Advance Policy Questions for Stephen P. Welby
Nominee for the Position of Assistant Secretary of Defense for Research and Engineering

1. Duties

1.1 What is your understanding of the duties and functions of the Assistant Secretary of Defense for Research and Engineering?

The Assistant Secretary of Defense for Research and Engineering (ASD(R&E)) is the principal staff advisor to the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)) and to the Secretary and Deputy Secretary of Defense, for research and engineering matters. The ASD(R&E) serves as the Chief Technology Officer for the Department of Defense.

1.2 What background and experience do you possess that you believe qualify you to perform these duties?

I believe my strong, multidisciplinary background in technology and technical leadership has prepared me well to perform these duties. I have over 28 years of professional experience as an engineer and technologist, serving both in and out of government, working on cutting-edge technology development. I am currently serving as the Acting Principal Deputy Assistant Secretary of Defense for Research and Engineering and as the Deputy Assistant Secretary of Defense for Systems Engineering (DASD(SE)). As the DASD(SE), I serve as the senior leader for the Department's systems engineering workforce, support the Military Departments and Defense Agencies in the execution of engineering and development efforts, and advise the USD(AT&L) on the technical execution and risk of major defense acquisition programs. I began my technical career in a defense laboratory, and I have previously served in a number of leadership roles at DARPA. If confirmed, I believe my background and experience would enable me to discharge the responsibilities of the ASD(R&E) to develop technology that enhances the operational capabilities required by our armed forces.

1.3 Do you believe that there are actions you need to take to enhance your ability to perform the duties of the Assistant Secretary of Defense for Research and Engineering?

I believe that I have the necessary background, skills, and ability to perform the duties of the ASD(R&E).

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

If confirmed, I expect the Secretary to assign me duties and functions commensurate with those of a Chief Technology Officer, and any other duties the Secretary may deem appropriate.

2. Relationships

Section 138(b)(8) of title 10, United States Code, and DoD Directive 5134.3 discuss the responsibilities and functions of the Assistant Secretary of Defense for Research and Engineering. Other sections of law and traditional practice also establish important relationships outside the chain of command. Please describe your understanding of the relationship of the Assistant Secretary of Defense for Research and Engineering with the following:

A. The Deputy Secretary of Defense

If confirmed, I would work closely with the Deputy Secretary to provide advice and assistance commensurate with the role of a Chief Technology Officer, including transitioning technology to the field, prioritizing science and technology investments, supporting a culture of institutional innovation, and leveraging technology to enhance current and future military capabilities.

B. The Under Secretary of Defense for Acquisition, Technology, and Logistics

The ASD(R&E) is subject to the authority, direction, and control of the USD(AT&L). If confirmed, I expect to support the USD(AT&L) with technology insight and technical leadership for the defense research and engineering community.

C. The Under Secretary of Defense for Intelligence

If confirmed, I would work closely with the Under Secretary of Defense for Intelligence to ensure our research and engineering needs are synchronized across the Department. I believe intelligence on emerging adversary capabilities is critical to informing and shaping our defense research and engineering programs.

D. The Under Secretary of Defense (Comptroller)

If confirmed, I would work closely with the Under Secretary of Defense (Comptroller/Chief Financial Officer) to ensure that investments in research and engineering meet the overall priorities of the Department and are managed in accordance with DoD policy.

E. The Under Secretary of Defense for Personnel and Readiness

If confirmed, I would work closely with the Under Secretary of Defense for Personnel and Readiness to ensure that our current research and engineering workforce is ready to support the needs of the Department, and to ensure that the technical talent necessary for the future readiness of our forces would be available to the Department.

F. The Deputy Chief Management Officer of the Department of Defense

If confirmed, I would work closely with the Deputy Chief Management Officer of the Department of Defense on issues regarding the effective and efficient execution of the Department's research and engineering practices.

G. The Service Secretaries

If confirmed, I would work to foster a close working relationship with the Military Departments to support their research and engineering priorities and technology investments and to ensure that the overall Department research and engineering portfolio is aligned and balanced.

H. The Service Acquisition Executives

Research and Engineering is critical to the overall acquisition process, so I view the Service Acquisition Executives as being among the primary customers of the knowledge and capabilities developed through the defense research and engineering enterprise. If confirmed, I would work closely with the Secretaries of the Military Departments and the Service Acquisition Executives on research and engineering matters that leverage technology for their missions.

