Advance Policy Questions for Robert Behler
Nominee for Director of Operational Test and Evaluation, Department of Defense

Department of Defense Reforms

The National Defense Authorization Act for Fiscal Year 2017 included the most sweeping reforms since the Goldwater-Nichols Department of Defense Reorganization Act of 1986.

Do you support these reforms?

Response: Yes.

Do you support the acquisition reforms that were authorized and mandated by the Weapons Systems Acquisition Reform Act of 2009?

Response: Yes.

What other areas for defense reform do you believe might be appropriate for this Committee to address?

Response: Rigorous developmental test and evaluation (DT&E), conducted early in a program's development, can help avoid performance problems, cost increases, and schedule delays. As the Department begins to implement the FY17 National Defense Authorization Act (NDAA) acquisition reforms, I urge this Committee to support the Department's DT&E resources and personnel, and ensure DT&E leadership has the authority and responsibility to inform senior acquisition executives regarding the conduct and results of DT&E for major defense programs.

Duties and Qualifications

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

Response: I know from personal experience there are three imperatives in combat: believe in yourself and training, believe in your mission and commanders, and believe in your equipment and weapons. If confirmed, my duty will be to provide independent and objective assessments to protect the taxpayer investment and ensure our soldiers, sailors, airmen and marines believe in their equipment and weapons, and are confident they are combat ready.

Specifically, I understand the duties and functions of the Director of Operational Test and Evaluation outlined in Title 10 of U.S. Code Section 139 and Section 2366. I

understand that, if confirmed, I would serve as the principal advisor to the Secretary of Defense and Under Secretary of Defense for Acquisition, Technology, and Logistics for all operational test and evaluation within the Department. I would formulate and implement policy for operational test and evaluation and provide oversight of the operational testing of major defense programs, major automated information systems and other systems as I designate. I would be required to provide Congress an Annual Report summarizing operational test and evaluation activities that includes comments and recommendations on operational test and evaluation resources, facilities and funding. In addition to the Annual Report, I would provide Beyond Low Rate Initial Production Reports, Early Fielding Reports for systems that are urgently needed and deployed before completion of initial operational testing, Live Fire Reports and respond to requests from Congress. My duties would include responsibility for prescribing policies and procedures for the conduct of live fire test and evaluation and for monitoring, reviewing, and reporting on all operational and live fire test and evaluation within the Department. I would also be responsible for coordinating joint operational testing. I would review and provide recommendations to the Secretary of Defense on all budgetary and financial matters relating to operational and live fire test and evaluation, including test facilities.

If confirmed, what duties and functions do you expect that the Secretary of Defense will assign to you?

Response: If confirmed, the Secretary may seek my advice on matters related to the capabilities and limitations of our weapons systems, as demonstrated in operational and live fire test and evaluation (LFT&E), in order to support his initiatives and latest guidance to restore readiness and build a more lethal force. Given early and comprehensive weapons systems test results, the Secretary also may seek my advice to address performance shortfalls found in weapons systems test and evaluation (T&E).

What background and experience do you have that qualify you to perform these duties?

Response: I have spent my entire career in the areas of defense, testing, and the engineering and management of complex technical problems. I am currently the Chief Operating Officer and Deputy Director at the Carnegie Mellon University Software Engineering Institute, a Federally Funded Research and Development Center, where I work to advance software engineering and cybersecurity to solve national cyber challenges through focused research, development, and transition to the broader software engineering community.

I understand employing weapon systems in a combat environment. During my USAF career, I have sent airmen into harm's way and have personally flown in combat, receiving air medals for sustained aerial combat while flying the SR-71 Blackbird. I have served as a developmental and operational test pilot, and commanded an operational test

squadron that tested major defense acquisition programs including the B-1B, B-2, B-52 Advanced Avionics System, Advanced Cruise Missile, and other classified programs. I am a Fellow in the Society of Experimental Test Pilots and an Associate Fellow in the American Institute of Aeronautics and Astronautics. I gained valuable legislative experience as the Chief of the USAF Senate Liaison Office, where I worked regularly with the Senate Armed Services Committee. As the DOT&E assistant for strategic systems in the late 1980s I gained a solid understanding of the defense acquisition process and DOD OT&E policy. I served as President and Chief Executive Officer of SRC, Inc., Senior Vice President and General Manager at MITRE Corporation, and the Business Area Executive of Precision Engagement at the John Hopkins University Applied Physics Laboratory. I was Commanding General at the Air Force Command and Control & Intelligence, Surveillance, and Reconnaissance Center as well as the Deputy Commander at Joint Headquarters North, NATO, Stavanger, Norway. I am a retired U.S. Air Force Major General, a graduate of the U.S. Air Force Test Pilot School, and a National Security Fellow at Harvard University's John F. Kennedy School of Government. I have earned advanced science and technical degrees and have demonstrated leadership at all level.

Do you believe that there are actions you need to take to enhance your ability to perform the duties of the DOT&E? If so, what are they?

Response: Yes, I believe it is critically important in DOD acquisition that the DOT&E has a strong working relationship with the Secretary of Defense, Deputy Secretary of Defense, USD (AT&L), Combatant Commanders, Secretaries of the military services and service acquisition executives. If confirmed, I will work closely with the Secretaries of the military services and service Chiefs to understand their current operational challenges. When possible, I will visit forward operating locations to observe combat operations and the capabilities of their weapon systems. I will observe major joint exercises, both kinetic and cyber, to witness the current state of our weapons and the individuals who deploy them.

