<u>**Senate Armed Services Committee**</u>
<u>**Advance Policy Questions for Mr. Douglas Craig Schmidt**</u>
<u>**Nominee for Appointment to be Director of Operational Test and Evaluation**</u>

<u>**Duties and Qualifications**</u>

Section 139 of title 10, U.S. Code establishes the position of the Director of Operational Test and Evaluation in the Department of Defense. The law provides that "[t]he Director shall be appointed without regard to political affiliation and solely on the basis of fitness to perform the duties of the office of Director."

What is your understanding of the duties, functions, and authorities of the Director of Operational Test and Evaluation (DOT&E)?

My understanding is that the Director of Operational Test and Evaluation (DOT&E) is the primary advisor to the Secretary of Defense on operational test and evaluation (OT&E) and live fire test and evaluation (LFT&E). These functions are pivotal within the Defense Acquisition System. It is therefore incumbent upon the DOT&E to ensure comprehensive and methodical planning and execution of OT&E and LFT&E, thereby enabling thorough operational assessments of DoD systems' effectiveness, suitability, survivability, and, when necessary, lethality as they mature across their acquisition lifecycles. Such evaluations are indispensable, offering critical insight to acquisition authorities, strategists, and operators for informed decision-making.

The DOT&E is imbued with the authority to shape policy and furnish guidance for all OT&E and LFT&E across the DoD's acquisition pathways, including sanctioning strategies and plans for systems under its purview. Notably, transitioning to full rate production in major defense acquisition programs is contingent upon the DOT&E's reporting to Congress and the Secretary of Defense. These reports are vital, summarizing independent assessments of testing sufficiency and the systems' operational capabilities in realistic military contexts. Differentiating OT&E and LFT&E from other testing activities involves the utilization of operationally representative environments and threats, alongside trained personnel employing current tactics and procedures.

An additional responsibility includes the submission of the annual DOT&E report to Congress, which describes the fiscal year's OT&E and LFT&E endeavors, outcomes, and challenges encountered. The DOT&E also has a significant role in reviewing and advising on fiscal matters linked to OT&E and LFT&E, identifying and articulating any resource deficits and prioritizing needs essential for conducting thorough evaluations. Understanding that the DOT&E's responsibilities are delineated in Title 10 U.S.C. Sections 139, 4171, and 4172, as well as DoD directives and instructions, I am prepared, if confirmed, to uphold and execute these duties in alignment with legal and policy frameworks to support our defense objectives and overarching national security and military strategies.

What experience and expertise do you have that qualify you for appointment to this position?

My professional involvement with national security spans four decades, marked by extensive work in researching, developing, and testing military systems, including the following:

- In the 1990's I evaluated software product lines for mission computing systems in military fighters, assessing the reliability of avionics and cockpit functions.
- In the 2000's I served as a program manager at the Defense Advanced Research Project Agency and led national efforts on developing, validating, and verifying technologies applied in mission-critical systems, such as the US Navy's total ship computing environments and the US Air Force's time-critical targeting systems.
- In the 2010's I oversaw cybersecurity and software testing initiatives as the Chief Technology Officer at Carnegie Mellon University (CMU)'s Software Engineering Institute (SEI) Federally Funded Research and Development Center (FFRDC), working closely with the United States Air Force as a member of their Scientific Advisory Board to assess the Air Force's cyber situational awareness efforts, as well as aircraft testing and sustainment efforts.
- During the past decade I've continued to work with the CMU/SEI performing independent technical assessments for the United States Missile Defense Agency, Sentinel program, and Long Range Stand Off program.
- Recently, I've led research and development efforts at Vanderbilt University and CMU/SEI focused on responsible application of generative augmented intelligence in automated programming and testing of defense acquisition systems.

What recommendations, if any, do you have for changes in the duties, functions, and authorities of the DOT&E?

Recognizing the Department's commitment to innovation and the pressing need to expedite the delivery of superior technological capabilities to our forces, it is apparent that the current duties, functions, and authorities of DOT&E are based largely on a traditional, hardware-centric acquisition model. However, the contemporary landscape of defense is increasingly defined by software, data, and complex algorithms. This shift necessitates a transformation towards a data-centric approach, underpinning the joint force's lethality, survivability, and agility.

Given the rapid growth in capability, complexity, and connectivity of modern systems, it is essential to evaluate whether the existing responsibilities and authorities of DOT&E are sufficient to fostering innovation within the test and evaluation sphere. If confirmed, my approach would involve collaborative efforts with the DOT&E team, Congressional representatives, the Secretary of Defense, and other crucial stakeholders to critically assess how the test and evaluation enterprise can keep pace with dynamic system development and the operational performance of these systems within joint warfighting constructs.

If confirmed, I will work with the stakeholders listed above to scrutinize the role of OT&E and LFT&E in the context of systems that exhibit dynamic changes throughout their operational life. I would emphasize exploring potential avenues to augment the efficiency of OT&E and LFT&E, particularly through the application of advanced science and technology (such as the effective and responsible use of artificial intelligence, machine learning, and autonomous capabilities) in testing to help assess the extent to which the Department's systems work as expected and needed in modern warfare. These

examinations would also consider how existing duties and authorities may facilitate or impede such advancements. This comprehensive assessment would aim to identify and implement changes that will ensure DOT&E's functions are fully aligned with the demands of 21st-century defense imperatives.

Major Challenges

In your view, what are the major challenges that you would confront, if confirmed, as the DOT&E?

If confirmed as the Director of Operational Test and Evaluation, the major challenges I would confront include the following:

- **Aligning rapid technological advances with comprehensive and robust testing protocols**, such as integrating emerging technologies like generative AI and robust cybersecurity measures within operational testing frameworks to ensure they meet the rigorous demands of current and future warfighting environments. Likewise, implementing the DoD data management strategy across the test and evaluation enterprise to include DOT&E is another challenge that if resolved will enable data analytics and automation needed to accelerate data collection, analysis, and subsequent test planning.

- **Achieving a balance between the expedited deployment of defense systems and their thorough validation**, ensuring that mission effectiveness, suitability, survivability, and, when necessary, lethality are not compromised, which necessitates a nuanced approach to testing that supports both timeliness and thoroughness. I anticipate striking the right balance will be particularly important to improve survivability in contested environments, with particular emphasis on achieving adequate OT&E and LFT&E at scale and speed in contested cyberspace; contested, congested, and constrained electromagnetic spectrum environment; and contested space.

- **Modernizing the testing infrastructure to address the scale and complexity of new threats and capabilities**, such as hypersonics and kill webs. Scalable and adaptive representation of the multi-domain operating environment in test—including operationally representative and relevant targets—is the foundation of OT&E and LFT&E. Meeting this challenge requires continuous attention to stay ahead of the continuously evolving and persistent adversary. Addressing these issues involves overcoming resource constraints, such as test range limitations and the need for updated self-defense test platforms, as well as effectively incorporating OT&E capabilities derived from research and development initiatives (such as those at DARPA, Service labs, and FFRDCs) to better assess DoD systems' capabilities and resilience against sophisticated adversaries.

- **Overcoming organizational inertia and establishing a new paradigm where DOT&E's input is integral from the beginning of programs.** Proactively inserting operational testing considerations into the early stages of requirements definition and system architecture development (i.e., "shifting left") is essential for influencing design choices from the outset, thereby mitigating later-stage integration issues.

However, this proactive engagement may encounter resistance given DOT&E's historical positioning later in system lifecycles. Likewise, I would also expect to confront challenges related to building and fostering an agile and enduring workforce that have skills needed to accurately assess performance throughout DoD system lifecycles, which is essential to achieving the pillars of the DOT&E strategy, as well as the broader test and evaluation enterprise.

If confirmed, what plans do you have for addressing each of these challenges, and on what specific timeline?

Addressing the multi-faceted challenges I described above requires a concerted effort across the Department. If confirmed, my initial six-month agenda includes cultivating robust partnerships within the test and evaluation community, encompassing Service test agencies, acquisition, R&D, requirements, and intelligence sectors. The aim is to not only map out ongoing initiatives targeting these challenges but also to uncover potential new areas for improvement.

These collaborations will be crucial in pinpointing synergies that could amplify and expedite innovation within our operational framework. Concurrently, I plan to establish a structured alliance with the Joint Staff, particularly to confront and prioritize challenges that intersect both testing and training domains. This alliance will facilitate the creation and swift execution of innovative solutions, thereby enhance our testing and training infrastructures, as well as the associated tools, processes, and workforce development.

Engaging with Congressional members and the wider Department is a priority, as it is vital to foster these relationships and partnerships. Our collective efforts will be directed towards dismantling obsolete practices, streamlining processes, fostering integration and innovation, and training a future-ready workforce. This timeline sets a decisive course for addressing the challenges we face with the urgency and collaboration they require.

If confirmed, what broad priorities would you establish and how would you measure progress in achieving these priorities?

If confirmed, based on my experience and current understanding of the acquisition and test and evaluation processes and challenges, my top priorities and measures of success would be:

- **Advancing comprehensive multi-domain testing approaches for modern warfare**. To enhance the representation of joint multi-domain operations in testing environments, I would focus on reinforcing initiatives that facilitate precise simulation of the interconnected battlefield. I would emphasize optimizing OT&E and LFT&E processes to enhance DoD's survivability in contested domains, such as cyberspace, electromagnetic spectrum operations, and space. Progress in this domain can be measured by developing and integrating advanced physical, virtual, and combined/constructive testing capabilities. This comprehensive assessment of testing capabilities will ensure DOT&E's readiness to address the dynamic demands of contemporary combat, thereby increasing the resilience and efficacy of our military systems.

- **Optimizing DoD testing through advances in data management, technology, and training**. I would start by prioritizing the implementation of the Department's data management strategy for T&E needs which include creating and applying digital tools and analytics to refine test planning, execution, analysis, and reporting processes. This effort will support the Acquisition Pathways framework and help ensure that innovative technologies, including autonomous systems, artificial intelligence, and cybersecurity measures, are effectively integrated into both operating and assessing defense systems. In parallel, I would prioritize initiatives related to building, training, and retaining a highly skilled DOT&E and test and evaluation workforce prepared to meet the toughest challenges. Progress would be measured by shortening the cycle from conceptual development to field testing, aiming to cut this duration by a significant percentage.

- **Promoting transparency with Congress and stakeholders**. Transparent reporting of test outcomes is crucial for our nation since it fosters a culture of continuous improvement that reaffirms our Armed Services as the world's preeminent fighting force. I would therefore establish regular, clear, and detailed communications regarding the findings of tests and the statuses of different programs with Congress and other stakeholders.

If confirmed, I would assess the status of any activities related to these priorities. I would also baseline existing processes, define desired end-states, and develop measures and metrics to measure and report on progress against those end-states.

Relations with Congress

If confirmed, what actions would you take to sustain a productive and mutually beneficial relationship between Congress and the DOT&E?

The essence of the Director of Operational Test and Evaluation's role, a position established by Congress, hinges on a synergistic relationship with the Legislative branch. If confirmed, I pledge to maintain a strong commitment to delivering unbiased and prompt assessments on all aspects of Operational Test & Evaluation (OT&E) and Live Fire Test & Evaluation (LFT&E).

My dedication extends to offering impartial and definitive evaluations of OT&E and LFT&E sufficiency, and comprehensive appraisals of the operational effectiveness, suitability, survivability, and lethality of DoD systems throughout their procurement phases. Likewise, I will ensure that evaluations of OT&E and LFT&E resources are grounded in objectivity and provided in a timely manner for both individual acquisition programs and at the departmental level.

Engagement with Congress will be a cornerstone of my position as the Director of Operational Test and Evaluation. I am eager to build relationships with members and staff of the House and Senate Armed Services Committees, the House and Senate Committees on Appropriations, and all other Congressional members. My objective is to establish a clear understanding of expectations and to ensure that DOT&E remains responsive and trustworthy in addressing any concerns or directives from Congress.

