what information is contained in the Integrated Decision Support Key identified in the DoDI 5000.89. **3.1.2 Study –** Review T&E phases across the acquisition cycle, their value added, and the reason for their cost and schedule. Apply a new, mission-based approach to T&E to highlight the differences, risks, and benefits and change T&E plan guidance based on the outcome. Coordinate with Services and T&E stakeholders. As per the study, in the first year, develop efforts to advance data collection and model-test-model efforts to advance the quality, and reduce time/cost to execute certain phases of test. **3.1.3 Integrated Testing Memo –** Partner with USD(R&E) to issue a joint memo on integrated testing that clarifies that (1) integrated testing focuses on capabilities that affect mission outcomes; (2) both developmental and operational testers should participate in the execution of integrated test activities; (3) test goals should evolve with the maturity of the system and integrated testing should incorporate mission relevance appropriately based on the phase of testing; and (4) all testing should be seen on a continuum – where test strategies are sequentially updated and refined based on previous test outcomes. **3.1.4 5000.89 Companion Guide –** Partner with DTE&A to publish a companion guide to the DoDI 5000.89 for planning integrated test events and evaluating systems based on data from integrated test. **3.1.5 Early Involvement and Feedback –** Eliminate requirements that are ill-formed, untestable, or do not support or evaluate the mission of the system under test by working with USD(A&S) and the Joint Staff to become involved early in the requirements development and design phases by attending analysis of alternatives meetings, early requirements meetings, early PDRs, and design reviews with vendors. Establish feedback loops that enable DOT&E to communicate and implement OT&E/LFT&E findings into future system design requirements, TTPs, etc. **3.1.6 Post-Fielding Monitoring –** Partner with the T&E Executive Leadership and USD(A&S) to develop mechanisms for monitoring system performance after fielding.
3.2 Integrated Test Design Methodologies – Ensure that programs adopt integrated T&E approaches where individual test events build upon each other and support the data requirements for multiple stakeholders simultaneously	**3.2.1 Method Adaptation** – Adapt Bayesian and sequential methods for test planning, execution, and evaluation to avoid redundancies; encourage programs to implement these methods as part of an efficient test strategy. **3.2.2 HSI Guidance** – Publish guidance on incorporating HSI evaluations throughout a program's testing lifecycle to identify problems prior to IOT&E and promote user acceptance. **3.2.3 Pilot Programs for New Methods** – Work with the services to identify a set of pilot programs to implement Bayesian and sequential methods and demonstrate their value. **3.2.4 Test Data** – Ensure that programs are collecting, maintaining, and sharing test data in accordance with the DoD Data Strategy to facilitate integrated T&E approaches. **3.2.5 Training** – Develop new training curriculum on sequential methods in T&E; create and execute plan to deliver training to OT&E and LFT&E communities.

Focus Area 4. Digital Transformation (Cross-Cutting) Goal: Establish the strategic foundation needed to advance digital engineering in OT&E and LFT&E, enabling streamlined, automated, model-centric OT&E and LFT&E processes	
Enterprise Objectives	**DOT&E Key Initiatives and Activities**
4.1 Digital Engineering - Use digital technology to transform testing of software-intensive and cyber physical systems in development from linear, serial processes to iterative, incremental processes that build a body of evidence over time usable for operational assessments and evaluations	**4.1.1 OT&E Digital Engineering (DE) Requirements and Business Case** - Establish the OT&E requirements for DE processes and infrastructure, and partner with USD(R&E) (EPS, TRMC) to ensure those requirements are addressed. **4.1.2 Model-Based and Automated Approaches** – Encourage programs to adopt model-based approaches and/or automated test tools when appropriate. **4.1.3 Data Practices, Intra and Inter** - Support the development of ontologies and taxonomies to enable data exchange and define requirements for authoritative data to support end-to-end digital tool chains, implement common data practices to support data sharing and reuse across the T&E enterprise, and promote reuse of early test data to inform later test designs and evaluations. **4.1.4 Guidance** – Issue relevant OT&E DE guidance (e.g., determining fitness of automated test tools, best practices for using digital engineering in OT&E, lessons learned for using digital engineering in OT&E).
4.2 Full Spectrum Survivability - Institutionalize the adequate assessment of the full spectrum of survivability (comms kill, mobility kill, firepower kill, catastrophic kill) early in LFT&E through rapid provisioning of an adequately representative digital environment and mission-based scenarios	**4.2.1 Use Cases** – Develop use cases that can be used to characterize the functionality of the system; scope and develop early functional requirements. **4.2.2 Strategic Approach –** Partner with right organizations (HPCMO, TRMC, JTCG-ME, etc.) to develop strategic approach and roadmap.