A significant component of accomplishing DOT&E's mission is the Service Operational Test Agencies. If confirmed, I will regularly visit their test locations and witness the conduct of OT&E and Live Fire T&E to get a solid picture of today's complex operational environment. I will meet regularly with the test communities, acquisition community, Joint Staff and Combatant Commanders to gain insight to deliver combat ready weapons to their warfighters as rapidly as possible.

Major Challenges

In your view, what are the major challenges that will confront the DOT&E?

Response: In my view, the immediate challenge will be adapting to the changes that are coming to the DOD acquisition system as a result of the FY17 NDAA provisions for acquisition reform. To date, little is known about the details of this reform effort. Other

challenges include balancing adequate testing with the desire for rapid development and fielding, and implementing greater use of credible models and simulations to augment T&E of complex and software intensive systems.

If confirmed, what plans do you have for addressing these challenges?

Response: If confirmed, I plan to engage with the Deputy Secretary and the USD (AT&L) to ensure the acquisition reform effort includes adequate testing to determine operational effectiveness, suitability, and survivability. I plan to more broadly apply the DOT&E existing policy that evaluates mission-related risk to determine the appropriate level of operational test and evaluation for rapid development programs. I plan to leverage my knowledge and experience as Chief Operating Officer and Deputy Director at Carnegie Melon University's Software Engineering Institute to design adequate OT&E to effectively evaluate how well a system, and its supporting software, supports its missions. I believe it is important to use data and information from robust and operationally relevant developmental testing, if available, to augment OT&E and provide critical T&E results earlier in a program's development.

What do you consider to be the most serious problems in the performance of the functions of the DOT&E?

Response: The problems the DOT&E faces today are complex; weapon systems need to be developed, tested and deployed in a much shorter timeframe; the testers need to understand the new, game-changing technologies; and our test facilities need to reflect an operationally representative environment. I understand that over the past 34 years DOT&E has made a positive impact on these challenges with sound direction and guidance, but more can be done. If confirmed, I will review the functions, processes, products, and staffing of the Office of the DOT&E. I will discuss any challenges I identify with the Secretary in order to keep the Office of the DOT&E aligned with the Secretary's objectives to rebuild a more lethal force. I will inform this committee of my findings and intended actions.

If confirmed, what management actions and timelines would you establish to address these problems?

Response: If confirmed, at the beginning of my tenure I will evaluate the efficacy of the government and contractor mix in the office of the DOT&E to identify areas that may need to be complemented with individuals who are savvy with emergent technologies and current operational experience. I will continually encourage close communication with the acquisition and requirements organizations to minimize potential areas for disconnect earlier in the acquisition process. From the discussions I have had to-date with those familiar with the management of the Office of the DOT&E, I am not aware of any systemic problems in the performance of the DOT&E functions.

Relations with Congress

What are your views on the state of the relationship between the DOT&E and the Senate Armed Services Committee in particular, and with Congress in general?

Response: During my conversations with staff members from the Senate Armed Services Committee I received very positive comments about the responsiveness and professionalism from the DOT&E and DOT&E staff. From those conversations I assess the relationship between DOT&E and the SASC as very good. With respect to the Congress in general, I do not have knowledge of any major relationship issues. If confirmed, I will be committed to maintaining a transparent and strong relationship with Congress.

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

Response: If confirmed, I will ensure the leadership of the SASC and other defense committees are informed in a timely manner of significant OT&E and LFT&E results. I will make my staff available to work with the defense committee staffs to ensure they are informed. My top priority will be to support congressional requests for independent and objective evaluations and information from the Office of the DOT&E.

Independence and Objectivity

Congress established the position of DOT&E as an independent and objective evaluator of the performance of major systems. Section 139 of title 10, United States Code, states that "The 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, Technology, and Logistics and all other officers and entities of the Department of Defense responsible for acquisition."

Can you assure this Committee that, if confirmed, you will be independent and objective in your evaluations, and that you will provide your candid assessment of Major Defense Acquisition Programs to Congress?

Response: Yes. Independence and objectivity are bedrock to the Office of the Director, Operational Test and Evaluation. The effectiveness and credibility of DOT&E are a direct reflection of the integrity, independence, and leadership of the Director. I assure the Committee that if confirmed, I will be independent and objective, and will provide Congress my unvarnished assessments.

In your view, does the DOT&E have the necessary authorities under sections 139 and 2399 of title 10, United States Code, and applicable Departmental regulations to carry out the duties prescribed?

Response: Yes, and I believe the current provisions under sections 139 and 2399 of title 10, United States Code should be preserved.

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

What is your view of these requirements?

Response: I believe these requirements are appropriate, and if confirmed, I will ensure the Office of the DOT&E follows them. Impartiality of the testers involved in operational test and evaluation is indispensable in obtaining a fair and objective understanding of the capabilities of the system. Employees of the contractor for the system being tested must not be involved in its operational test and evaluation except when the Secretary of Defense determines that persons employed by that contractor would be involved in future deployment of that system in combat. I agree with that policy and with the restriction of contracting any person for advisory and assistance services if that person participated in the development, production or testing of that system.

How would you maintain independence from the often conflicting goals of the acquisition community and the mandates for necessary operational testing?

Response: Throughout my professional career I have demonstrated integrity and courage. If confirmed, I firmly believe that these attributes will also guide me to maintain independence as the Director of Operational Test and Evaluation. The acquisition community and operational testers share a common goal: to field the best, most cost-effective military systems for our military personnel, as quickly as possible. With this as a common objective, if confirmed, I would work to establish open and honest working relationships with senior leaders within the OSD and Service acquisition communities, and insist that my staff do the same.