If confirmed, specifically how would you leverage your unique and independent access to Congress better to provide technical and program information in support of this Committee's legislative and oversight processes?

The Director's independent access to Congress is a foundational aspect of DOT&E's mission, ensuring that its activities are marked by impartiality and objectivity. If confirmed, I am committed to leveraging this access to forge a strong partnership with this Committee. I will provide transparent, succinct, and robustly substantiated, data-centric evaluations of technical requirements and programmatic endeavors across all systems within my purview. These assessments will be instrumental not only in fulfilling oversight responsibilities but also in facilitating the legislative processes of this Committee.

To facilitate continuous communication, I propose the initiation of regular synchronization meetings with Members of Congress and their staff, subject to their availability. These sessions will serve as platforms for periodic—or on-demand—reviews of technical and programmatic details, along with any other aspects pertinent to OT&E and LFT&E, ensuring that Congress is kept fully informed and engaged.

Independence and Objectivity

Congress established the position of DOT&E as an independent and objective lead for test and evaluation across DOD, including test and evaluation relating to major defense acquisition programs. Section 139 of title 10, U.S. Code, provides that "[t]he Director [of Operational Test and Evaluation] shall consult closely with, but the Director and the Director's staff are independent of, the Under Secretary of Defense for Acquisition and Sustainment, the Under Secretary of Defense for Research and Engineering, and all other officers and entities of the Department of Defense responsible for acquisition."

If confirmed, what specific steps would you take to ensure that your evaluations are wholly independent and objective?

The cornerstone of DOT&E's mission is to uphold independence and objectivity. Recognizing that DOT&E reports directly to the Secretary of Defense while maintaining autonomy from other DoD officials is crucial. If confirmed, I pledge to maintain this independence rigorously, working in consultation but distinctly separate from the Under Secretary of Defense for Acquisition and Sustainment (USD(A&S)), Under Secretary of Defense for Research and Engineering (USD(R&E)), and other acquisition entities within the DoD.

To maintain the integrity and thoroughness of DOT&E's analyses, I will ensure the team possesses the necessary tools and training to independently evaluate a wide array of systems, simulations, and threat models. The competencies of DOT&E personnel will be regularly assessed and updated to meet the evolving demands of independent data examination, including live test data and simulated results. Moreover, I will focus on equipping DOT&E with advanced digital tools that streamline routine tasks, thereby freeing up resources to concentrate on more sophisticated analyses and evaluations. A

commitment to scientific rigor will underpin evaluations of operational effectiveness, suitability, survivability, and, when necessary, lethality, with a continuous drive to enhance efficiency through the use of science and technology.

Data integrity and evidence-based assessment will be the foundation of all conclusions drawn, employing established data analysis methods while remaining open to diverse interpretations to ensure the robustness of our assessments. Every finding will be the product of meticulous analysis, untainted by bias and reflective of the true performance observed.

If confirmed, what specific steps would you take to ensure that the assessments of major defense acquisition programs you provide to Congress are candid and complete?

If confirmed, my focus will be on upholding the thoroughness and transparency of OT&E and LFT&E, facilitating assessments that are both candid and comprehensive. I will take measures to ensure that the testing strategies and plans are robust enough to yield data that supports sound and operationally significant evaluations. For instance, I will incorporate the most current intelligence to ensure that OT&E and LFT&E are performed in conditions that accurately reflect operational environments, encompassing the range of both kinetic and non-kinetic threats. Utilizing early testing phases conducted by contractors and during development will be key to achieving the independent objectives of OT&E and LFT&E.

In addition, I will equip DOT&E with the capabilities to promptly process and scrutinize vast datasets across various levels of classification, including conducting stringent, scientifically grounded analyses of the verification and validation plans for modeling and simulation. I will also ensure that the gathered information undergoes a detailed analysis, accounting for all underlying assumptions and potential limitations within the test parameters. These considerations will be communicated transparently in the final evaluations.

My approach to presenting these assessments to Congress will be driven by the evidence. I will ensure that commendable performance does not overshadow any identified deficiencies, and likewise, that the limitations do not diminish recognized strengths. My commitment is to provide balanced, impartial, and comprehensive evaluations that reflect the full scope of the findings from rigorous OT&E and LFT&E processes.

Section 2399 of title 10, U.S. Code, establishes certain requirements regarding the impartiality of contractor testing personnel and contracted-for advisory and assistance services used with regard to the test and evaluation of a system.

If confirmed, how would you ensure the independence and impartiality of contractor testing personnel and contracted advisory and assistance services, including when employing personnel from Federally Funded Research and Development Centers (FFRDCs)?

If confirmed, I am committed to sustaining the independence and impartiality of all contractor personnel involved in advisory and assistance services for DOT&E, especially regarding OT&E and LFT&E. I will rigorously enforce a policy where DOT&E does not engage contractors who have had—or currently have—a role in developing, producing, or testing any system under review for any military department, Defense Agency, or other DoD contractors.

Collaboration with the Department of Defense Inspector General will be essential to verify that comprehensive measures are in place to ensure contractor neutrality. Moreover, I will mandate that DOT&E contracts include robust organizational conflict of interest clauses, complete with effective mitigation strategies, as appropriate. These clauses will ensure that contractors and their subcontractors remain detached from any developmental activities of systems they may subsequently evaluate as part of DOT&E's Title 10 obligations. I will also reinforce the protocol where DOT&E's civilian workforce rigorously examines and validates all activities and outputs delivered by contractors, thereby preserving the integrity and objectivity of our evaluations and recommendations.

Operational Testing Issues

If confirmed, how would you manage disagreements with other elements of the Office of the Secretary of Defense and/or the Military Departments and Services, that seek to progress or approve programs, notwithstanding the results of operational testing that suggests further development, testing, or technical and engineering work is required?

If confirmed, I would respectfully address any disagreements with evidence-based and data-driven arguments. I understand that DOT&E reports directly to the Secretary of Defense without obtaining approval or concurrence of any other official within the DoD. If confirmed, I will consult closely with—but my staff and I will be independent of—the USD(A&S), USD(R&E), and all other officers and entities of the DoD responsible for acquisition. To avoid or mitigate the effect of the disagreements, I would communicate and coordinate early and frequently to align on expectations and will use OT&E and LFT&E to characterize risk to the acquisition program, the warfighter and DoD operations.

If confirmed, I will always ensure my expectations and findings are based on data and rigorous analysis and are taken into the context of joint warfighting concepts, operational plans, concept of employment, concept of operations, kills webs, mission threads and other joint force tasks. Likewise, if confirmed, I will forthrightly provide assessments of all covered systems in support of major acquisition and other program decisions. I will be transparent and will ensure that my findings are timely and defensible. These assessments will always be independent and reflect my evaluation of the data revealed by testing. I will ensure that other elements of OSD and/or the Military Departments and Services fully understand the underlying data and analyses that led to my conclusions. If disagreements arise, I will listen to all counterpoints to ensure the quality and strength of my conclusions.

In your view, to what extent should the DOT&E evaluate system capabilities and testing results to verify formal requirements established in a program? Please explain your answer.

Formal requirements established in a program are necessary as they focus system development, influence program decisions, and provide contractual specifications. While DOT&E serves as an advisor to the Joint Requirements Oversight Council on matters within DOT&E authority and expertise, if confirmed, I would look for opportunities to actively engage the OT&E and LFT&E community in the development of program requirements to ensure program requirements are measurable, testable, justifiable, achievable, and relevant to the operational mission. Some flexibility also needs to be offered in requirement updates in the context of the very dynamically changing operating environments.

If confirmed, I would have a healthy respect for the program requirements and would ensure OT&E and LFT&E is planned and executed to enable the evaluation of the ability of the program to meet its requirements. I would also ensure OT&E and LFT&E is planned and executed to enable the evaluation of operational effectiveness, suitability, survivability, and lethality (as applicable) of the DoD system in its operationally relevant and expected environments. This evaluation would include the current and emerging threats and targets even if those do not align with the stated requirements but are expected in planned military operations.

In your view, when evaluating system capabilities and testing results for new system, to what extent should the DOT&E consider the capabilities of deployed, legacy systems that the system undergoing testing is designed to replace? Please explain your answer.

I understand that the acquisition system is designed to acquire products and services that satisfy user needs with *measurable (and timely) improvements* to mission capability, materiel readiness, and operational support. In my view, to measure such improvements DOT&E would have to consider the baseline capabilities related to the deployed, legacy systems that the system undergoing testing is intended to replace and improve.

To meet the acquisition system intent, if confirmed, I would consider the capabilities of deployed legacy systems to enable the evaluation of measurable improvements of the system undergoing testing and its ability to improve mission capability, materiel readiness, and operational support, as applicable. This comparison may also provide additional perspectives to the acquisition decision authorities.

In your view, to what extent should the DOT&E evaluate system capabilities and testing results against known or expected threats the system will face across its lifetime while in operational use?

Evaluating DoD systems in an operationally representative environment which includes current and emerging adversary threats and targets—represented in capability, scale, and density—while also considering the adversary tactics/techniques/procedures is the hallmark of OT&E and LFT&E and the foundation of the combat credibility of DOT&E's

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evaluations. OT&E and LFT&E must use the latest intelligence community knowledge and must be conducted in operationally representative and relevant, multi-domain environments that include the full spectrum of kinetic and non-kinetic threats and targets, as applicable, within the program's expected life cycle. These include but are not limited to kinetic, cyber, electromagnetic spectrum, including directed energy weapons, and chemical, biological, radiological, and nuclear threats, and other operationally relevant kinetic and non-kinetic threats and targets.

Recreating a fully realistic threat environment is often not practical, and in those cases, evaluation must include accredited modeling and simulations tools, anchored by live test events. Striking the right balance between synthetic environments and range testing speaks to the critical relationship that DOT&E must maintain with the Defense Intelligence Agency to ensure OT&E and LFT&E is equipped with foreign materiel, threat, and target surrogates to include their digital representations tailored to the unique OT&E and LFT&E requirements.

In your view, how should the DOD design testing environments to mirror perceived denied and degraded environments? What benefit would such testing design yield the testing and evaluation (T&E) process?

A DoD testing environment that mirrors perceived and degraded environment is critical to the DOT&E mission and the ability to evaluate operational performance and readiness in combat representative conditions. The DoD testing environment should include state-of-the-art physical facilities including modernized open-air infrastructure as well as virtual facilities, tools and equipment needed for OT&E, LFT&E, and even training, and mission planning. Such testing environment should be designed to enable interconnected, interoperable network of ranges with geographically distributed live, virtual, and constructive systems capable of evaluating system interoperability, multi-domain kill chains, and emerging technologies in realistic environments. The design should support dynamic upgrades to threats and targets to keep pace with the advanced and persistent threat. The design of the test environment should support the adequacy of T&E processes positioned to enable rapid development and delivery of capability to the warfighter.

In your view, what information must DOT&E have access to in order to support testing, and who is (and should be) responsible for obtaining and maintaining access to that information?

I understand that DOT&E must have access to all records and data in the DoD (including the records and data of each military department) that DOT&E considers necessary to review to carry out the DOT&E duties established by the law. Examples include but are not limited to program artifacts such as system design data, requirements data and their rationale, concepts of operations and concepts of employment data, acquisition strategy data to adequately plan the tests needed to support those decisions. DOT&E also needs access to data that may affect the test and evaluation program, such as test and evaluation resource shortfalls, test asset or test range limitations, and known system design deficiencies and vulnerabilities.