I. The Service Science and Technology Executives

The Service S&T Executives are responsible for developing and executing the science and technology programs for their respective Service. If confirmed, I would work to share technical insights and to ensure that the overall DoD S&T investment is coordinated and provides the best possible military capabilities and return on the taxpayer's investment.

J. The Directors of Department of Defense Laboratories and Research Centers

If confirmed, I would work closely, through the heads of the DoD components, with the Directors of Defense Laboratories and Research Centers to provide them with the guidance, resources, and support needed to deliver technology in support of DoD needs. I would also work to establish and maintain standards for laboratory and research center performance.

K. The Director of the Defense Advanced Research Projects Agency

If confirmed, I would work closely with the Director of the Defense Advanced Research Projects Agency (DARPA) to ensure that DARPA continues to explore new technical fields, create technological surprise, and develop new technologies that have a profound impact on national security in accordance with DoD Directive 5134.10.

L. The Director of the Defense Threat Reduction Agency

If confirmed, I would work with the Director of the Defense Threat Reduction Agency on research and engineering matters, including those pertaining to weapons of mass destruction.

M. The Joint Staff

If confirmed, I would work closely with the Joint Staff to consider technology options and alternate procedures to enhance DoD systems and ensure our warfighters are affordably equipped with superior warfighting capabilities.

N. The Director, Defense Test Resource Management Center

If confirmed, I would work with the Director, Defense Test Resource Management Center to consider technology options and alternate procedures to enhance the effectiveness and efficiency of the test resources employed in the test and evaluation of DoD systems, including new and developing requirements such as cybersecurity testing.

O. The Director, Operational Test and Evaluation

If confirmed, I would work with the Director, Operational Test and Evaluation, to include consideration of technology options and alternate procedures for enhancing the operational test and evaluation of DoD systems.

P. The Director of the Joint Improvised Explosive Device Defeat Office

If confirmed, I would work with the Director of the Joint Improvised-Threat Defeat Agency, or any successor to it, to identify technology and system solutions for defeating current threats and countering future anticipated threats.

Q. The Department of Defense Chief Information Officer

If confirmed, I would work closely with the Chief Information Officer to provide and align technology options to support the delivery and cyber protection of enhanced information management, information assurance, satellite communications, navigation and timing, spectrum utilization, and global military telecommunications capabilities.

R. The Director of the Defense Information Systems Agency

If confirmed, I would work closely with the Director of the Defense Information Systems Agency to support the provision, operation, and surety of the Department's globally accessible enterprise information infrastructure, command and control, and information-sharing capabilities.

S. The Director of the White House Office of Science and Technology Policy

If confirmed, I would work closely with the Director of the White House Office of Science and Technology Policy to ensure DoD research and engineering goals and priorities are aligned with the Administration's goals and priorities.

3. Major Challenges

3.1 In your view, what are the major challenges that will confront the Assistant Secretary of Defense for Research and Engineering?

The Department currently faces the most technically challenging future defense environment we have seen since the Cold War. I believe the critical task for the ASD(R&E) will be protecting the future technological edge of U.S. forces, by ensuring that the warfighter has access to technical capabilities that counter, defeat, and provide compelling overmatch against those that can be fielded by any potential adversary. U.S. military technological strength provides the critical underpinning to U.S. conventional deterrence. Today's emerging competitive technology environment will require faster and smarter development and adoption of innovative, technologically enabled capacities that offset the growing technical capabilities of potential threats.

A second challenge involves ensuring that we can affordably deliver advanced capabilities in an efficient and effective manner, to permit modernization to continue at pace, even in a fiscally constrained environment. This challenge motivates the use of novel technologies and new system concepts and architectures that enable significant reductions in overall lifecycle cost.

A third challenge is the need to refresh continually the core technologies that support our defense advantage – the disruptive breakthrough capabilities that allow the U.S. to "leap ahead" of potential adversaries. The discovery engine that underpins our warfighting technologies offers a critical hedge against uncertainty, mitigates against technological surprise, and supports our system development efforts.

A fourth critical challenge is the need to ensure that the defense research and engineering enterprise is responsive to the demands of both the current conflict and the developing strategic environment – accelerating those advanced capabilities that can make a critical difference from laboratory to battlefield.