<u>Operational Testing Issues</u>

How would you balance the tradeoffs between rapid deployments of new capabilities with the need to ensure that said capabilities are fit for purpose?

Response: If confirmed, I would make rapid deployment of new capabilities one of my priorities. In my experience as an engineer and tester, I have found that conducting appropriately tailored, operationally realistic testing early in a program's development can identify problems early, so that they can be addressed early. Early identification and

correction of deficiencies can allow rapid fielding of necessary combat capabilities, in a measured and incremental fashion. Doing this enables fielding a capability that works as early as possible. If confirmed, I will look for ways to conduct efficient operational testing as early as possible, and recommend that the program office support such testing.

How would you manage major disagreements with the Office of the Secretary of Defense and/or the military services, especially in cases where they seek to progress or approve programs despite operational testing that suggests further development is required?

Response: I believe open and honest communication with OSD, Service acquisition officials, and Congress, of significant results from OT&E is critical. If confirmed, I will prioritize such communication, and ensure that senior leaders understand the mission impacts of fielding systems when OT&E results indicate further development is warranted.

Should the DOT&E evaluate system capabilities and testing results against formal requirements established in the program?

Response: Yes.

If confirmed, I will ensure the DOT&E evaluates system capabilities against formal requirements established by the program in operationally realistic environments as part of the DOT&E title 10 responsibilities to evaluate system performance and determine operational effectiveness, suitability, and survivability.

Should the DOT&E evaluate system capabilities and testing results in consideration to the capabilities of deployed, legacy systems that the system under testing is designed to replace?

Response: Yes.

If confirmed, I will ensure the DOT&E evaluates system capabilities and testing results in consideration to the capabilities of deployed, legacy systems that the system under test is designed to replace.

Should the DOT&E evaluate system capabilities and testing results against known or expected threats that the system will face during operational use?

Response: Yes.
If confirmed, I will ensure the DOT&E evaluates system capabilities and testing results against known or expected threats that the system will face during operational use.

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 and a requirement for direct funding of test and evaluation (T&E) facilities.

In your view, how are these changes working to address funding and sustainability concerns at the Department's test ranges and bases?

Response: If confirmed, I will review the adequacy of operational and live fire test infrastructure. I will discuss any shortfalls I identify with the Secretary and I will inform this committee of my findings and intended actions.

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

Response: If confirmed, I will review the funding of the Department's T&E capabilities, including infrastructure and workforce. I will discuss any shortfalls I identify with the Secretary and I will inform this committee of my findings and intended actions.

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

Response: My general impression is no. There are emerging technologies that need to be tested at DOD test facilities in order to stay ahead of our adversaries' threats. An alarming trend over the past 10 years is that our potential adversaries are increasing their capabilities faster than DOD's test infrastructure can adapt and realistically replicate them. The data also show the operational test workforce has been steadily declining. If confirmed, I will review the adequacy of the Department's T&E capabilities, including infrastructure and workforce, to perform the full range of T&E responsibilities of Department weapons systems and equipment. I will discuss any shortfalls I identify with the Secretary and I will inform this committee of my findings and intended actions.

What are your views about the importance of accurately projecting future test facility resource requirements and budgeting for these needs?

Response: In my opinion, accurately projecting future test facility resource requirements and budgeting for these needs is essential for the DOT&E mission to conduct adequate

operational and live fire testing to determine operational effectiveness, suitability, and survivability.

How will the sufficiency of investments in test resources and workforces be factored into your assessments and review of proposed test plans and schedules for acquisition programs?

Response: If confirmed, I will review the sufficiency of investments in test resources and workforces as these affect the Department's ability to conduct adequate operational and live fire testing of acquisition programs. Adequate resources are a key factor in determining the adequacy of Test and Evaluation Master Plans (TEMPs) and test plans. I will inform senior Departmental leadership and Congress of test resource and workforce shortfalls so that they can be addressed.

How do you plan to evaluate and improve the operational testing workforce in the Department especially 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?

Response: New technologies, especially embedded software are exponentially improving the functionality of weapons systems, both ours and the adversary's. However, emerging technologies are creating vulnerabilities that can be exploited. This will require testers who have domain understanding of new technologies. This challenge cannot be solved by DOT&E alone. The DOT&E has historically advocated for necessary improvements in the Services operational testing workforce, and included an assessment of the operational testing workforce in previous annual reports to Congress. If confirmed, I will continue to do so, and will team with Congress, the Director of Test Resource Management Center, the Secretaries of the military services, service Operational Test Agencies, Defense Acquisition University, DOD Federally Funded Research and Development Centers, testing professional societies, academia and industry to address critical workforce gaps.

What is your assessment of the current level of support for Office of the Secretary of Defense developmental test and evaluation capabilities?

Response: Under the Department's current plan for implementing the FY17 NDAA reforms, it is not clear who will have authority for DT&E within OSD or where the current DT&E personnel will reside. Given the importance of robust DT&E to the success of DOD acquisition programs, I believe it is critical that the Department maintain a robust DT&E oversight capability within OSD, with leadership empowered to advocate for, and report on the results of, robust DT&E.

Office of the Director of Operational Test and Evaluation

How would you assess the adequacy of resources provided to the Office of DOT&E given the missions and responsibilities of the office?

Response: The most important resource within the Office of DOT&E is the workforce. To adequately assess the operational effectiveness, suitability, and survivability of weapon systems, there must be a clear understanding of the current operational tactics, techniques and procedures and the operational threats to these systems. The new technologies embedded in our weapons systems require testers with a deep domain understanding of these technologies. If confirmed, I will make it my priority to assess whether the Office of DOT&E has adequate resources to perform its responsibilities.