To ensure T&E program efficiency, DOT&E should have access to all test data () and information that would help scope the next testing phase. DOT&E also must have access to the assessed accuracy, limitations, and assumptions associated with any modeling and simulation tools that are used to evaluate weapon system performance. DOT&E should receive all raw artifacts and processed data as soon as they are collected to start independent data analysis, and to inform all decisions in a timely fashion. The program office, test organizations, test ranges, and model managers are collectively responsible for maintaining access to these data although ongoing data management efforts may further finalize data ownership and management processes.

If confirmed, what specific steps would you take to encourage information sharing among testing communities, program offices, and contractors?

If confirmed, I will advocate for the implementation of a test and evaluation data management strategy at both a test and evaluation enterprise level and at an acquisition program level to make all test and evaluation data and program artifacts including digital engineering models and related data visible, accessible, understandable, linked, trusted, interoperable, and secure. Datasets, including classified and proprietary, and process flow should be promptly accessible to cleared and need-to-know stakeholders as soon as the data become available. Information should be accessible over networks in open and interoperable formats, such as commonly available databases with networked application programming interfaces to those who have been properly authorized access. Data may be preliminary and will be identified as such. Data pedigree will also be transparent.

In your view, what is mission engineering and in what ways does it impact the T&E process, if any?

In my view, mission engineering is an interdisciplinary process encompassing the entire technical effort to analyze, design, and integrate current and emerging operational needs and capabilities to achieve desired mission outcomes. Mission engineering decomposes missions into constituent parts to identify gaps, issues, and opportunities, to inform decisions regarding requirements, architectures, and technologies needed to achieve strategic and tactical mission objectives defined by the Combatant Commands. Mission engineering brings the advantage of understanding the operational performance of the Joint Force vice an individually acquired system or service.

OT&E and LFT&E have the potential to improve mission engineering and accelerate development and use of joint warfighting concepts, by providing operationally relevant data about mission outcomes back into the mission engineering process. OT&E and LFT&E are best positioned to inform mission engineering when OT&E and LFT&E become better integrated in systems development to learn about systems' capabilities and how those capabilities support mission outcomes. Industry has embraced getting feedback from operations to improve their delivered products (to include hardware-based systems). Moreover, operational feedback can be used to better define and interpret requirements in the context of operational mission outcomes and even update requirements as missions and threats evolve.

Interoperability remains a challenge for the DOD with a litany of systems fields over the last several decades fielded not designed to communicate within its own service, let alone the Joint Force.

If confirmed, how would you plan to construct test environments to ensure interoperability of command and control systems for the Joint force?

Combat brings multiple warfighting systems together to gain battlefield superiority. Testing new DoD technologies together—as they would be used by the Joint Force—in the combat representative conditions is needed to replicate this reality and ensure system-of-system interoperability. Interoperability evaluation of networked systems must address both the ability of hardware, software, and network to exchange data, but also include doctrine, tactics and training necessary to ensure users can accomplish their mission.

If confirmed, I will review the data architecture for range infrastructure to identify and address data sharing, access, and integration gaps. I will consider the advantages of deploying advanced computing tools like machine learning and cloud computing to facilitate system-of-system testing. I will also team up with the operational test agencies, particularly the Joint Interoperability Test Command, allies, partners and DoD's joint test programs to review the existing system-of-system capabilities and interoperability test standards to provide a more detailed plan to construct test environments to ensure interoperability of command and control systems for the Joint Force.

What is the DOT&E role in the Department's CJADC2 development?

I understand that DOT&E is currently closely monitoring the development of CJADC2 capabilities and is placing elements of them on the T&E Oversight List. I also understand that DOT&E has been developing joint test concepts to identify the test and evaluation infrastructure, tools, methods, and processes required to support the OT&E and LFT&E of such complex concepts and systems.

If confirmed, I would continue to monitor the development of CJADC2 capabilities, with the goal of ensuring that adequate OT&E and LFT&E is planned and executed to enable credible evaluation of those capabilities in operationally relevant environments.

In your view, does DOT&E need to modernize or reform its approach to planning for, executing, and assessing weapons system operational effectiveness, operational suitability, survivability, and interoperability? If so, in what areas are reforms most needed?

I believe that DOT&E needs to modernize, innovate, and in some cases, reform its approach to T&E planning, execution, and data analysis to allow for increased flexibility and agility without compromising the credibility of the evaluations. I believe that a T&E reform will be necessary given the development of increasingly complex weapon systems that are highly interconnected and adaptive, and the rising complexities of the multi-domain operational environment that changes rapidly in both space and time. The use of the latest advances in science and technology should be leveraged to supply

credible digital environments and digital models to balance the physical testing with virtual testing required in many cases to support OT&E and LFT&E.

Moreover, data architectures to store, share, and improve the way OT&E and LFT&E captures and analyzes the volumes of data are needed to enable more dynamic test, analysis, and smart reporting. In addition, adequate OT&E and LFT&E of software intensive systems will be dependent on the ability of OT&E and LFT&E to support the software development cadence. In addition, AI-enabled systems will require OT&E and LFT&E throughout operations and sustainment to evaluate any drift in performance and changes in survivability.

Cyber T&E needs innovative tools to improve efficiency, operational realism, and to meet the exponentially growing demand for such testing. These points all lead to a need to examine the way we train and prepare our T&E workforce for the future, to infuse new techniques and training that will be required to implement these reforms.

In your view, what additional test and evaluation (T&E) initiatives would best position DOT&E to support digital transformation and modernization of warfighting capabilities and concepts in multi-domain environments? What resources would be required to effectuate these initiatives?

Digital transformation and modernization of warfighting capabilities and concepts in multi-domain environments require enterprise-level solutions and coordination across USD(R&E), USD(A&S), the Intelligence Community, the Services, the Joint Staff, and Combatant Commanders. If confirmed, I will seek to coordinate an effort to identify the requirements and resources needed to develop an adequate representation of the multi-domain operational environment, which will depend on the adequacy of the virtual environment and digital twins of our systems, their interoperability, and expected threats.

If confirmed, I will also evaluate the development and credibility of digital twins and the feasibility of requiring digital twins early in an acquisition program to inform T&E plans and reduce overall risk. I will also evaluate the required verification, validation, and accreditation process to support the intended use of digital twins in OT&E and LFT&E. I will work with USD(R&E) to build upon their digital engineering initiatives, to include the development of a digital ecosystem and the data architectures needed to adequately store, access, and then analyze T&E data, the management of which is critical to the transformation of T&E efforts. Likewise, I will review any ongoing initiatives to provide a more detailed course of action that also includes the estimate of required resources.

Test and Evaluation for Complex Emerging Technologies

Emerging technologies, like artificial intelligence (AI), autonomy and quantum-enabled systems, are likely to pose challenges to DOD processes and capabilities for operational test and evaluation.

What shortfalls or challenges, if any, do you foresee in DOD capabilities (including funding, test infrastructure, manpower, and processes) for test and evaluation of systems and application that leverage artificial intelligence?

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The following are some unique shortfalls or challenges I foresee spanning the development, system integration, and long-term sustainability of AI-enabled systems:

- **Data ecosystem challenges**. One challenge is related to data and ensuring a secure, rich, and well managed data ecosystem, as well as a well-established risk evaluation method that pertains to that data.

- **AI performance characterization**. Another challenge may be related to characterizing the AI model performance, critical to the evaluation of operational performance warranting a selection of operationally meaningul performance metrics and test data. Some form of Live Virtual Construct (LVC) may also be required to test the AI model within an integrated or partially integrated system as well as human-system interaction of the AI-enabled system in nearly real operational conditions. Integration of AI models into systems to achieve desired operational outcomes needs OT&E and LFT&E to evaluate the AI solution within the system or workflow in the intended operational environment and with representative users.

- **AI longevity and sustainment**. I also foresee challenges with needing to OT&E and LFT&E the AI model's longevity as part of an overal sustainment plan, highlighting the strategies to monitor performance and setting the stage for periodic recalibration and assessment, and, ultimately, retirement and (possible) replacement of the AI model.

- **Test infrastructure and workforce**. Challenges may also exist with the test infrastructure and trained workforce to understand how to produce appropriate test inputs into those AI systems, and how to evaluate the output from the AI systems, all in an operationally realistic combat environment.

In your view, how will DOTE help test AI systems for responsible behavior?

If confirmed, I will support any ongoing efforts and initiate new ones, as required, to support the development and demonstration of quantitative ethical benchmarks and a responsible autonomy framework. This will require meaningful developmental and operational testable metrics representative of military operational values in accordance with DoD AI ethical principles and international humanitarian law.

If confirmed, I will also support ongoing initiatives and start new ones, as required, to decompose the five responsible AI principles into autonomy readiness levels, which may include development of processes and tools to test and certify autonomous weapon systems, rapid scenario development and evaluation tools, and reduced order data/test planning. This may also include the development of generative environments to be anchored by live data collections. If properly designed, such test tools will illuminate how the AI system interacts with its human user, and whether those interactions result in appropriate, responsible outcomes under combat conditions.

In addition, if confirmed, I will coordinate with the technical community, ethical/legal/societal experts, and military operators to converge on potential solutions to help test AI systems for responsible behavior.

How should the Department consider the T&E of AI systems to characterize complex or emergent behavior based on the continuous influence of new and interacting data? How will T&E evaluate changing behavior in such systems, including hallucinations or the effects of attempts to disrupt such systems through data poisoning or adversarial AI attacks?

Data driven systems, including AI systems, are only as good as the quality of the data. Ability to gather and consolidate large data volumes with different formats and protocols have long been challenges for data driven systems and will continue to be challenges. Data can be corrupted by adverse actions, but it can also become not usable simply because data are not kept up to date. Thus, an operational evaluation of data centric systems must include a plan to examine the adequacy of database and the processes, technologies, and personnel used to protect the database, detect anomalies, mitigate those anomalies, and restore the database as needed. This database should include the data collected during systems operations and sustainment.

As AI-enabled systems enter the field, a form of operational effectiveness, suitability, and survivability assessments will need to be established to monitor the user's trust in the AI and any changes in systems' behavior. Such assessment should include data poisoning and be based on adversarial AI attack techniques, tactics, and procedures to adequately prevent, mitigate, and recover from these attacks in operations.

In your opinion, how should the Department consider infrastructure and capability investments to ensure it is positioned to test systems when they become available?

The DoD has an array of test and training ranges and capabilities managed, funded, and operated by different stakeholders. To enable efficient and structured modernization and sustainment of existing range capabilities while also transforming the ranges to meet the demands of the future, it is important to have an accurate and common picture of existing and required, future range capabilities including the status of required capabilities (e.g., a clear understanding into who will deliver the capability, when, and in accordance with what requirements). It will be equally important to ensure this common picture is digitized, and transparent to key acquisition and, test and evaluation, training, and intelligence community stakeholders to enable collaboration in developing joint/interoperable solutions, avoiding redundancies while increasing capability delivery and efficiencies.

If confirmed, I will evaluate the efficiency of the existing processes and provide data-backed recommendations for ensuring infrastructure and capability investments are positioned to enable the testing of systems, in the most efficient and effective means feasible, when they become available.

What capabilities does the Department have in place to systematically evaluate commercially available systems to help inform commercial purchases (such as

5G/6G systems) or adoption of commercial technologies that do not require additional development?

I understand that the DoD may not currently have adequate processes to systematically evaluate "off the shelf" commercial technologies that do not require additional development. Commercial technology that works fine for commercial purposes may not necessarily work on the battlefield. If confirmed, I will advocate that critical commercial technologies assessed to potentially affect the warfighter and DoD operations complete adequate OT&E and LFT&E so the DoD can accurately assess any risks of their use in combat.

In your opinion, what process changes should DOD consider to be better prepared to test and evaluate some of these emerging technologies?

I understand that DOT&E has well-established processes for evaluating the operational performance of complex systems in operationally representative environments. If confirmed, I will conduct a review of any acquisition and test and evaluation processes related to systems using emerging technologies for warfighter and DoD operations. If confirmed, I will advocate for modernized test infrastructure, including synthetic test environments, needed to evaluate the operational performance of such technologies efficiently and comprehensively in a combat-relevant environment. I will coordinate my recommendation with USD(A&S) and other key stakeholders.