3.2 Assuming you are confirmed, what plans do you have for addressing these challenges?

If confirmed, I would develop research and engineering plans that address these and other challenges, leveraging the strengths of the Military Departments and Defense Agencies to meet the defense science and technology needs of the warfighter. These plans would emphasize opportunities for increased effectiveness and efficiency across the Department's research and engineering enterprise.

3.3 What do you consider to be the most serious problems in the performance of the functions of the Office of the Assistant Secretary of Defense for Research and Engineering?

A long-term challenge for the defense research and engineering enterprise is the "graying" of our workforce, within the office of the ASD(R&E), across the Military Departments and Defense Agencies, and within the defense industrial base. Our senior workforce possesses significant skill and experience, but over the near term the R&E enterprise will see an accelerated loss of experience as a significant fraction of its workforce retires. Attracting, developing, and retaining talent with critical twenty-first century skills in domains such as advanced microelectronics, cybersecurity, embedded software development, and data analytics will be a significant challenge to the performance of the functions of the Office of the ASD(R&E) over the next decade.

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

If confirmed, I would work with other OSD offices and the Military Departments to explore creative solutions to refresh the technical talent of the Department's workforce. Solutions may include specific workforce development initiatives, opportunities to provide greater flexibility to those who wish to spend a "tour" with the Department as part of their career, and innovative projects to enhance the environment and culture of the Department's research and engineering institutions to make them more attractive to key talent.

4. Priorities

4.1 If confirmed, what broad priorities would you establish in terms of issues that must be addressed by the Assistant Secretary of Defense for Research and Engineering?

If confirmed, I expect my priorities for the Department's research and engineering enterprise to be consistent with those established by the Secretary and the USD(AT&L).

These priorities would include:

1) Responsively addressing the technological needs of the warfighter in support of ongoing operations
2) Developing technologically enabled capabilities that establish and preserve U.S. military technological advantage against potential adversaries
3) Developing leap-ahead science and technology that offer a long-term disruptive advantage to U.S. forces
4) Maintaining the capacity of the Department to attract and retain the best and brightest scientists and engineers
5) Encouraging appropriate relationships with academia and industry to pursue cutting-edge science and technology
6) Enhancing warfighting capabilities by supporting acquisition programs with technologies that make weapon systems more effective and affordable

4.2 What defense technologies do you consider the highest priorities for development to enhance DoD's ability to pursue its designated missions?

I believe that an effective research and engineering program must focus on balance – balance between near- and long-term technology development and balance between pursuing technology that supports continuous improvement in military capability and technology with the potential for more revolutionary impact. There are many opportunities to leverage technology to provide capability advantage for U.S. forces. Today, near-term opportunities exist in areas such as autonomy, data analytics, communications, electronic warfare, propulsion, cyber-defense, undersea technologies, advanced manufacturing, and space technologies that can shape new systems concepts and operational architectures. Over the longer term, emerging ideas in areas such as quantum science, material science, biology, and new computational architectures will feed future capability opportunity.

4.3 What will be your strategy for developing these technologies in a manner to support needed defense capabilities in a timely and cost-effective way?

If confirmed, I would look at all available development strategies and evaluate them against the constraints of being timely and cost-effective. I believe that the future competitive national security environment will drive the Department to place increasing value on the pace by which we move technologically enabled capabilities from concept to field. To accelerate our pursuit and exploration of innovative concepts, the Department must make best use of its own in-house capabilities, those of academia, and those of industry – large and small. We must also be open to new engagement with innovative non-traditional commercial entities and make better use of the global capabilities of our partners and allies.

5. <u>Investment in Science and Technology</u>

5.1 If confirmed, what metrics will you use to assess the size and portfolio of investments made under the defense science and technology (S&T) program?

I believe the Department's S&T program must forge ever-closer relationships with the requirements, intelligence, acquisition, sustainment, and logistics communities as it discovers, develops, and matures advanced technologies. Metrics and measures can help the S&T community assess its effectiveness in meeting the needs of these communities. The Department's current S&T investments range from those addressing long-term, strategic objectives to those focused on narrower, nearer-term project goals, and appropriate metrics must be established that reflect the differences in nature, goals, and risk versus payoff of the work. If confirmed, I would leverage the ongoing efforts of the 17 communities of interest under the Reliance 21 process to identify and characterize technology impact through performance measures. The Better Buying Power 3.0 initiative is also focused on improving performance of the S&T enterprise by developing metrics and measures that can help identify where we are having the most impact in creating options to help shape future military competition, moving technology into the hands of our warfighters, and creating opportunities for new and novel military capabilities. If confirmed, I would leverage these ongoing efforts.