4.3 Digital TEMP - Develop a Digital Engineering TEMP, reducing development time of the TEMP, and increasing utility of the TEMP through fully integrated DE processes	**4.3.1 Strategic Approach** – Partner with DTE&A and TRMC to develop a strategic approach and roadmap toward a DE-based TEMP. **4.3.2 Use Cases** – Develop use cases that can be used to characterize the functionality of the system; scope and develop early functional requirements. **4.3.3 Integration with OSD's Digital Engineering Processes** – Integrate TEMP requirements with the Department's digital engineering processes, enabling capabilities identified in roadmap (e.g., digital configuration, requirements continuity from design to delivery, real-time visibility of tasks and deliverables against requirements, model-based assessment of risks, quantified uncertainties using digitally available MRTFB and performance data, analytics to determine next best course of action).

Focus Area 5. Workforce Expertise and Partnerships (Cross-Cutting) Goal: Deepen and expand in-house scientific and technical expertise and access to technical talent to ensure a workforce that is capable of leveraging S&T advancements to conduct OT&E and LFT&E	
Enterprise Objectives	**DOT&E Key Initiatives and Activities**
5.1 Workforce Expertise – Deliver needed in-house expertise and create a pipeline of incoming workforce with the knowledge, skills, and abilities in advanced S&T areas to meet the demands of the future T&E mission	**5.1.1 Workforce Analysis** – Conduct workforce analysis to (1) identify current and future military and civilian personnel skillsets and unique expertise requirements; (2) assess current workforce skillsets and gaps in expertise; (3) identify needed in-house expertise and training to be fulfilled; and (4) develop future hiring and training objectives to fill those needs. **5.1.2 Training Curriculum** – Refine, adapt, and develop new training curriculum in specific technical areas – including cybersecurity, AI/ML, data analytics, M&S development, and advanced scientific test design and analysis methods; create and execute plan to deliver training to workforce; ensure DOT&E AO participation in training opportunities such as Defense and Aerospace Test and Analysis Workshops (DATAWorks). **5.1.3 Rotational and Detail Assignments** – Create additional detailee and rotational assignments opportunities within DOT&E to build understanding, awareness, and advocacy of the DOT&E mission with partnership organizations; create plan to communicate, advertise, and recruit staff into these assignments. **5.1.4 Recruitment** – Identify avenues for recruitment of future workforce (e.g., internships, universities, service academies) that builds fundamental awareness of and enthusiasm to work on the challenges faced by the OT&E community.
5.2 SME Partnerships – Build partnerships with and create reachback mechanisms to access SMEs within key universities, research organizations, and industry to fill knowledge gaps for identified technical areas	**5.2.1 Reachback Needs Assessment** – Conduct assessment to identify additional SME reachback expertise needs (e.g., digital engineering, human factors, artificial intelligence); identify sources of that expertise; and create mechanisms (e.g., interagency agreements) to readily access those SMEs. **5.2.2 Partnership Engagement Campaign** – Develop and execute DOT&E-wide coordinated engagement campaign to build fundamental awareness of and enthusiasm within the private sector to work on the challenges faced by the OT&E community.
5.3 Federal and Coalition Partnerships – Cultivate and maintain partnerships with key federal and international partners to share lessons learned, ensure operational assessments fulfill requirements and meet guidance, and leverage mutual areas of interest in T&E investments	**5.3.1 Internal DoD Partners** – Strengthen current partnerships with USD(A&S), USD(R&E), including DTE&A and TRMC, and explore additional/new partnerships that should be formed within the DoD to advance the DOT&E S&T strategic goals. **5.3.2 Defense Intelligence Enterprise** – Through TETRA, set up an enduring mechanism that identifies and feeds cross-DOT&E threat model requirements to the defense intelligence enterprise, tracks ongoing work, and collaboratively solves challenges to ensure red threat system models are tailored to T&E needs. **5.3.3 Government Labs** – Identify current DOT&E-funded work within each DoD Service laboratory, DARPA, and other R&D organizations; identify specific POCs at each organization; set up recurring meetings to discuss mutual issues, track ongoing work, and feed new requirements to build tools for the OT&E/LFT&E mission. **5.3.4 Federal OT&E Partners** – Explore partnerships with federal partners who have T&E missions to address mutual goals and to exchange lessons learned and best practices in statistical test design and analysis techniques. **5.3.5 Coalition Partners** – Identify opportunities and develop mechanisms to leverage our foreign partners' OT&E ranges; expertise; and advanced tools, methods, and techniques that may advance DOT&E capabilities.