Test and Evaluation Funding

Concern over long-term support for and viability of the Department of Defense's test ranges and facilities led to the creation of the Defense Test Resource Management Center in 2002, as well as a requirement for direct funding of T&E facilities. Yet, almost 20 years later, concerns about test ranges and facilities remain.

Do you believe that the Department's T&E capabilities, including infrastructure and workforce, are adequately funded? Please explain your answer.

I understand that both Congress and the DoD have made some significant investment in the last few years to address the shortfalls associated with T&E infrastructure and workforce. I also understand that the challenges related to test infrastructure and workforce are complex and are continuously growing due to persistent advancement of adversaries' capabilities. I understand that some challenges likely remain in the ability of the DoD to replicate the adversary threat and targets—in terms of capability, density, and timely upgrades. I understand that building, sustaining, and accrediting virtual environments and digital tools to supplement live or physical infrastructure is a complex challenge that will require continuous enhancement, accreditation, and modernization. These investments include implementation and sustainment of big data centers, data management infrastructure, and appropriate classified networks and workstations in sensitive compartmented information facilities.

Updates to physical ranges, threats, instrumentation, and connectivity may also remain necessary to represent the realistic threat laydown, enable system of system testing,

interoperability, and testing of emerging technologies such as directed energy weapons, hypersonic, space-based systems and similar. Development of automation test tools including those for software, cyber, AI and integrated T&E has likely not yet been fully resolved. In addition, a qualified workforce including personnel with expertise in digital engineering, software, electronic warfare, AI, big data science, space operations, will likely persist as the DoD continues to compete with industry for this same talent.

If confirmed, I will establish a process for developing, prioritizing, and tracking data-based requirements for the test infrastructure and workforce and will work with DoD stakeholders to develop data-based, investment recommendations.

Do you believe that the Department's current T&E capabilities in the aggregate, including infrastructure and workforce, are adequate to perform the full range of test and evaluation responsibilities of Department weapons systems and equipment?

If confirmed, I will review and assess the adequacy of Department's current T&E capabilities in the aggregate and the ability to perform the full range of T&E responsibilities of the Department weapons systems and equipment. Based on my current understanding, it seems that additional investments may be needed to support efficient and scalable testing of networked sensor-to-shooter kill chains. Availability of accurate test surrogates across all domains to enable testing against operationally representative threat and targets still appear to be challenges. These challenges include contested, congested, and constrained electromagnetic spectrum operations, contested cyberspace, space, air sea, land domains affecting OT&E and LFT&E of air warfare, naval warfare, land warfare, net-centric, and space warfare systems. Dynamic and efficient testing of networks and system of system events also appear to remain a challenge.

If confirmed, I will also work with the Test Resource Management Center and the Service T&E executives on the identification, prioritization, tracking, and funding of test infrastructure capabilities in support of current and emerging OT&E and LFT&E events.

In your view, how effective has DOD been in accurately projecting future test facility resource requirements and budgeting for these needs? How would you improve these processes, if confirmed?

In my view, accurately projecting future test facility resource requirements and budgeting for these needs is essential to conducting adequate OT&E and LFT&E, and determining combat credible operational effectiveness, suitability, survivability, and lethality. If confirmed, I will collaborate with USD(R&E), the Director of Cost Assessment and Program Evaluation (CAPE), and the Service T&E executives to review the current processes established to project future facility resource requirements and budget for these needs.

If confirmed, I would also at a minimum establish a data management plan that increases transparency in existing capabilities and ongoing initiatives across all key stakeholders intended to close identified gaps. In addition, I would review and refine, if needed, the process that identifies and prioritizes the 'range of the future' requirements

as compared to existing and emerging OT&E and LFT&E needs, and critical technology areas identified in the National Defense Strategy.

If confirmed, how would the sufficiency of investments in test resources and the workforce factor into your review and approval of proposed test plans and schedules for acquisition programs?

If confirmed, I will factor the sufficiency of investments in test resources and workforce in determining the adequacy of test and evaluation master plans, strategies, and test plans. If confirmed, I will ensure that test resources are requirements are identified as early as feasible to support investment and development where required, and advocate for necessary funding. In coordination with CAPE, I will annually assess the adequacy of available T&E resources and workforce to execute OT&E and LFT&E actions across the Future Years Defense Program. I will inform senior DoD leadership and Congress of any test resource and workforce shortfalls.

In your view, should adjustments be made in the regulations and policies that govern the allocation of testing costs to test customers?

In my view, existing regulations and policies have been in place for many years and a review is warranted to accurately establish how test costs are allocated to customers, and whether the policies and funding processes the Services are required to use are still the most effective and efficient ways to support T&E. Piloting new process and authorities to make them simpler, more responsive, and more effective might be worth considering. I also understand that the National Academies of Sciences, Engineering, and Medicine (NASEM) independently reviewed the adequacy of DoD test ranges and capabilities.

If confirmed, I would seek to understand the recommendations made by NASEM in this report, conduct additional analyses, as required, and make all appropriate recommendations to the Secretary and this Congress on any potential revisions to existing regulations and policies that would promote more efficient and thorough OT&E and LFT&E.

Data

If confirmed, what initiatives would you undertake to ensure that the Department of Defense collects, maintains, and provides appropriate access to appropriate personnel for all relevant data derived from the development, testing, and operational use of systems and platforms to support acquisition, testing, and operations?

If confirmed, I will support any ongoing initiates or start new ones, as appropriate, to ensure DOT&E and the T&E community have an adequate and executable plan to meet the intent of the DoD Data Management Strategy. As the Department transforms digitally, we must make data visible (so we can easily locate it), accessible (so we can retrieve it when needed), traceable (so we can link conclusions to data sources), secure (so we can rely on it) and integrated (so we can track our performance and collaborate). Having acquisition program artifacts and all test and modeling and simulation results

accessible and in a consumable format allows them to be more effectively utilized to inform the evaluation of operational performance at all stages of the acquisition life cycle.

If confirmed, I would also support the development and implementation of advanced analytics capabilities for large data sets to further enhance OT&E and LFT&E. If confirmed, I will work in partnership with USD(A&S), CDAO, and CIO, to ensure that DOT&E is both able to consume and provide data associated with T&E to support my role in informing other senior decision-making activities.

For new AI systems, the data going into training the systems will be critical to achieving consistency of outcomes, and to ensuring behavior for such systems can be properly characterized and consistently enforced. In your opinion, how should DOT&E be evaluating the data going into testing, as well as the resulting data as an output of the process?

In my opinion, data evaluation should be a critical element of OT&E and LFT&E of AI enabled systems – given their significant reliance on data. Data ingestion, curation, normalization, and data quality processes ensure the reliable and accurate capture, organization, accessibility, and integrity of data. Data ingestion enables movement of data across different environments, ensuring no data quality deterioration while maintaining timeliness. Data curation involves the collection, structuring, indexing, and cataloging of data that ensure the availability, accessibility, and usability of data including testers. Data normalization ensures that data are represented consistently across different systems or different subsystems enabling interoperability, and facilitating reliable decision-making based on the data. Data quality is critical to ensuring that the data used for decision-making and system operation is accurate, reliable, and complete. Data quality involves establishing rules, criteria, and standards to assess the adequacy and completeness of the data. Machine Learning (ML) techniques can also be utilized to enhance data quality and enrichment, leveraging algorithms to detect and correct anomalies, outliers, or errors in the data. Automation should also be in consideration for data quality to ensure efficiency. Testers need an understanding of data quality to inform areas of risk for assessment. Data security practices are necessary for ensuring data quality.

In my opinion, DOT&E must also evaluate the data used for training. As testers, we must understand the breadth and quantity of data used for training the systems. These data directly inform potential weaknesses and biases in the training of the system and the amount of operational testing necessary to identify potential effects on warfighter use in combat. DOT&E should ensure OT&E and LFT&E evaluate the (data) training pipeline as though it is part of the actual system itself. DOT&E should also test how rapidly we can retrain these systems on new data that become available from the field, with an eye towards rapidly correcting any undesirable/unintended behaviors in the field.

Office of the Director of Operational Test and Evaluation

In April 2021, then-Acting DOT&E testified that the office faces numerous workforce challenges, including a limited number of civilian staff responsible for

program oversight, and limited expertise in important emerging technology areas and in the use of advanced digital tools.

> **If confirmed, how would you improve the operational testing workforce, particularly in light of the growing numbers of new technologies embedded in weapon systems and the desire to speed the acquisition and deployment of systems to the battlefield?**

People are our strategic strength. If confirmed, I would promote a structured approach for the development and sustainment of the operational testing workforce to enhance workforce agility and response to emerging OT&E and LFT&E requirements. Operational testing workforce of the future requires access, bandwidth, and clear requirements to engage in continuous learning opportunities. The learning apparatus should evolve as quickly as the OT&E and LFT&E needs, resulting in easily adaptable courses, content, and training and workforce demands.

If confirmed, I will also work with USD(R&E) and USD(P&R) to leverage existing and implement new capabilities to address these needs. I will also continue the DOT&E scholarship, internship, and research and development programs and work with USD(A&S) to leverage their workforce development programs, like the Defense Civilian Training Corps (DCTC), to continue to increase the interest and influx of our talent from American universities and colleges in the field of OT&E and LFT&E.

> **If confirmed, how would you determining the correct mix of government, military, and contractor personnel necessary to meet the missions of the Office of the DOT&E?**

If confirmed, I would review the DOT&E portfolio, scope, workload, workforce capacity and skillsets to ensure that DOT&E is adequately positioned to meet DOT&E mission requirements and the Department's strategic initiatives. I would identify the competencies and skills needed to meet current responsibilities and future requirements given the rise of emerging technologies, the complexity of the operational environment, and the demands of adaptive acquisition framework initiatives. The number of personnel and types of skills should be based on the complexity and scope of DOT&E's oversight portfolio to ensure we can keep pace with the acquisition community, our adversaries, and the operational environment.

> **In your view, could the Office of DOT&E benefit from any unique personnel authorities, such as those available to DARPA, medical personnel, service academies, or defense laboratories, to attract, recruit, and retain the workforce needed to perform designated missions? Please explain your answer.**

It is my understanding that DOT&E regularly utilizes direct hire authority (DHA) to minimize mission disruption, and to ensure that civilian billets are filled quickly by personnel with the right expertise. If confirmed, I will evaluate the status of these authorities and would welcome unique personnel authorities to attract, recruit, and retain the very technical workforce who must also have a detailed understanding of the DoD mission, a combination that is hard to find.

In your view, could the Office of DOT&E benefit from any special acquisition or management authorities to more effectively and efficiently perform its designated missions?

Based on my current knowledge of DOT&E, I do not yet see a need for special acquisition or management authorities at this time. If confirmed, I will reassess with my staff and the USD(A&S) and USD(R&E). If we determine changes are needed, I will provide my best recommendations to the Secretary and the Congress.

Operational Test Agencies

Operational Test Agencies of the Military Services are tasked with conducting independent operational testing and evaluation of acquisition programs. Recent demands on these organizations have increased to meet rapid acquisition initiatives, to demonstrate joint and advanced concept technology programs and commercial technologies, and to evaluate information assurance, information operations, and joint T&E requirements.

How would you propose to arbitrate shortfalls between program managers' limited funding and operational test agencies' independent test requirements?