5.2 What role should the Assistant Secretary of Defense for Research and Engineering play in the detailed development and coordination of service and agency S&T investment strategies, programs, and budgets?

I believe the ASD(R&E) should provide investment and management guidance that integrates Military Department and Defense Agency efforts to provide a full spectrum of DoD capabilities. Each of the Military Departments and Defense Agencies S&T programs should leverage and complement each other's efforts. The ongoing Reliance 21 effort provides an overarching framework to support joint S&T planning and coordination, ensuring that the joint DoD S&T community provides solutions and advice to the Department's senior-level decision makers, warfighters, Congress, and other stakeholders in the most effective and efficient manner possible. If confirmed, I anticipate leveraging the Reliance 21 process to support information sharing, alignment of effort, coordination of priorities, and support for scientists and engineers across the Department.

5.3 What, in your view, is the role and value of S&T programs in meeting the Department's transformation goals and in countering irregular, catastrophic, traditional, and disruptive threats?

The Department's S&T portfolio plays a vital role in producing and maintaining operational advantages for our force, in meeting the Department's goals for transformation, and in countering irregular, catastrophic, traditional, and disruptive threats. The DoD S&T program provides the foundation for all of the Department's capability development. An investment in S&T that is balanced across near-term capabilities and long-term technological options ensures that critical warfighter

challenges are met with effective, multi-domain solutions. With the warfighter and national security in mind, our scientists and engineers generate innovative solutions to address the vast array of current and future threats.

5.4 What S&T areas do you consider underfunded by the Department?

The ASD(R&E) and the DoD Components balance S&T resources across the budget submission to ensure that resources are applied to the highest payoff areas and are focused on the most critical emerging technologies. The Department continually assesses which technology areas have the greatest opportunity to bring advantage to our warfighters and we develop new programs and focus research in those areas. Routine communication among the ASD(R&E) and DoD Component S&T executives is critical to ensure we remain closely aligned and focused on the most critical threats. While I believe the overall S&T budget is appropriate, given the many demands on national security resources, I believe there are a number of fast-moving areas where the Department should consider additional emphasis. Some potential examples include: Advanced robotics; autonomous, distributed and collaborative systems; new frontiers in quantum science; new computing architectures; new engineering, design and manufacturing capabilities; advanced cyber-security capabilities and increased emphasis on prototyping and experimentation. If confirmed, I would work with the Military Departments and Defense Agencies to ensure that our portfolio of investment is balanced and adequately focused on these and other potential high-payoff S&T areas.

5.5 In your judgment, will the funding levels in these areas affect the Department's ability to meet the threats of the future?

In a time of significant pressure on resources, the Department has continued to protect stable S&T funding, in order to preserve its capacity and prepare for an uncertain future. I believe, with appropriate balancing across technical opportunity, the Department's S&T budget is sufficient to prepare adequately for the threats of the future.

5.6 Do you feel that the Department's current science and technology investment strategy strikes the appropriate balance between funding innovative, disruptive technologies and addressing near-term operational needs and military requirements?

Yes, I believe the current DoD S&T investment strategy strikes an appropriate balance between funding innovative, disruptive technologies (such as new capabilities for directed energy weapons) and addressing near-term operational needs and military requirements (such as software and systems capabilities to increase operator effectiveness). As technology evolves and the threat changes, DoD must constantly re-examine and adjust our S&T strategies to ensure that this balance is maintained.

6. Basic Research

6.1 Given the continuing nature of basic research and the broad implications and applications of discovery-focused and innovation-focused sciences, what criteria would you use, if confirmed, to measure the success of these programs and investments?

DoD's investment in basic research has played and continues to play a central role in creating and preserving our military technological advantage. Today's fielded technologies are rooted in and dependent upon the basic research discoveries of past decades. Basic research introduces disruptive change, born of new knowledge and physical insight, but this change typically emerges over time.