In your view, does the Office of DOT&E have sufficient support from Federally Funded Research and Development Centers and other contractors to support designated missions?

Response: If confirmed, I will inventory the organic workforce and current FFRDC support to confirm the work is being accomplished in the most efficient manner that will sustain the current and projected workload.

In your view, does the Office of DOT&E's current workforce represent the correct mix between government and contractor personnel?

Response: If confirmed, I will evaluate the workforce ratio to confirm the workforce mix is appropriate to perform the work in the most efficient manner to sustain the current and projected workload.

Does the Office of DOT&E need any special 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?

Response: If confirmed, I will evaluate the efficacy of special personnel authorities in the Office of the DOT&E. I appreciate the support of Congress for such special authorities in the past, and I believe it is critical to make these authorities permanent in order to continue to hire and retain the needed technical expertise in DOT&E.

Does the Office of DOT&E need any special acquisition or management authorities to more effectively and efficiently perform designated missions?

Response: If confirmed, I will evaluate whether the Office of the DOT&E requires any special acquisition or management authorities to more effectively and efficiently perform designated missions.

Tailoring Operational and Developmental Testing to Defense Acquisition Program Models

The Department of Defense's acquisition process is no longer one-size-fits-all. According to DOD Instruction 5000.02, Operation of the Defense Acquisition System, "[Milestone Decision Authorities] will tailor program strategies and oversight, including program information, acquisition phase content, the timing and scope of decision reviews and decision levels, based on the specifics of the product being acquired, including complexity, risk factors, and required timelines to satisfy validated capability requirements."

Considering the various defense acquisition program models:

How should the Department determine the appropriate point in concept development of a new acquisition program for incorporation of T&E planning and integration of testing requirements?

Response: Test and evaluation planning and integration should be part of the development planning process for a new acquisition program from the very inception of the acquisition program. Test and evaluation should be part of a process to assess the capability gap and validate the requirements before a concept becomes an acquisition program. Incorporating T&E planning into this process will also help ensure requirements are testable. Once a system enters into the Materiel Solution Analysis phase; results from early T&E can be reflected in the request for proposal, the acquisition strategy, and the contract.

What steps, if any, do you believe the Department should take to ensure that testing takes place early enough in the program cycle to identify and fix problems before it becomes prohibitively time-consuming and expensive to do so?

Response: I believe that operationally realistic testing should occur as early as possible during program development. If confirmed, I will encourage robust DT&E, collecting OT&E-relevant data during early DT&E events, and integrated DT&E and OT&E events early in program development.

What are your views on the current relationship between developmental and operational testing?

Response: If confirmed, I will evaluate the current relationship between developmental and operational testing. I believe the DT&E and OT&E communities must have a strong and mutually beneficial relationship focused on the delivery of weapons that work and are useful to the warfighter. As previously indicated, the Department has not yet clarified the placement of DT&E functions within the DOD's reformed acquisition management structure.

Do you believe there is value in involving the operational test and evaluation community in providing input into developmental testing and, if so, at what point should that process begin?

Response: Yes, I believe there is great value in involving the operational test and evaluation community whenever possible. The operational test and evaluation community should influence early testing to be as realistic as practicable. This would help identify and correct system deficiencies early in the design process when they are much cheaper to fix.

Under what development approaches is it appropriate for developmental and operational testing to be combined?

Response: I believe there are many instances where integrated DT&E and OT&E is beneficial, where OT evaluations can benefit from data acquired during DT, and where DT events can benefit from greater operational realism. For example, DT&E results can help inform the content of OT&E for software intensive programs. For electronic warfare systems, testing against threats may be more informative and cost-effective in a laboratory environment. I believe the Department should always look for efficient ways to combine and integrate test events and results irrespective of the particular development approach. I do not believe combining test planning and execution limits the independent operational evaluation of the DOT&E.

The reorganization of the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics offers the opportunity to reassess the structure and location of the Office of the Secretary of Defense's developmental test and test resource management capability.

From your perspective, what is the optimal structure for these capabilities and where should they be located organizationally?

Response: I believe the DT&E and test resource management functions are critical to delivering weapons that work. Regardless of the organizational structure ultimately agreed upon by Congress and the Department, I believe the official responsible for DT&E should be responsible for directly reporting to senior Department officials the adequacy and results of DT&E, and be sufficiently resourced to perform these responsibilities. I believe the official responsible for the test resource management function should have the authority to ensure the DOD's test resources are adequate to support current and future developmental and operational testing.

<u>Testing in the Context of Incremental Development and Agile Methods</u>

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 acquisition process toward smaller increments fielded more frequently, posing challenges for developmental and operational testing.

What are the major unique challenges to the testing of information systems and software?

Response: Primary challenges include the complexity of major DOD information systems and software, and the integration of such systems and software into complex legacy systems and networks. Large information systems such as those supporting advanced fighter aircraft, global command and control, battle management, DOD-wide healthcare, and Service-wide financial and personnel services often have millions of software lines of code supporting hundreds of critical functions. These systems typically must integrate with dozens of complex legacy systems spanning the globe, and operate in environments with limited network bandwidth, all while surviving kinetic, cyber, and electronic attacks by an enemy. Testers must design tests that reflect this complexity, while emulating an operationally realistic environment, including the threats.

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

Response: As with any system, the DOT&E should oversee OT&E of software intensive weapons systems, business systems, and enterprise information systems and report the adequacy of testing to determine operational effectiveness, suitability, and survivability. As the Department moves away from a traditional acquisition process toward smaller increments fielded more frequently, the DOT&E should develop policies for OT&E aimed at tailoring the level of OT&E to the risk involved for the warfighter/user should the software increment to be fielded demonstrates less than desired performance.