If confirmed, I would seek to enhance the involvement of OT&E and LFT&E stakeholders in the development of acquisition contracts to identify any information and artifacts that the vendor could provide to mitigate test and evaluation cost and schedules. I would also make sure that the policy is clear on the need to have OT&E and LFT&E stakeholders involved in the program at its inception to align early and often on OT&E and LFT&E requirements. I would impart on DOT&E staff working with program managers and operational test agencies that they should expect efficient testing methods, including the use of test data throughout program development where feasible to supplement test data accumulated solely through dedicated developmental test. I will also work with the Services leadership to ensure the latest advances in science and technology are used to optimize the available resources. I would ensure adequacy of the above through planned OT&E and LFT&E, and associated test resources, by my approval of program test strategies.

Do you have any concerns about the independence of the operational test agencies? Please explain your answer.

If confirmed, I will assess and raise any concerns about the independence of the operational test agencies. If confirmed, I will review all test and evaluation master plans, strategies, and plans, and ensure they adequately consider all operational conditions and are planned and executed to support of a credible evaluation of operational effectiveness, suitability, survivability, and lethality.

Should policies and procedures governing the activities of the operational test agencies be standardized across the Department of Defense, in your view?

In my view, the DoD could benefit from standardized policies and procedures. Data formatting, collection, storage, analysis, and dissemination is one category of OT&E and

LFT&E activity that would significantly benefit from standardization. This would enable easier access to data and enhanced use of data analytics to glean trends, lessons learned, strengthen OT&E and LFT&E efficacy, and potentially reduce the time needed to conduct an adequate test. Standardization would also enable accelerated implementation of digital and smart documentation tools. However, each Service has unique systems to test. A fair amount of flexibility and Service- or program-specific customization is therefore necessary. If confirmed, I will strive to seek a balance between maximizing standardization at the enterprise level, without introducing inefficiency and unnecessary overhead into programs.

Operational and Developmental Testing in the Adaptive Acquisition Framework

The Department of Defense recently implemented its Adaptive Acquisition Framework, which uses a series of six pathways, each designed for the unique characteristics of the capability being acquired. With the new framework, DOD encourages the use of Integrated T&E.

In your view, what value is provided to the department by the operational T&E community providing input into developmental testing?

In my view, OT&E and LFT&E would provide significant value by providing input into developmental testing. With OT&E and LFT&E input, developmental testing could consider operationally relevant and representative environments, users, and conditions early offering an opportunity to identify and correct operationally relevant deficiencies related to either effectiveness, suitability, survivability, or lethality before the system matures.

Typically, the later issues and solutions are identified, the more complex, expensive, and time-consuming the fixes are to implement. Early problem discovery may allow the program to better manage cost and schedule. Most importantly, addressing problems early in the acquisition process mitigates the risk of discovery during operational test. Providing operational input into developmental testing may also help OT&E and LFT&E agencies collect relevant data to inform preliminary and final evaluations of operational effectiveness, suitability, survivability, and lethality – creating a more informed and more efficiently scoped OT&E and LFT&E event. This input may introduce efficiencies and more rigorous evaluation of the system across the entire acquisition life cycle not just on production or fielding representative assets.

If confirmed, what guidance would you provide on how the Service programs can responsibly streamline the Test & Evaluation Master Plan or other planning guides to support rapid prototyping Middle Tier of Acquisition programs?

I understand that Middle Tier of Acquisition programs develop Master Test Strategies that are significantly streamlined from the traditional Test & Evaluation Master Plan. If confirmed, I would support the continued use of a streamlined planning process. It is important that the test strategies address the program's purpose for these types of acquisition programs.

I understand that rapid prototyping can span the development of a system prototype to inform future development or can support a limited fielding to the warfighter. The amount of testing should be sufficient to the imposed risk at the completion of the program. The test and evaluation strategy for the prototype that is intended to be fielded would likely be tailored to the specific operational environment and mission that it would be fielded for. All testing should consider performance related to operational effectiveness, suitability, survivability, and lethality of DoD systems. I would also emphasize that it is important to identify what data would be needed to y evaluate this performance.

If confirmed, I would also encourage programs and the test and evaluation communities to lean on science and technologies to optimize the value of test and the value of data collected during all test events to increase efficiencies and effectiveness of their test and evaluation strategies. If confirmed, I would focus on modernization and innovation of test and evaluation tools and practices to accelerate test planning, execution, analysis and reporting and increase efficiencies in those domains vice the scope of the test and evaluation strategies that would compromise our knowledge about the system to be fielded in combat.

What steps, if any, do you believe the Department should take to ensure early prevent late discovery of system performance issues?

I believe that some late discovery of system performance issues could be mitigated by having OT&E and LFT&E provide input into developmental testing. With OT&E and LFT&E input, developmental testing could consider operationally relevant and representative environments, users, and conditions early offering an opportunity to identify and correct operationally relevant deficiencies related to either effectiveness, suitability, survivability or lethality before the system matures.

Some late discovery of system performance could be mitigated by adequately accounting for potential system deficiencies and vulnerabilities in the cost assessments to preclude shortening developmental test at the expense of fixing the system. Other late discovery of system performance could be mitigated by using digital twins, digital tools, and virtual environments to assess and stress the system early and often further mitigating risks. Other late discovery of the system performance could be mitigated by increasing the rigor of developmental test.

In your view, are T&E policies and practices sufficient to manage the pace of changing technologies and threats where the boundary between fielded systems and development environments has become increasingly porous? Please explain your answer.

In my view, the T&E policies are sufficient to manage the pace of changing technologies and threats where the boundary between fielded systems and development environments has become increasingly porous. The implementation of such policies however may not be as efficient and may be hindered by existing practices, tools, methods, and infrastructure needed to adequately comply with the policy.

If confirmed, I would focus on supporting the delivery and implementation of capabilities that will enable adequate implementation of emerging DOT&E policies and guidance. If

confirmed, I will also emphasize the importance of keeping policy and procedures current with technologies so that development environments more closely mirror the operational environments.

If confirmed, how would you balance the tradeoffs between rapid deployment of new capabilities and the need to ensure that deployed capabilities are operationally effective and suitable?

DoD's relatively new adaptive acquisition framework encourages conducting operational evaluations early in the acquisition phase, such as embedding intended users into early developmental tests. Such events provide early insights that can expedite an adequate evaluation. If confirmed I would advocate for early operational evaluations to find and fix problems early, which will greatly increase the likelihood of operationally effective, suitable, survivable, and lethal capabilities being fielded as soon as possible.

If confirmed, I would also advocate for the development and implementation of advanced tools, processes, and methods to accelerate data collection, sharing, analysis, and optimization of the use of all available data. I would ensure OT&E and LFT&E objectives and requirements are defined early and inform acquisition contracts to optimize the use of contractor data, skills, and resources. I would also foster the relationship with the Joint Staff and Combatant Commanders to fully understand the operational need and requirements for rapid deployment. I would ensure that DOT&E regularly engages with the Joint Requirements Oversight Council, Service Secretaries, and acquisition executives to better understand the desired capabilities and fielding timelines, and to conduct independent assessments.

If confirmed, what changes in DOT&E policies, processes, and practice would help DOD achieve its goal of timely delivery of weapon systems, while still ensuring that weapons are safe, effective, and lethal?

I understand that DOT&E has initiated a major effort to establish new policy for OT&E and LFT&E tailored to the needs of the adaptive acquisition framework and the emergence of new technologies such as AI-enabled and autonomous systems. If confirmed, I will focus on supporting the development of new tools, processes, methods to enable adequate implementation of these emerging policies. If confirmed, I will also establish a process to ensure our policy remains relevant and aligned with emerging needs. I will also seek to establish a digital platform to deploy this policy and allow for real time feedback that will serve to inform future policy updates, guidance, and potential instructional materials.

If confirmed, how would you propose to achieve an appropriate balance among the desire to reduce acquisition cycle times, T&E resource demands and constraints, and the need to perform adequate testing and evaluation?

To deliver capability to the warfighter at the speed of relevance is important but it cannot come at a cost of inadequate OT&E and LFT&E that may result in inferior or unproven operational performance. I believe that efficiencies can be achieved by reviewing existing processes and identifying opportunities for automation; use of smart documentation, digital engineering, digital tools; and the use of data analytics capable of

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optimizing the use of all available data to introduce efficiencies and accelerate data collection, analysis, and reporting. I believe efficiencies can be gained by optimizing the integration across all test events planned for the acquisition program—a concept termed integrated decision support key. Using rigorously accredited and capable modeling and simulation tools offer another opportunity to accelerate our knowledge about the system. Advancing our workforce and equipping them with professional development and training opportunities should not be underestimated in offering enhanced efficiencies.

What requirements and criteria would you propose to ensure an effective test and evaluation program is established for rapid and/or agile acquisition programs?

I understand that DOT&E has developed a policy for OT&E and LFT&E applicable to all DoD software-reliant systems and software embedded in systems including modern methods such as Agile and Development, Security, Operations (DevSecOps). The policy outlines the requirements and criteria intended to ensure an effective test and evaluation strategy and plans for such systems. For instance, OT&E and LFT&E organizations will use documented user agreements to engage users and employ operationally representative conditions across the acquisition life cycle to enable real-time feedback throughout software development. OT&E and LFT&E cadence will align with the incremental software development cadence composed of a sequence of capability releases. OT&E and LFT&E may also leverage the acceptance criteria – prevalent in agile programs to identify conditions that need to be met for the requirements to be considered complete. OT&E and LFT&E could use these acceptance criteria to instill agreed upon test requirements into the development process and ensure an adequate test program. OT&E and LFT&E should also integrate with the software factory processes to evaluate any effects on operational performance.

What are your views on how testing and evaluation can best support systems under spiral, iterative, or agile development? When, in your view, should follow-on testing and evaluation be required?

Regardless of the systems development approaches now available through the adaptive acquisition framework – to include spiral, iterative, and agile development – adequate OT&E and LFT&E of DoD systems is critical to fielding weapons that work. As is the case with all systems, OT&E and LFT&E must be completed in a timely manner to provide the right information to those who need it, to support funding and schedule decisions, system development and fielding decisions, and development of operator concepts of operations and employment and tactics/techniques/procedures. While the timeliness and frequency of such decisions has been changing demanding more frequent, smaller-scale tests vice less frequent large-scale tests – the intent of OT&E and LFT&E has not.

Typically, follow-on T&E is conducted using fielded production systems with appropriate modifications, upgrades, or increments. I believe this should remain the case in programs adopting a spiral, iterative, or agile development paradigm. The differences in follow-on T&E, due to the iterative nature of these methods, are twofold: (1) DoDI 5000.87 requires software to be instrumented such that it supports data collection during

operations; and (2) the iterative process enables testers to collect data from tests over time, building a cumulative knowledge base over time.

Cybersecurity

The most recent DOT&E annual report highlighted cybersecurity as one of the areas in which the DOD test community needs to make the most progress.

If confirmed, how would you propose to improve cybersecurity testing of systems and technologies, including the security of commercial cloud services?

If confirmed, I would review existing practices and challenges to refine my proposal. Based on my experience and current understanding of the challenges I would advocate for cybersecurity to be embedded into the DNA of every system from its inception where cybersecurity and its testing become an integral part of every phase of system development life cycle. I would also promote cybersecurity testing of our weapon and mission systems that entirely shifts the emphasis from cyber compliance to operational effectiveness.

It is imperative to start with operational readiness and trace those to cyber survivability requirements that ultimately drive system design and test requirement. I would therefore also advocate for mission-based system-of-systems tests and exercises to evaluate the operational effectiveness of systems in their relevant contested environment since cyber testing and even design cannot merely focus on an individual system. I would promote implementing continuous automated testing and cyber technologies to better represent and protect against the persistent threat. I would propose to enhance and increase use of operational copies and models of systems such as digital twins and hardware-in-the-loop to enable continuous testing during operations and sustainment.