If confirmed, I would continuously assess our investments in basic science and discovery by asking a series of questions about each effort:

- Does this basic research investment lead to the creation of new fields of interest and/or help mitigate DoD capability challenges?
- Do the investments lead to original approaches and novel technical strategies to meet DoD needs?
- Does this investment lead to original, multidisciplinary approaches or support radically new perspectives?
- Are the results of this research contributing to and being vetted by the broader community, including universities, industry, and through publication in peer-reviewed journals?
- Do the types of problems and approaches supported by this DoD investment selectively attract the finest scientists and engineers in the Nation to build a broader and smarter national security community?

I believe these questions provide a test of the relevance and quality of DoD's S&T investments.

6.2 What concerns do you have, if any, about current levels of funding for Department basic research? How would you plan to address those concerns?

I believe that, in the context of finite resources, the current level of funding for the Department's basic research is reasonable, and represents a historically stable balance with overall S&T funding. Stability of research funding is necessary to provide continuity of research capabilities. If confirmed, this is an area I would watch closely.

6.3 If confirmed, how would you determine whether there is an adequate investment in basic research to develop the capabilities the Department will need in 2025?

If confirmed, I would review existing studies of the Department's basic research activities and budgets. Making this assessment is, in part, a subjective one, depending on the balance of research opportunities, near-term needs and long-term

investments, and input from experienced S&T resources. This includes input from external sources, including the National Research Council and the Defense Science Board.

6.4 If confirmed, what steps, if any, will you take to increase efforts in unfettered exploration, which has historically been a critical enabler of the most important breakthroughs in military capabilities?

If confirmed, I would reemphasize to the DoD Components S&T executives, my belief that basic research is a critical component of our future military capability, and that the Department – from its senior officials to its bench scientists – should engage and be engaged with the Nation's and the world's leading scientists and engineers. If confirmed, I would also commit to the Department's policy of minimizing restrictions on Department scientists to perform and interact with great research, and to reinforce our policy that sponsored fundamental research shall be performed without restriction, other than those restrictions imposed by law or national regulation.

7. Chief Technology Officer

If confirmed, as Assistant Secretary of Defense for Research and Engineering, you will be the Chief Technology Officer (CTO) of the Department of Defense.

7.1 What do you see as the role of the CTO of the Department of Defense?

The role of the Chief Technology Officer of the Department is defined in the ASD(R&E) charter. The charter defines the role of the ASD(R&E) as the Principal Staff Assistant to the USD(AT&L) and the Secretary on all technical matters. The ASD(R&E) should provide guidance to shape the DoD S&T program and should lead efforts to develop technology options for the Department. The CTO should also contribute significantly to ensuring that major acquisition programs are conducted with acceptable technological risk.

7.2 What experience do you have in your career that will enhance your ability to serve as CTO of DoD?

My broad background in defense technology development provides the critical background and requisite knowledge to permit me to serve effectively as CTO of DoD. This experience includes time spent as a researcher in a defense laboratory, as a program manager and senior leader directing major research investments at DARPA, working critical technology programs with each of the Military Departments, and my experience over the past five years as the DASD(SE) within the Office of the ASD(R&E)

7.3 Do you believe the position for Assistant Secretary of Defense for Research and Engineering currently has adequate authorities to exercise the responsibilities of a CTO?

Yes

7.4 How are the activities of the Advanced Manufacturing Institutes being incorporated into the Department's science and technology activities?

I am aware that each of the Advanced Manufacturing Institutes currently has an S&T lead to connect each Institute back to the Department's broader science and technology activities. If confirmed, I would review the interaction of the planned work of the Advanced Manufacturing Institutes with the Department's science and technology activities.

7.5 What is the status of the Department's long-range research and development planning activities? What noteworthy results have been realized from that initiative so far?

The Long-Range Research and Development Planning Program is a line of effort under the Defense Innovation Initiative which is focused on identifying emerging technology and materiel opportunities that could strengthen DoD capabilities in a competitive future national security environment. Since November 2014, I have been leading the 2015 LRRDPP study, which has included engaging technical experts across the Department's research and engineering enterprise, as well as academic, not-for-profit, and defense and non-defense commercial organizations, to identify emerging opportunities for future military innovation. The classified LRRDPP study continues to identify opportunities to accelerate and demonstrate new system concepts that can inform future materiel plans.