Are you satisfied with the Department's capabilities—including tools and test environments—to test and evaluate information systems, including embedded software?

Response: If confirmed, I will evaluate the Department's capabilities—including tools and test environments—to test and evaluate information systems, including embedded software. I will discuss any shortfall I find with the Secretary and inform this committee of my findings and intended actions.

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?

Response: I believe the Department should be extremely cautious in using the results of commercial sector testing as part of its evaluation of system performance. However, in my opinion, DOD has not fully leveraged the T&E resources of the commercial sector nor of academia, both of which can make significant contributions to the overall T&E process. If confirmed, I will review DOD current IT T&E capabilities in the context of those offered by the commercial sector and academia. I will discuss any shortfall with the Secretary and inform this committee of my findings and recommendations.

What methodological or procedural changes are required of the DOT&E in order to effectively test software developed using agile development methodologies?

Response: Agile development methodologies were designed to incrementally and iteratively develop software solutions. This process allows the system to keep pace with current threats and emergent technologies. Each increment should be evaluated for its operational utility and survivability. Procedurally, I believe OT&E and DT&E should function as an integrated team for an agile-based development program and be embedded within the program. Automated testing is a best-practice methodology used in commercial markets to rapidly deliver the minimum viable product to the market. If confirmed, I will assess commercial best practices for testing systems that are developed by agile methods, and if applicable, implement them within the DOT&E community.

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

Response: My experience in dealing with the challenges of testing software intensive systems has demonstrated the Department has gaps in its overall expertise, tools, and staffing across the system lifecycle. I am concerned about DOD's ability to continually stress DOD systems in a dynamically changing operational/cyber environment in order to identify and mitigate vulnerabilities. The complexity of software-defined weapon systems has created unique testing challenges. It is difficult to achieve a complete understanding of the scope and magnitude of the gaps, but if confirmed, I will evaluate for adequacy the Department's expertise, staffing, and funding to carry out its testing responsibilities as they relate to software intensive systems. I will discuss any shortfalls I find with the Secretary and inform this committee of my findings and intended actions.

Business and Cloud Computing Systems

Are you satisfied with the Department of Defense's capabilities to test business systems?

Response: DOD has had mixed results with current testing practices for business systems. I generally agree with the GAO's recent findings and recommendations; that we

can and should improve developmental testing for DOD business systems. If confirmed, I will evaluate for adequacy the Department's capabilities to test business systems. I will discuss any shortfalls I find with the Secretary and inform this committee of my findings and intended actions.

How would you improve the capabilities to evaluate the operational suitability of business systems and the business processes they are intended to support?

Response: In the FY16 Annual Report to Congress, the DOT&E outlined best practices observed in successful Major Automated Information Systems developed by the Department. These include 1) robust senior-level participation in resource allocation, shortened decision cycles, and enforcement of updated business practices; 2) flexible and disciplined requirements management, driven by the user's operational needs; 3) change management that starts early and continues throughout program development; 4) an architecture description in accordance with the Department's Architectural Framework; and 5) robust developmental testing with operationally representative interfaces and networks. It is my opinion, that implementing the practices described in the DOT&E report would improve the Department's ability to evaluate the operational suitability and effectiveness of major business systems and improve the Department's ability to deliver systems that are operationally suitable and effective. If confirmed, I will evaluate for adequacy the Department's capabilities to evaluate the operational suitability of business systems and the business processes they are intended to support. I will discuss any shortfalls I find with the Secretary and inform this committee of my findings and intended actions.

Are you satisfied with the Department's capabilities to test cloud computing systems and services?

Response: The Department's ability to test cloud computing systems and services that the Department owns and operates may be adequate. On the other hand, the Department has no authority to conduct independent testing on commercial cloud systems, unless the commercial entity permits such testing. Without proper contractual agreements with the commercial cloud providers, the Department may not be able to adequately assess critical aspects of these systems, such as cybersecurity. If confirmed, I will evaluate for adequacy the Department's capabilities to test cloud computing systems and services. I will discuss any shortfalls I find with the Secretary and inform this committee of my findings and intended actions.

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

Response: In my opinion, the biggest challenge to cloud computing operational suitability is determining cyber effectiveness and deployment agility. Rapidly deploying

new features is a key benefit of the commercial cloud, but commercial cyber practices are typically not up to DOD standards. DOD's stringent security requirements greatly complicate migration of DOD business systems to the cloud and limits DOD's ability to conduct scalability testing. If confirmed, I will evaluate for adequacy the Department's capabilities to evaluate the operational suitability of cloud computing systems and services. I will discuss any shortfalls I find with the Secretary and inform this committee of my findings and intended actions.

Testing of Commercial Technologies

The Department of Defense is making significant efforts to use more commercial technologies and systems, including technologies and software developed in Silicon Valley.

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

Response: A Silicon Valley approach to developing software is to produce a minimum viable product and get it to market to satisfy the early adopter. The next set of features are developed after considering feedback from the product's initial users, and this cycle continues. I suggest that DOD become an early adopter for those commercial systems that have application to the defense mission, and develop a capability to incrementally roll out systems. Additionally, as DOD acquires commercial software or technologies defined by software, the software code and related documentation must be provided if developed specifically for the DOD and its capability is not classified or export restricted. If confirmed, I will evaluate the policies and practices that the Department has to govern the developmental and operational testing of these kinds of commercial systems. I will discuss any shortfalls I find with the Secretary and inform this committee of my findings and intended actions.