If confirmed, I would advocate for NSA-certified Red Team resources to support the scale and speed of OT&E and LFT&E. Emulating enemy attacks using cyber red teams that are well trained and equipped is critical to adequate OT&E and LFT&E. To ensure our DoD cyber test teams are prepared to adequately assess the security of commercial clouds, I would advocate for the additional training to operate in cloud environments and foster a community relationship with commercial cloud defenders to enhance defense mechanisms.

If confirmed, how would you propose to ensure the Office of DOT&E, program offices, and the Military Departments' and Services' Test Agencies have the appropriate infrastructure for cybersecurity testing?

The ever evolving, expanding and exploitable cyberattack surfaces, as well as adversaries who are becoming more sophisticated in their attack methods are stretching our core cyber T&E capabilities. If confirmed, I will work closely with the Services to estimate their growing needs for testing so I can prioritize and support the development of required tools, test environments, and capabilities in the context of this dynamic landscape. I will work closely with the DARPA, USD (R&E), U.S. Cyber Command, National Security Agency (NSA) and the Services to increase visibility and make

maximum use of available cyber ranges (e.g., National Cyber Range Complex), Red Teams, tools, and models.

If confirmed, I will further continue the close working relationship with the existing DoD Cyber Red Teams to support priority cybersecurity testing on live systems and operational networks, where necessary. I would encourage cyber red teams to be available during program development to ensure the system design is secure, and during program sustainment to ensure the system stays secure against evolving cyber threats. I would support ongoing efforts by USD(R&E) to expand and improve cyber test ranges, and efforts by USD(A&S) to expand the infrastructure used to conduct strategic cyber assessments.

If confirmed, how would you propose to improve use of National Security Agency-certified red teams and other mechanisms for stress testing?

If confirmed, I would champion for the resources, personnel, and authorities required to improve and expand NSA certified Red Teams. Emulating enemy attacks using cyber red teams that are well trained and equipped is essential to ensuring our DoD systems are mission ready. The DOD Cyber Red Team community, a critical enabler of cyber survivability, is heavily tasked and demand for them continues to grow. Boutique and highly targeted capabilities against DoD weapon systems often require time and resources beyond what the current Red Team community can afford. OT&E and LFT&E are typically very limited in duration. A real-world adversary has years to develop techniques, while our Red Teams has limited numbers of personnel and limited or artificially compressed timeframes.

If confirmed, I would work within the Department and potentially this Committee to ensure our Red teams have the resources to procure commercial and threat-relevant data, including breach data, and access to existing repositories of known compromised information related to DoD equities. I would ensure they have the resources to create tailored and bespoke tooling for command and control, persistence, and initial access against DoD networks and capabilities. If confirmed, I would also work with the DoD Chief Information Officer, Principal Cyber Advisor, and NSA to further streamline the processes involved in certifying, manning, training, and equipping these teams and support the creation of tools to automate some of their workloads.

In your view, what is the appropriate time in the program lifecycle to conduct cybersecurity operational testing, particularly given almost constant updates in software?

Cyber survivability testing, using cyber red teams to emulate enemy attacks, should start early in the program lifecycle and be embedded and iterative in the development and early testing of programs, long before they reach the threshold for operational testing. As much as possible, we should integrate our cyber survivability testing across the entire development of the program, and then continue such testing after the systems are fielded.

If confirmed, what steps would you take to ensure DOD has the capability to emulate cyber capabilities of adversaries to ensure testing is responsive and realistic to evolving cybersecurity threats?

Ensuring that the DoD can effectively emulate the cyber capabilities of adversaries requires an intelligence-driven approach. If confirmed, I will work with my peers in the Under Secretary of Defense for Intelligence and Security (USD(I&S)), Defense Intelligence Agency, USD(R&E), and test communities to ensure our testers and DoD Cyber Red Teams have the latest intelligence information on adversary capabilities and the latest tools and threat models to emulate those threats as realistically as feasible. In addition, I will work closely with them to develop processes and information exchange agreements necessary to rapidly generate such environments based on timely, validated intelligence community threat data. These same data and environments will be able to support and augment cyber Red Team activities.

Information Systems and Software Test Issues

The Department of Defense's weapon systems, enterprise IT systems, and business systems are increasingly software intensive and software defined, requiring a fundamental shift away from a traditional "waterfall" acquisition process toward smaller increments fielded more frequently. This poses challenges for developmental and operational testing.

In your view, what are the most significant challenges unique to the testing of incrementally developed information systems and software?

I support the DoD's efforts to change its acquisition process toward smaller increments fielded more frequently; if done correctly, such a process can get capability to the field faster. If confirmed, I would work with the acquisition community to effectively synchronize the rapid development pace with the appropriate level of OT&E and LFT&E to ensure those incremental capabilities are adequately tested at the right time to inform capability fielding decisions. In addition to greater use of online and automated test and test management tools, in my view, there are several opportunities unique to the testing of such systems.

If confirmed, I would also ensure OT&E and LFT&E perspectives are provided during strategic planning and requirements generation for crucial software-reliant systems. Testers need to advise acquisition contracts and generate test processes that allow access to test data during the development cycle while still enabling independent evaluations with commensurate frequency and appropriate rigor. Test teams must also integrate with users for the requirements and T&E processes. Endorsing constructive Government/commercial teaming may also enable groups to "fail fast" and fix things as quickly as possible.

If confirmed, I would also support conducting adequate independent assessments during software development without hindering the pace of software development. T&E strategies and plans need to be able to adapt around constantly changing requirements. Our testers need to have associated training for emerging technology, test tools, processes, and to enable testing as scale and speed.

In addition, if confirmed, I would also work on improving our reporting processes. While the software development community is continually conducting process improvements, test reporting processes have virtually been unchanged over the last 50 years. The T&E community must find ways to deliver operational effectiveness, suitability, survivability, and lethality evaluations at the same pace as the software development. Additionally, the T&E community must navigate the information flow to effectively communicate with all stakeholders on incremental software deliveries.

Historically, DOT&E evaluates programs against requirements established at the beginning of system development.

What role do you believe the DOT&E should play in testing of software intensive weapons systems, business systems, and enterprise information systems?

Pending available resources, I believe DOT&E must provide oversight of OT&E and LFT&E of all DoD systems acquired via the Defense Acquisition System including software intensive weapon systems, business systems, and enterprise information systems. Historically, DOT&E has focused its oversight on major capability acquisition programs, programs that are of high interest to Congress, including middle tier of acquisition programs, and those that provide the most significant capabilities to the DoD.

If confirmed, I would ensure that the T&E Oversight List for OT&E and LFT&E includes such programs, subject to available resources, and I would continue to monitor operational test agency efforts to ensure test adequacy for the software intensive weapons systems, business systems, and enterprise information systems. If confirmed, I would also ensure that DOT&E has an established policy and guidance for OT&E and LFT&E for such systems.

For example, I could imagine the need to address the changes in software requirements and the effect it may have on planning OT&E and LFT&E. Software development methodologies believe that requirements are at their weakest at the beginning of a program and mature over time as users and the warfighter better define and understand their mission and the capabilities required to execute that mission. Consequently, OT&E/LFT&E and contracting processes need to become adaptable to changing requirements. Similarly, OT&E/LFT&E planning and reporting documentation need to be able to handle ever changing requirements without extensive rewrites and approvals.

Does the test and evaluation community of the Department possess adequate tools, test environments, expertise, staffing, and funding to carry out its testing responsibilities as they relate to software intensive systems?

I understand that there are currently some significant shortfalls in this area, most notably in the test capabilities needed for OT&E and LFT&E of data-centric systems incorporating machine learning and artificial intelligence capabilities. The pace of software development in DoD as well as across the Federal agencies could outrun the pace of test and evaluation capabilities without additional staffing and funding to update tools and test facilities.

If confirmed, I would advocate support to provide additional value in this mission space. For example, I will sustain and enhance the DOT&E internship, scholarship and research and development program to also include software engineering and science tailored to OT&E and LFT&E needs.

What access to commercial information services, software, and systems does the operational test and developmental test community need to identify potential performance and security issues, and confirm operational effectiveness and suitability prior to a system's use by the Department of Defense?

I understand that security issues are addressed by the Defense Information Systems Agency (DISA) using a risk management framework to determine an acceptable level of risk. This process creates a compliance-based process that is not completely adequate in determining if DoD systems are survivable. Cyber OT&E/LFT&E approaches are threat based and should be contractually mandated on the cloud service provider.

Access to proprietary cloud infrastructures is essential to ensure adequate security of DoD's classified data. As the DoD increases its use of machine learning and artificial intelligence capabilities, access to proprietary algorithms for such capabilities will also be essential to ensure adequate operational testing is performed. DOT&E may not be able to maintain pace with the rapid rate at which DoD intends to field systems without heavily integrating automation and tooling into software development processes.

If confirmed, I would investigate the commercial software test tools and services that provide different capabilities to our test teams. Examples include network monitoring, commercial attack surface analysis, and static application security testing tools. The intent would be to offer a directory of vetted tools to the test teams that can be leveraged quickly to complete OT&E and LFT&E while reducing the time needed for the test team to prove that each tool is fit for purpose.

What role, if any, should commercial sector testing play in the Department's testing and evaluation of commercial information systems that are being modified to support defense needs?

Commercial testing is a data-rich environment for OT&E and LFT&E. Commercial testing can be part of a comprehensive test program where OT&E/LFT&E leverages that data for operational evaluation. However, to ensure adequate operational testing, DoD contracts should specify that any commercial network, cloud, or system that supports critical DoD missions should be accessible to independent, DoD-sponsored test teams, including cyber red teams. I understand this access is beginning to happen for some programs, and if confirmed I would encourage this to become the norm in DoD. Testing performed solely by the commercial sector, with no involvement by the DoD, is problematic due to the lack of independence of the testing, and would generally be not adequate for use in OT&E or LFT&E.

Modular Open Systems Approaches and Interfaces

Congress has enacted legislation mandating the use of Modular Open Systems Approaches (MOSA) in systems acquisition and the delivery to the government of interface characterizations to enable interoperability.

What are the unique challenges and imperatives, if any, in testing MOSA-based systems and verifying compliance with interface requirements?

Many net-centric programs across the Department, including MOSA-based programs, must develop dozens or even hundreds of interfaces internally, or to other products and legacy systems, in order to be operationally effective. To ensure that these interfaces work correctly, it is imperative that the program fund an adequate developmental test environment so that modules of the system can change and improve over time. This would include with operationally realistic interfaces and data flows so that the program can mitigate performance and interface problems early. Programs that do so are much more likely to succeed during operational testing and are deployed soon after. Programs without an adequate developmental test environment usually experience severe delays and cost overruns.

Business and Cloud Computing Systems

If confirmed, how would you improve DOT&E capabilities to test and evaluate the operational suitability of business systems and the business processes they are intended to support?

Business systems are particularly appropriate for automated testing, which can be an efficient way to discover and fix problems early, thereby improving the chances of on-time delivery of a capability that works.   If confirmed, I would advocate for increased automation of these test processes, and particularly the anti-fraud testing of key business systems. I would also advocate for adequate funding to support development of a realistic developmental test environment to run the automated testing in. The more realistic the test environment is, the more likely to find problems early and thereby keep the program on schedule and budget.

How would you improve the capabilities to test and evaluate the operational suitability of cloud computing systems and services?

As the DoD moves more capabilities into commercial clouds, our adversaries are likely to focus their attention on finding ways to break into those clouds. I strongly support Section 1553 of the FY23 NDAA, which requires DoD to perform independent, threat-realistic cyber assessments of the commercial cloud infrastructure containing classified data.

If confirmed I would work with industry and DoD leaders to expand the scope of cloud systems testing to include cyber red team assessments of the underlying infrastructure of those cloud offerings. I would also ensure continued and enhanced automated testing of "software as a service" offerings to assure performance, security, functional performance, interoperability, network performance, load, and stress testing. Issues that need to be addressed as part of this challenge include data security, test complexity and distribution of tests to simulated actual distributed usage. Utilizing cloud testing

capabilities within DoD and via commercial offerings are also avenues that can be used to improve the testing of cloud systems and services.