It is also anticipated that this effort will identify key research and engineering areas for assessment and prioritization in future research and engineering planning. To date, among other input, the study has completed its review of over 400 submissions received from outside the Department in response to the 2014 Request for Information and have conducted site visits, meetings, and interviews with DoD and Department of Energy labs, small businesses, corporate research and development centers, academic institutions and intelligence community organizations. We are in the process of synthesizing the results of this study into a set of classified recommendations for the Deputy Secretary of Defense. We have synthesized the results of the first phase of the study into a set of classified recommendations for the Deputy Secretary of Defense. The second phase of the study is ongoing.

We anticipate that these specific results will emphasize themes supporting the use of limited autonomy to enable deploying manned and unmanned systems together in new ways to enable new capabilities, themes that permit the execution of precision capabilities from long range, and themes that provide new ways to counter the complex threat environment we anticipate when operating against technologically advanced actors in the future.

8. Offset Technologies

During the Cold War, the DoD pursued three key technologies to offset the numerical superiority of Soviet conventional forces: precision guided munitions, stealth technology, and satellite-based navigation. These three technologies have given U.S. forces unparalleled superiority until now. However, with advancements by our emerging adversaries, it seems like the military technological superiority is beginning to erode. As a result, it is critical that the United States once again focus on offsetting the technology advantages being gained by our adversaries.

8.1 Which technology priorities do you believe the Department of Defense should be pursuing to maintain the military technological superiority of the United States?

Since the Cold War, U.S. forces have had assured conventional military technology dominance over every adversary they have faced or might have faced. The combination of precision weapons, advanced intelligence surveillance and reconnaissance systems, stealth, digital command and control, and space-based capabilities including navigation and communications have provided clear technology overmatch against any potential adversary. Over the last 30 years, others have had significant opportunity to study the systems and technologies that advantage U.S. military capabilities. In recent years, other nations have begun to field systems that are closing the gap with U.S. capabilities and, in some cases, directly challenging the technical advantages we have used in the past to enable U.S. power projection. This is a result of specific investments made by potential future competitors, the globalization of advanced technology, supply chains, and technical talent, and the loss of technical data through cyber exfiltration.

I believe that the Department of Defense should pursue innovative technologies that will minimize the effectiveness of these foreign investments and create the opportunity to impose extraordinary cost on future adversaries. These technological priorities should shift future national security competition from areas where U.S. advantages are narrowing to areas where U.S. strengths in agility, flexibility, and technical execution can flourish. Critical to executing these priorities will be identifying opportunities to drive cost out of future systems – through advanced design technologies; prototyping and demonstration; and advanced, flexible manufacturing capabilities to reduce risk. If confirmed, these areas would be a high priority for me.

8.2 What strategies would you recommend that Secretary Carter implement to develop these technology priorities?

The Department is emphasizing the need to pursue innovative system concepts and technology solutions being developed within the Department itself, within the defense sector, and within the non-defense commercial sector, where the pace of technology adoption is often greater. We have increased our engagement with technology developers globally to ensure that we have awareness of and can leverage the best

technical capabilities, regardless of source. Most importantly, the Department is re-emphasizing the importance of prototyping, demonstration and experimentation as a means to mature rapidly emerging technical capabilities, gain insight into the operational capabilities they might offer, and to more rapidly inform modernization program development. These three approaches – (1) openness to innovation, (2) speed from idea to implementation, and (3) prototyping, demonstration, and experimentation to inform decision making – provide a means to explore new offsetting technological advantages, and if confirmed, these approaches would be a priority for me.

8.3 What role do the Services have to play in their development?

I believe that the Military Departments play an essential role in developing, maturing, and fielding the future systems necessary to shape the future competitive strategy of the Department.

9. Technology Readiness Assessment Process

9.1 Have you participated in or observed the development of Technology Readiness Assessments to support Milestone Decisions for defense acquisition programs?

Yes, as the DASD(SE), I have observed and supported the Technology Readiness Assessment process and its employment in defense acquisition decisions.

9.2 What is your assessment of the value, strengths, and weaknesses of the current process?

The Technology Readiness Assessment process provides a valuable measure of the maturity of critical technology elements in a defense acquisition program and can be useful in highlighting areas where relatively immature technologies may increase acquisition program risk. The existing process, however, reduces this very complex and somewhat subjective assessment to a single number, which offers limited insight into the actual risk that an acquisition system may bear. There are many technical risks that should be assessed in evaluating a defense acquisition program, including integration risk, supply chain risks, and reducibility risks. Technology Readiness Assessments can contribute, but they are only one part of a holistic assessment of overall program risk. If confirmed, I would be particularly attentive to ASD(R&E) efforts to assess the full range of technical risk as part of our efforts in support of defense acquisition programs.