Adaptation of T&E to Evolving Acquisition Strategies

If confirmed, how would you propose to achieve an appropriate balance between the desire to reduce acquisition cycle times and the need to perform adequate testing and evaluation?

Response: Achieving a proper balance between assuring operational effectiveness, suitability and survivability and continual delivery of warfighter competitive advantage depends on making the operational test community an integral member of the acquisition team from the earliest possible time. In that way, the acquisition process will include the identification of the most critical operational characteristics of the system that reflect how the system will perform in the warfighting environment. If confirmed, I will evaluate the efficacy of existing policies and practices to achieve an appropriate balance between the desire to reduce acquisition cycle times and the need to perform adequate

testing and evaluation. I will discuss any shortfalls I find with the Secretary and inform this committee of my findings and intended actions.

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

Response: Rapid and agile acquisition is inherently about continuous engineering to enhance warfighter capability across the lifecycle. In this model, it is imperative that T&E be based on an integrated DT&E and OT&E strategy that builds on the evidence from each developed block or increment of capability delivered. If confirmed, I will propose three criteria for rapid/evolutionary acquisition programs. First, the test and evaluation community should be an active member of the acquisition team. Second, we should forge a stronger relationship between the acquirers, developers and operators. And third, we should assure that the T&E strategy is robust throughout the acquisition lifecycle yet flexible enough to be effective and affordable.

If confirmed, how would you ensure that critical equipment being fielded is effective, safe, and suitable for our military to take into combat?

Response: The equipment fielded today is more complex in design than in previous generations, and we expect it to be more effective, keep our combatants safe, and deliver high mission value. If confirmed, there are two actions I will take in collaboration with the Services and the T&E community. First, I will make sure we have the necessary focus early in acquisition on the operational capability of equipment and that we have the T&E policies, practices, and resources in place to continuously evaluate the mission effectiveness and suitability of such equipment. Second, I will work with the operational commanders and the acquisition community to ensure DOD's making the appropriate tradeoffs to deliver equipment to the warfighter that is effective, suitable and survivable for combat.

What are your views on the testing and evaluation of systems under spiral, iterative, or agile development?

Response: I view spiral, iterative and agile development as risk-driven development processes that start with a small set of requirements and progress through each phase of the development lifecycle. Spiral and other development methods have advantages in certain applications, making it imperative for developers to select the method that enables the system being developed to be most successful. In order to deliver timely test results with any development method, the most effective T&E approach is to become engaged early to influence the testability of the system. If confirmed, I will ensure that OT&E sets a strategy that aligns T&E with the velocity of the development method and

that testers are equipped with the knowledge, skills, and experience to execute their roles regardless of the development environment.

Do you believe that follow-on operational testing and evaluation should be required for each program spiral or deliverable?

Response: Yes. I believe that it is important to view T&E as a continuous process for the lifecycle of the system. The pace of technology change and emerging advanced threat systems, coupled with the need to maintain our warfighters with the competitive advantage means that T&E is never done. This is especially the case with software-intensive systems, where we make more changes that impact system performance and functionality through software than through hardware.

How should the Department's service and agency test organizations project future resource requirements given the uncertainty of testing demand, urgent operational needs, and rapid fielding and development initiatives?

Response: By monitoring the Department's investments in its science and technology (S&T) portfolio and by mirroring those areas with investments in the T&E/S&T portfolio, the Services and Test Resource Management Center can position the Service and agency test organizations to be ready to test the solutions developed with state of the art technologies. I believe this approach can mitigate the uncertainty surrounding future T&E resource requirements because solutions for urgent operational needs, and rapid fielding and development initiatives will be limited by what is technically feasible based upon technology readiness levels.

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?

Response: Yes. Combined testing and training events add value through a broader, more varied context than would otherwise be the case in stand-alone testing. When the test criteria and training objectives can be synchronized and safety issues adequately addressed, I believe operational testing should be combined with scheduled training exercises. There are several reasons that make testing during training exercises very appealing, such as interoperability with real coalition partners and other friendly forces, exposure to high fidelity threat and red defensive systems, evaluating high ops tempo maintenance procedures and providing an opportunity to compare the capabilities of new and legacy systems. Also, user involvement in the development process provides a means to modify or experiment with new ConOps and TTPs, and

provide opportunities for earlier identification of system deficiencies.

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

Response: There are barriers, but in my opinion, none that should be considered insurmountable. The key to combining testing with scheduled training exercises is to design scenarios that will allow for gathering the right T&E data and conducting a meaningful training exercise. At times, testing and training objectives differ, and can be philosophically opposing. To mitigate this, priorities for the exercise need to be decided early in the planning cycle. Another barrier is that it can be challenging to predict the maturity of the system in test at the time of the exercise. A third barrier is spectrum management for data collection and training center activities. Finally, combining test assets and training asset could present significant safety issues.

How can training and testing ranges be used more jointly and efficiently?

Response: I believe impediments to using training and testing ranges more jointly and efficiently include the difference between the testing and training culture. Specifically, the differences in how test events and training events are funded given reduced budgets, overtaxed personnel, and scheduling conflicts on test/training ranges. These compounding effects make joint testing and training difficult to accomplish, despite its potential advantages.

"System of Systems" Testing

What inherent challenges exist for operational testing with regard to the Department of Defense's programs that are a part of an overall "system of systems"?