In your view, what are the challenges currently affecting DOD's ability to determine the operational effectiveness and suitability of commercial information services prior to their deployment and use?

The DoD's information services are constantly under cyberattack, and many of those services are critical to DoD's warfighting capabilities. Hence, cyberattacks present a major risk to the operational effectiveness of these services. Historically, commercial information services were acquired without much concern for their cyber survivability, but in today's environment cyber survivability is paramount. One of the challenges includes the need to change the culture of the DoD personnel involved in acquiring such services to a "warfighting mindset" that supports rigorous cyber survivability, operational effectiveness, and suitability testing.

Testing of Commercial Hardware Based Systems and Technologies

The Department of Defense is making significant efforts to use more commercial hardware platforms, technologies, and systems.

What policies and practices should the Department establish to govern the developmental and operational testing of these kinds of commercial systems?

If confirmed, I will review existing policies and practices to provide a more informed recommendation. Based on my current experience and I understanding, I would offer that to enable adequate cybersecurity testing of commercial hardware systems, such as commercial clouds, the Department should establish policies that require DoD contracts with commercial vendors to permit independent, DOD cybersecurity assessments of commercially owned platforms, technologies, and systems.

What best practices from the commercial industry can inform DOT&E's approach to evaluating defense systems?

I understand that DOT&E has been conducting environment scans to identify best practices from the commercial industry and academia that can inform DOT&E's approach to evaluating defense systems. Specific technologies assessments that have been recently initiated include AI, software and data proliferation, digital-physical fusion, and space.

If confirmed, I would synthesize the findings from these scans to leverage these findings and develop actionable recommendations. I would also continue the environmental scan activities on different technologies while also deep diving the already identified best practices.

Combination of Testing with Training Exercises

Some hold the view that the most representative operational testing would be to allow operational forces to conduct training exercises with the system under evaluation.

In your view, should testing be combined with scheduled training exercises for efficiency and effectiveness?

Training exercises offer a unique opportunity to test in more realistic operational scenarios that better replicate the density and complexity of modern warfare. They can and should be leveraged to provide critical operational test data on joint force interoperability and tactical employment. However, data-driven operational test objectives are not always compatible with training objectives because training exercises are not often intended to address, and do not include the instrumentation necessary to generate the high-quality data needed to characterize system performance, and to determine mission outcomes and root causes of system deficiencies. I understand that DOT&E frequently observes training exercises in which developmental systems participate to gain early insights, but the aforementioned factors currently limit the extent to which these activities should be combined.

If confirmed, I will advocate for addressing these challenges and identifying opportunities to effectively combine training and testing events to optimize them for meeting some of OT&E and LFT&E objectives.

What are the barriers, if any, to doing so?

Combined test and training events require trained personnel, a relatively mature system under test, and agreed-to and compatible test and training objectives. These resources and conditions are typically available only near the end of system development, which may limit available opportunities. Differences in test and training objectives also make integration of these events difficult. Another significant barrier is the lack of affordable, high-quality instrumentation that is common to both test and training systems. Installing modular, open-air battle shaping instrumentation systems on both test and training systems would enable both communities to leverage these events while applying emergent big data analytics and knowledge management capabilities to improve post-mission analyses. Standing up big data analytic teams that are capable of engineering and analysis to develop requisite tools and analysis methodologies is also required to accurately assess the results of large-force exercise and/or test events.

How can training and testing ranges be used more jointly and efficiently, in your view?

If confirmed, I would actively support the coordination of the development of test range capability requirements that may support both test and training needed. I would also support efforts to enable high-quality data collection in training venues, which would significantly improve both testing and training and lead to more opportunities for combined test and training activities.

In your opinion, what role, if any, should DOT&E have in experimentation events?

At minimum, DOT&E should be monitoring experimentation events as these events tend to provide leading indicators of future warfighting capabilities. Being involved in these

events, provides insight into future test resource and range requirements, test strategies of future programs through potential warfighter use of advancing technologies, and analytical processing needs.

I understand that DOT&E includes a Joint Test and Evaluation (JT&E) program that may be particularly suited to support the planning, execution, analysis, and reporting of experimentation events to ensure operational realism of such events given their objectives and potential outcomes.

If confirmed, I will ensure JT&E is engaged, to the maximum extent possible, within the resources available.

"System of Systems" Testing

What inherent challenges exist for the operational T&E of DOD programs that are part of an overall "system of systems"?

As I understand it there are several challenges with adequate OT&E and LFT&E of system of systems. A good example of such a system of systems is the Missile Defense System, which comprises more than a dozen different missile, sensor, and network systems, all of which must work together during wartime. Operational test challenges for such a system of systems include getting all system owners to agree on the testing plans, schedule, and scope; obtaining an appropriate venue for such a large-scale test; and obtaining adequate funding to support operationally realistic testing.

For the Missile Defense System, Congress has helped the DoD achieve more realistic testing by mandating that the Army and the Missile Defense Agency conduct joint testing of their individual missile defense systems. Similar mandates are not applied across other system of system testing which may become critical with the proliferation of joint warfighting concepts, kill webs, and mission threads.

How should a "system of systems" be tested to assess the effectiveness of the whole system? Please explain your answer.

To understand how a system of systems will perform in combat it is important to test it as a system of systems, with all its component systems deployed against operationally realistic threats. Such tests may be hard to conduct routinely due to a variety of operational test challenges. It is not hard to imagine a solution that includes a combination of modeling and simulation and real-world testing, where the real-world testing is designed to validate and accredit the modeling and simulation.

I understand that DOT&E has several initiatives to develop joint test concepts to intended to develop recommendations for evaluating kill webs, mission threads and other system of system scenarios. These concepts will help inform the requirements, infrastructure, tools, and measures needed to adequately scope OT&E and LFT&E of such tests and adequately inform the operational performance of the joint force.

In your opinion, how should the Department adapt its processes to conduct T&E for an initiative such as Combined Joint All-Domain Command and Control

(CJADC2)? Does the Department have the technology, processes, or people in place to conduct T&E for CJADC2?

As I understand it, CJADC2 capabilities are being developed over time by several Services and organizations within the DoD. A key component of CJADC2, for example, is the Joint Fires Network being developed to support USINDOPACOM. Such capabilities will be a challenge to test, because of the wide variety of systems that would need to be available at the same time, over a large geographic area. A combination of both live test events and modelling and simulation will clearly be required to adequately conduct OT&E for such capabilities.

if confirmed I will advocate for the resources needed to ensure adequate OT&E of CJADC2 capabilities.

Similarly, the ability to conduct testing across mission threads or complex kill webs will require new approaches for T&E.

In your opinion, what are the challenges, to include technical, process, and infrastructure, for the T&E community in dealing with the test and evaluation of systems against mission threads, as well as requirements?

Real-world mission scenarios involve the use of multiple systems of varying complexities and pedigrees working together to achieve the desired lethal effect. The emergence of highly network-centric concepts, greater dependency on connectivity, and the use of large amounts of data from a wide array of shooters and sensors across multiple domains, at machine speeds, warrants a review of the T&E processes within individual acquisition programs. Evaluating warfighting capability is further challenged by asynchronous updates and continuous evolution of the various components that comprise these system-of-systems operations. This demonstrates an inherent need to continually characterize the interoperability of such systems and their effectiveness as would be employed by the Combatant Commands.

With the emergence of joint all domain command-and-control solutions and the concept of kill webs, it is important to define the process and the required T&E tools that would effectively measure the success rates of mission threads, concepts, and solutions. I understand that DOT&E has several initiatives underway to develop joint test concepts intended to provide guidance for evaluating kill webs, mission threads and other system of system scenarios. These concepts will help inform the requirements, infrastructure, tools, and measures needed to adequately scope OT&E and LFT&E of such tests and adequately inform the operational performance of the joint force.

If confirmed, I would evaluate the status of these initiatives and inform the next course of action to operationalize such testing.

Live Fire Testing

The live fire testing program is a statutory requirement enacted to ensure DOD assessment of the vulnerability and survivability of platforms, while also assessing the lethality of weapons against required target sets.

What are the major challenges facing the live fire testing program, in your view?

The major challenge facing the live fire testing program is implementing realistic survivability and lethality testing of covered systems that also includes testing against non-kinetic threats and coordinated kinetic and non-kinetic attacks. This will require alignment of kinetic and non-kinetic kill criteria so survivability and lethality can be assessed with consistency across all effects. Clearly defined requirements for the digital tool capabilities needed to support full-spectrum survivability and lethality T&E across the acquisition life cycle including the operations and sustainment phase would also need to be addressed. Effect-specific test requirements to justify digital tool development and promote development of common digital tool interface standards so different effects tools can be linked together may also need to be considered.

An agile and effective process to assess the landscape of changing adversary threats and prioritize which effects across the spectrum are most important for inclusion in full-spectrum survivability and lethality testing is also important. Consistent use of model-based engineering in acquisition could increase survivability and lethality testing efficiencies and help weigh risk, benefit, cost of the full-spectrum survivability assessment by allocating components of the test to digital tools and live test. Availability of a trained workforce with expertise in model-based engineering, data management, data analytics, software, artificial intelligence/machine learning, VV&A to include uncertainty quantification, and other relevant fields may also be a challenge.

Is live fire testing to determine whether weapons systems, vehicles, or personal protective equipment meet military and contract specifications for procurement an inherently governmental function, a function that can be outsourced, or a function that can use a mix of government and commercial facilities? Please explain your answer.

Live fire testing that supports a fielding decision or full-rate production decision is inherently governmental function. Warfighters should be provided systems that have undergone government testing at a government facility or, under limited circumstances, testing at non-governmental facilities with government supervision. The government could use private certified labs, as necessary, to meet surge requirements or to conduct research and development testing. When testing is conducted at commercial facilities, it must have government oversight and meet a common standard appropriate for the intended use of the data.

Modeling and Simulation

Advances in modeling and simulation have provided an opportunity to streamline the testing process, saving time and expense.

What do you believe to be the proper balance between modeling and simulation and actual testing of a developed product?

Enough physical or testing must be conducted to provide the right amount and type of data needed to verify, validate, and accredit modeling and simulation so they may be used to complement or supplement actual testing. Using modeling and simulation results that have not been accredited with a rigorous verification, validation, and uncertainty quantification process is ill-advised and may lead to incorrect conclusions about the actual operational effectiveness, suitability, survivability, and lethality of DoD systems in combat.

The uncertainty in the modeling and simulation results must be quantified and understood prior to their use in lieu of actual test and in support of the evaluation of operational effectiveness, suitability, survivability, and lethality. Reducing that uncertainty may drive the amount of required actual or physical testing making the use of advanced science critical in optimizing limited test resource to maximize the knowledge gleaned from such tests in support of advancing and accrediting critical modeling and simulation tools. Increased use of accredited modeling and simulation in support of OT&E and LFT&E requires a significant investment in both development of the required modeling and simulation capability itself and the requisite workforce to support the rigorous accreditation.

The advancement of modeling and simulation will not reduce the need for actual testing. Actual testing ultimately provides operators confidence in their systems as it demonstrates performance under real-world conditions.

Are there areas in modeling and simulation that need to be advanced in order to improve its utility as a tool for operational and developmental testing?

Modeling and simulation provides a powerful and necessary means of augmenting or supplementing actual operational and developmental testing but significant advances in interoperability, enterprise software architecture expertise, and verification/ validation/uncertainty quantification will be required to increase the utility of modeling and simulation in OT&E and LFT&E. Inherently the test and evaluation enterprise is becoming more dependent on modeling and simulation to evaluate the efficacy and interoperability of DoD systems moving forward.

OT&E and LFT&E community will need to use the most modern quantitative methods and computing technologies available to remix and fuse live data with modeling and simulation and physics inside of "digital arenas" where complex joint warfighting scenarios can be interrogated in a comprehensive way. The skills required to use and evaluate the results of modeling and simulation must be commensurate with these advances. The upskilling of the Department of Energy workforce particularly in the domain of uncertainty quantification to ensure the credibility of the nuclear weapon stockpile since the 1990s when they stopped conducing live, full up nuclear explosive testing could serve as an example of the type and scale of advances required to increase the utility of modeling and simulation in OT&E and LFT&E.

Given recent advancements in modeling and simulation, and increasing interest in the Department's use of so-called "digital twin" or model-based systems

engineering technology to improve mission readiness and sustainment, where would you draw the line between the suitability of virtual testing and live testing?

Without credible digital technologies, the understanding of the critical warfighting capabilities will grow exponentially limited precluding the Department to identify and respond to new deficiencies and vulnerabilities in a multi-domain operating environment at the speed or need. In contrast, live testing continues to be a critical element of OT&E and LFT&E since they provide the data needed to inform and enhance digital technologies to include their adequate verification, validation, and accreditation.

Modeling and simulation must be credible, with its credibility anchored by comparison to live test data to confirm representation of the real world. As confidence develops in the modeling and simulation through validation, it is appropriate to lean more heavily on virtual testing. However, live test events should remain a part of testing to enable continued improvement and validation of modeling and simulation, and to mitigate the inherent limitations of modeling and simulation.

If confirmed, I would support the development, funding and execution of a digital technology development roadmap to identify and close the digital technology shortfalls and advance the use of virtual testing in OT&E and LFT&E. I would help define and enforce a process by which real-world operational and testing data will be used to inform and enhance digital technology. I would also define and implement a process to manage the required digital technologies to meet this intent.

How can the data or other outputs from such technologies be used to complement, enhance, or reduce, the time for traditional T&E?

The data or outputs from such technologies can be used to complement, enhance, or reduce the time for traditional T&E in several ways. Modern model-based engineering when combined with adaptive inference processes offer integrated, holistic approaches to generating and managing knowledge of system performance throughout the life cycle. Advanced performance inference techniques can be used to carry forward data from early prototypes through evaluation of production-representative systems. Moreover, model-based engineering can eliminate manual workflows through automation that enables generation and distribution of up to-date dynamic reports on systems and their status in the acquisition life cycle.

In addition, digital twins that can, for example, be subjected to stressing conditions early and often help developers and program managers improve system performance at the required pace. Digital twins have also begun to incorporate transmission of real-time data sensed by the real-world object. The judicious application of digital twins could thus be particularly useful in enabling continuous monitoring of operational performance of systems as they evolve over time. However, while digital twins create new opportunities for T&E to determine the performance of continuously evolving systems, they also create new verification, validation, and accreditation challenges that, if confirmed, I intend to help address.

Science and Technology

What are your views on the appropriate level of investment in science and technology (S&T) programs to develop next generation testing capabilities?

OT&E and LFT&E must leverage advanced science and technology to provide, with scientific rigor, the data and knowledge to system engineers and acquisition decision makers. Applied mathematics, statistics, and other test and design and analysis methods when combined with advanced technologies that leverage digital engineering, digital tools, technologies, predictive analytics tools using artificial intelligence and machine learning and similar will enable efficient use of data from multiple data sources, i.e., contractor test, developmental test, operational test, and live fire test data and modeling and simulation results.

Improved testing using inference methods, paired with improved data management methods, are critical to dynamically optimize the planning and execution of integrated T&E, OT&E, and LFT&E across the acquisition life cycle. Such technologies may also provide authoritative sources of models, simulation, data, and test artifacts to enable automation and reuse of test artifacts gaining greater accuracy and efficiency across OT&E and LFT&E.

If confirmed, I will review the investments in science and technology programs intended to develop next generation testing capabilities and will coordinate with this committee my conclusions and any proposed courses of actions.

If confirmed, what mechanisms would you employ to ensure the S&T portfolio is responsive to the Department of Defense's future test instrumentation needs?

Test instrumentation, especially as the complexity of DoD systems and those of our adversaries advance, is critical to the DOT&E mission. If confirmed, I will ensure DOT&E has a well-established process for identifying, developing, prioritizing, and tracking OT&E and LFT&E resources needs including those related to test instrumentation. I would tie those resources needs to the ongoing and projected OT&E and LFT&E events to justify the criticality and timeliness of the identified needs.

If confirmed, I would establish and maintain a productive relationship with USD(R&E) and their Test Resources Management Center to ensure we have a process in place that enables timely, comprehensive, and transparent communication on the OT&E and LFT&E test instrumentation needs. If needed, I would leverage the Department's annual planning, programming, budgeting, and execution process as another vehicle to address such requirements.

If confirmed, I would also leverage my unique and independent access to Congress to seek any support in ensuring the S&T portfolio is responsive to the DoD's future test instrumentation needs. I would also document my findings and recommendations in the DOT&E annual report to Congress.

In your view, in which areas should the Department's S&T program be investing with a view to improving the quality of current and future testing capabilities?

If confirmed, I will provide a more detailed review and assessment of current and future testing capability requirements to be addressed by the Department's S&T program. Based on my current understanding and experience, I anticipate the need to make further investments in the following:

1. Digital-physical fusion including but not limited to live, virtual, and constructive systems to balance test realism with the need to protect open air testing from adversarial observations,

2. Interconnected networks connecting ranges, facilities, labs and even industries to one another with secure communications that are survivable in cyberspace,

3. Capabilities to evaluate the interoperability and effectiveness of new systems working in concert with other warfighting technologies as technologies evolve more dynamically over time,

4. Realistic environments so testing can be more reflective of current battlefields, and

5. Testing capabilities to support adequate OT&E and LFT&E of the National Defense Strategy critical technology areas (e.g., advanced computing and software, directed energy, hypersonic, integrated sensing, cyber, space, trusted artificial intelligence and autonomy).

Encroachment and Environmental Issues

As is the case with military training, the Department of Defense's test and evaluation efforts must consider encroachment requirements and environmental regulations, both on land and at sea.

In your view, what is DOT&E's responsibility to the communities and environment near its test ranges?

In my view, a key part of DOT&E's responsibilities includes effective relations with the communities near the Department's test ranges. While DOT&E does not have oversight of the test ranges nor ownership of them, if confirmed, I will participate in the Department's oversight of the test ranges. I will voice my views and concerns to the Services and other offices in the Department through the Department's oversight fora concerning any issues that would affect communities near the test ranges.

I also understand that DOT&E is an active participant in collaborative outreach organizations such as the Southeast Regional Partnership for Planning and Sustainability and the Western Regional Partnership that address all manner of environmental issues associated with the test ranges and surrounding communities. I also understand that DOT&E participates in the Department's internal fora to address environmental concerns. These include the Range Commanders' Council Sustainability and Environmental Group and the DoD Conservation Committee. In addition, DOT&E provides inputs to the DoD Military Aviation and Installation Assurance Siting Clearing House, which works to protect the Department's mission capabilities from incompatible energy development by collaborating with DOD components and external stakeholders.

If confirmed, I will look to expand participation in environmental outreach organizations to improve our situational awareness of environmental issues that have the potential to affect the Department's usage of test ranges. I will also continue to support the Department's ongoing environmental activities such as the Readiness and Environmental Protection Integration Program and participation in the Sentinel Landscapes Partnership.

If confirmed, how would you address encroachment and environmental requirements, while ensuring the quality and quantity of the Department's test and evaluation programs?

If confirmed, I intend to participate in numerous environmental related fora to ensure that I have situational awareness of emerging encroachment and environmental issues. I will continue to support the Department's ongoing efforts to address encroachment and environmental issues through compatible development on and near test ranges. If confirmed, I would incorporate encroachment concerns and environmental considerations into my review and approval of test and evaluation master plans, strategies, and plans.

If confirmed, my situational awareness of encroachment and environmental issues will also permit me to raise these issues with the Services in the planning and execution of test programs. It would be my expectation that such issues can be effectively addressed through the Department's comprehensive test planning process.

Sexual Harassment

In responding to the 2018 DOD Civilian Employee Workplace and Gender Relations survey, 17.7 percent of female and 5.8 percent of male DOD employees indicated that they had experienced sexual harassment and/or gender discrimination by "someone at work" in the 12 months prior to completing the survey.

What is your assessment of the current climate regarding sexual harassment and gender discrimination in the office of the DOT&E?

Sexual harassment and gender discrimination are inconsistent with the dignity and respect that people deserve. I do not tolerate or condone such conduct. It jeopardizes mission accomplishment, weakens trust, erodes organizational cohesion, and has no place in any professional or personal environment. If confirmed, I will provide you with my assessment of the climate regarding sexual harassment and gender discrimination in the office of the DOT&E.

If confirmed, I would also hold DOT&E leaders and staff at all levels appropriately accountable for fostering a climate of inclusion that supports diversity, is free from harassment and discrimination, supports those who experience such behaviors, and prohibits retaliation against those who report such behaviors. If confirmed, I would ensure that DOT&E analyzes workplace climate data and implements prevention and response programs that address harassment and discrimination.

If confirmed, what actions would you take were you to receive or become aware of a complaint of sexual harassment or discrimination from an employee of the Office of the DOT&E?

If confirmed—and if I were to receive or become aware of a complaint of sexual harassment or discrimination from an employee of the office of the DOT&E—I would respond in an impartial and timely manner and ensure that such actions be promptly stopped. Likewise, I would ensure that individuals who report being sexually harassed or discriminated against receive information about available support services and are afforded appropriate privacy and confidentiality. I would also ensure that such individuals receive ongoing timely information regarding the status of the response to allegations. For substantiated complaints, I would ensure that appropriate administrative or disciplinary action be commenced. I would also conduct organization climate assessments to determine whether the complaint was indicative of a larger issue.

Congressional Oversight

In order to exercise legislative and oversight responsibilities, it is important that this committee, its subcommittees, and other appropriate committees of Congress receive timely testimony, briefings, reports, records—including documents and electronic communications, and other information from the executive branch.

Do you agree, without qualification, if confirmed, and on request, to appear and testify before this committee, its subcommittees, and other appropriate committees of Congress? Please answer with a simple yes or no.

Yes.

Do you agree, without qualification, if confirmed, to provide this committee, its subcommittees, other appropriate committees of Congress, and their respective staffs such witnesses and briefers, briefings, reports, records—including documents and electronic communications, and other information, as may be requested of you, and to do so in a timely manner? Please answer with a simple yes or no.

Yes.

Do you agree, without qualification, if confirmed, to consult with this committee, its subcommittees, other appropriate committees of Congress, and their respective staffs, regarding your basis for any delay or denial in providing testimony, briefings, reports, records—including documents and electronic communications, and other information requested of you? Please answer with a simple yes or no.

Yes.

Do you agree, without qualification, if confirmed, to keep this committee, its subcommittees, other appropriate committees of Congress, and their respective

staffs apprised of new information that materially impacts the accuracy of testimony, briefings, reports, records—including documents and electronic communications, and other information you or your organization previously provided? Please answer with a simple yes or no.

Yes.

Do you agree, without qualification, if confirmed, and on request, to provide this committee and its subcommittees with records and other information within their oversight jurisdiction, even absent a formal Committee request? Please answer with a simple yes or no.

Yes.

Do you agree, without qualification, if confirmed, to respond timely to letters to, and/or inquiries and other requests of you or your organization from individual Senators who are members of this committee? Please answer with a simple yes or no.

Yes.

Do you agree, without qualification, if confirmed, to ensure that you and other members of your organization protect from retaliation any military member, federal employee, or contractor employee who testifies before, or communicates with this committee, its subcommittees, and any other appropriate committee of Congress? Please answer with a simple yes or no.

Yes.