Response: In my view, the OT&E "systems-of-systems" challenge is driven by multiple factors. At one level, DOD systems operate interdependently in a net-centric environment. Significant resources are required just to verify and validate the performance of the networks across an ever-expanding set of mission systems. Second, the challenge of evaluating groups of manned and autonomous systems operating together as one fighting force executing wartime missions. It is critical that DOD have the ability to rapidly reconfigure and tailor packages of warfighting capability using new and legacy systems that were architected to different cybersecurity standards. At this level, understanding how to perform OT&E in mixed configuration is a major challenge. Finally, "systems-of-systems" OT&E may never stop in order to keep pace with emerging technologies and evolving missions.

How should a "system of systems" be tested to assess the effectiveness of the whole system?

Response: DOD has made progress in understanding "system-of-systems" testing and creating a robust infrastructure to integrate capabilities in a joint "system-of-systems" environment. DOD continues to invest in the Joint Mission Environment Test Capability, which enables a distributed and network-testing environment. If confirmed, I will work collaboratively with the T&E community to assess the maturity and capacity of this capability to identify the gaps that need to be addressed with the ever-increasing complexity and scale of a "system of systems."

Live Fire Testing

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

Do you believe that the Department of Defense's current live fire testing program is accomplishing its purpose?

Response: Yes.

The live fire testing program continues to prove the capability of new weapon systems against real threats and to take all reasonable measures to assure these systems and their occupants will survive the violence of combat.

What are the major challenges facing the live fire testing program?

Response: The live fire testing program should ensure it is resourced and staffed to adequately stay ahead of the current and expected threats. The survivability of new defense systems, including those in space, should be assessed against the operationally relevant spectrum of threats, both evolving kinetic threats and more sophisticated non-kinetic threats.

What is the Department's role, if any, in the research, development, and acquisition process with respect to live fire testing for Preliminary Design Model Tests, First Article Tests, and Lot Acceptance Tests?

Response: A major benefit from the live fire testing program is the focus it places on military materiel developers to ensure system and crew survivability and lethality are high priority. Inherently, the live fire testing program is designed to uncover and address

design shortcomings that had been built in, inadvertently or as a result of design trade-offs, that could adversely affect the system survivability, user casualties, or lethality. Developers, knowing that systems will undergo the scrutiny of live fire testing, place emphasis on designing in survivability and lethality. The Department has played a major role in live fire testing for Preliminary Design Model Tests, First Article Tests, and Lot Acceptance Tests. As an example, the Department has rigorously reviewed and generated science-based updates to test protocols to optimize system performance while minimizing government risks to support fielding of personal protection equipment. If confirmed, I will continue to provide oversight of live fire testing that supports contractor or materiel down select decisions and evaluate the Department's role in the research, development, and acquisition process with respect to live fire testing for Preliminary Design Model Tests, First Article Tests, and Lot Acceptance Tests. I will discuss any shortfalls I find with the Secretary and inform this committee of my findings and intended actions.

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?

Response: Live fire testing leading to a fielding decision or full-rate production is inherently governmental. Our warfighters should be provided with 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 conducted to a common standard, appropriate for the intended use of the data.

<u>Modeling and Simulation</u>

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 the developed product?

Response: I believe OT&E should be completed using actual testing of the developed product, wherever possible, in order to accurately evaluate its capabilities in an operationally realistic environment. However, a verified, validated, and independently accredited modeling and simulation (M&S) capability can save time and expense in testing. M&S can help in selecting the right subset of all possible operational conditions in which to conduct live testing, saving test resources. M&S can also build higher confidence in the results of operational testing, especially in cases where the scope of live testing is limited. In some cases, testing of a capability in an operationally realistic

combat environment is not feasible or practical. In cases where M&S is used, it should supplement actual OT&E rather than replace it, and should be accredited for use by an independent test agency based on a comparison of M&S results to live test results. To maximize the usefulness of the M&S, it should be designed into the test program early and developed to support acquisition timelines.

For DT&E, accredited M&S can be used more aggressively, and can be an essential element to understanding the performance of a complex system under a variety of operational conditions. Combinations of live testing and M&S can help inform both DT&E and OT&E.

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?

Response: Yes. In my opinion M&S tools should be developed for cyber T&E as an analog to kinetic testing. For example, cyber loads-testing M&S tools should be developed to stress software in order to identify coding flaws that can be fixed or redesigned before deploying the system. Similarly, LFT&E cyber tools should be developed to attack software-defined weapon systems to find vulnerabilities and confirm the system is survivable

T&E Science and Technology

What are your views on the appropriate level of investment in the science and technology (S&T) of testing?

Response: Weapon systems today, and the environment in which they must operate and survive have become very complex. The developmental and operation testing tools must also adapt to that complexity. However, the Department has historically failed to prioritize resources in support of S&T for testing, especially in the resource-constrained environment of the last few years. The Department faces critical challenges as it begins to develop new military technologies such as hypersonic and directed energy weapons, and cyber capabilities. DOD will need to deal with a rapidly advancing threat environment, best exemplified by the fact that space is no longer a sanctuary, but is rapidly becoming another warfare domain. Investments in S&T for testing will be critical to acquire the test capabilities required to conduct adequate T&E on emerging technologies, in the emergent threat environment. If confirmed, I will evaluate the Department's level of investment in the science and technology (S&T) of testing. I will discuss any shortfalls I find with the Secretary and inform this committee of my findings and intended actions.

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

Response: In annual reports to Congress, the DOT&E has pointed out specific test areas where more S&T is required in order to ensure future OT&E adequacy. DOT&E has also historically prepared issue papers for the Department's annual program and budget reviews, which highlight particular test resource issues, including those related to S&T. If confirmed, I will evaluate the Test Resource Management Center T&E/S&T portfolio. I will discuss shortfalls with the Secretary and keep this committee informed of my findings and intended actions.

What areas should the Department's S&T program be investing in to improve the quality of current and future testing capabilities?

Response: I believe S&T areas for investment include hypersonic weapons and defense, directed energy, contested space, cybersecurity, data analytics, electronic warfare, nuclear survivability, spectrum allocation, and real time casualty assessment. If confirmed, I will evaluate the TRMC T&E/S&T portfolio. I will discuss shortfalls with the Secretary and keep this committee informed of my findings and intended actions.

Operational Test Agencies

Operational Test Agencies (OTAs) 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 to evaluate information assurance, information operations, and joint T&E requirements.

In your view, are these agencies sufficiently staffed to perform the required functions?

Response: I am not aware of any specific OTA staffing shortfalls at this time. The DOT&E recently completed an analysis of the OTA workforce. This study showed that the OTAs have recently improved their hiring of key personnel, improved the training and educating of the workforce, and have increased the number of personnel with military experience. If confirmed, I will evaluate whether the OTAs are sufficiently staffed to perform the required functions. I will discuss shortfalls with the Secretary and keep this committee informed of my findings and intended actions

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

Response: US Code Title 10 and DOD Directives require DOT&E to assess the adequacy of operational testing. Services retain the responsibility to ensure programs are managed to meet testing requirements. One initiative that is helping address disconnects between acquisition timelines and the OTA's assessment of IOT&E resources is all of the Service OTAs have implemented initiatives to move operational test planning

before the request for proposal. The OTAs can then inform the program managers of their independent assessment of T&E resource needs prior to contract awards. If confirmed, I will ensure DOT&E facilitates dialogue between the program managers, the OTA, and senior Service and OSD stakeholders to ensure the Services ultimately support adequate OT&E.

Do you have any concerns about the independence of the OTAs?

Response: The independence of the OTAs must be protected, and this will always be a concern. Direct reporting to their respective Service Chief helps maintain the OTA independence; however, caution must always be exercised. There must to be a bright-line between the OTAs and Service Acquisition Executives. If confirmed, I will be mindful of OTA independence.

Should policies and procedures of the OTAs be standardized across the Department of Defense?

Response: I do not believe it is necessary to standardize policies and procedure of OTAs across the Department. Each Service OTA has defined processes for conducting OT&E tailored to their unique weapon systems. The goal is to perform adequate operational test and evaluations to show the system is ready for combat, standardization could limit their flexibility. If confirmed, I will meet with the OTAs to confirm my current perception is correct.

Encroachment and Environmental Issues

As is the case with military training, the Department of Defense's test and evaluation efforts can be hampered by encroachment and constrained by environmental regulations, both on land and at sea.

To what extent do you believe encroachment and environmental requirements on and around test and evaluation ranges are affecting the quality and quantity of the Department's test and evaluation programs?

Response: I believe DOD has been proactively addressing the many challenges related to range capabilities and encroachment; those challenges continue to grow, new ones emerge, and dynamic conditions and events exacerbate the original challenges. DOD's 2016 Report on Sustainable Ranges well states the range of challenges, including encroachment issues, affecting the scope of DOD's test and evaluation programs. Land use near military installations is a growing issue due to residential and commercial development along with increasing competition for land, airspace and water access can constrain training, testing and other military base activities. The DOD test community separately reports on encroachment factors affecting research, development, test, and

evaluation activities in their Strategic Plan for DOD T&E Resources. The training and testing communities, with the support of the installations and environment community, continue to work together to address encroachment issues under the Sustainable Ranges Initiative (SRI). To date, the DOD has implemented programs and processes to mitigate encroachment around its T&E ranges, which have preserved the quality and quantity of the DOD T&E programs. This is, however, an area that bears constant vigilance and due diligence by the Services and OSD.

What specific steps should the Department take to ensure that it has adequate spectrum to conduct developmental and operational test missions?

Response: DOD has always considered electromagnetic spectrum a vital resource. However, the demand for spectrum access from the commercial market is very strong. If confirmed, I recommend a three prong strategy to ensure adequate spectrum for developmental and operational testing. First, work with spectrum policy officials to protect T&E spectrum or establish T&E protection zones. Second, develop methodologies to enable spectrum sharing between test ranges and commercial users when feasible. Third, develop technology solutions to offset potential loss of spectrum like advanced modulation schemes and using non-traditional telemetry spectrum. If confirmed, I will monitor frequency spectrum issues related to the conduct of developmental and operational test missions and will address issues that may adversely impact use of spectrum for T&E.

Congressional Oversight

In order to exercise its legislative and oversight responsibilities, it is important that this Committee and other appropriate committees of Congress are able to receive testimony, briefings, and other communications of information.

Do you agree, if confirmed, to appear before this Committee and other appropriate committees of Congress?

Response: Yes.

Do you agree, if confirmed, to appear before this Committee, or designated members of this Committee, and provide information, subject to appropriate and necessary security protection, with respect to your responsibilities as the DOT&E?

Response: Yes.

Do you agree to ensure that testimony, briefings, and other communications of information are provided to this Committee and its staff and other appropriate committees in a timely manner?

Response: Yes.

Do you agree to provide documents, including copies of electronic forms of communication, in a timely manner when requested by a duly constituted committee, or to consult with this Committee regarding the basis for any good faith delay or denial in providing such documents?

Response: Yes.

Do you agree to answer letters and requests for information from individual Senators who are members of this Committee?

Response: Yes.

If confirmed, do you agree to provide to this Committee relevant information within the jurisdictional oversight of the Committee when requested by the Committee, even in the absence of the formality of a letter from the Chairman?

Response: Yes.