9.3 Would you recommend any changes to the processes used for the assessment of technological maturity and integration risk of critical technology elements?

In my current assignment as DASD(SE), I led an evaluation of our acquisition technical risk management process and have published guidance to the Department on more effective formal risk management, with a particular focus on improving our

capacity for active risk mitigation. If confirmed, I would continue to investigate methodologies that would provide better insight into technology maturity and integration risks in the context of an overall acquisition program risk management framework.

9.4 Are you satisfied that the Assistant Secretary of Defense for Research and Engineering is properly staffed and resourced to support decision makers in complying with the technology certification and assessment requirements that are its responsibility?

I believe the Office of the ASD(R&E) is currently adequately staffed to perform its various responsibilities with respect to technology certification and assessment.

9.5 What changes, if any, would you anticipate making, if confirmed, in this process?

If confirmed, I do not anticipate proposing any changes to the current technology certification and assessment requirements, but I would seek to leverage better these assessments as part of an increased emphasis on technical risk management and mitigation as a critical engineering function.

10. Coordination of Defense S&T Internally and with Other Agencies

10.1 If confirmed, how do you intend to integrate the S&T programs of the Services and Defense Agencies to reduce redundancy, leverage investments, and promote cooperation in order to achieve greater efficiency and technological advancement? Will you use existing structures such as Reliance 21?

If confirmed, I would expect to continue to employ the Reliance 21 process to integrate and coordinate Military Department and Defense Agency S&T programs. The Reliance 21 process has been successful in leveraging S&T efforts across the DoD Components to improve efficiency and effectiveness, spur collaboration, and reduce undesirable duplication of effort.

10.2 Do you believe the mechanisms of coordination between federal civilian agencies and the Department are adequate to ensure that the military can best leverage the advances of agencies such as:

- **National Science Foundation on defense needs for basic science, especially in social sciences?**

  DoD funds basic research in targeted areas deemed most critical for defense but also relies heavily on complementary basic research insights funded by U.S. Government agencies such as the National Science Foundation. I believe that coordination between the DoD and NSF is critical and is currently adequate and effective.

In the social sciences in particular, where defense efforts tend to be more narrowly scoped for particular regions and problems, DoD projects frequently build on NSF-funded basic research insights regarding the more universal drivers and mechanisms for conflict and cooperative behavior at individual and group levels. Without a robust NSF investment in social sciences, DoD would need to divert its social science research funds away from specific defense issues to fill in those foundational gaps.

- **National Aeronautics and Space Administration on hypersonics and other space research and the viability and availability of testing facilities?**

  I believe the current level of coordination of DoD efforts with NASA is adequate and effective. NASA provides input for our biennial Space S&T Strategy report and the Department reviews draft NASA technology roadmaps to identify areas for cooperative activities. In addition, NASA and DoD participate in numerous forums where our staffs interact, at both the working and senior levels, to discuss and coordinate our efforts.

- **National Institutes of Health on areas in which military medical research and vaccine development overlap with civilian medical needs?**

  I believe the current level of coordination of DoD efforts with NIH is adequate and effective. The focus of NIH investment (the broad health needs of the Nation) and the focus of DoD health care S&T investment (the specific and unique medical needs of the warfighter) differ, but in areas where military and civilian research needs overlap many programs are complementary and mutually supportive. The degree of collaboration in these areas is extensive. For example, programs for the development of Human Immunodeficiency Virus vaccines are collaborative efforts with the aim of meeting programmatic objectives of both the NIH and the military. These efforts have made use of the extensive laboratory and clinical trials managed and maintained by the military while taking advantage of the extensive fundamental and applied research effort of both the NIH and the military focused on developing new vaccine candidates. The synergy between these programs was critical to the development of the only vaccine candidate that provided some degree of protection against HIV and for improvements to the vaccine that will ultimately be used to protect both military and civilian populations. If confirmed, I will work with the ASD(Health Affairs) and the Surgeons General to foster collaborative research and development efforts with NIH in areas of mutual interest.

- **Intelligence Community in setting defense research priorities to prepare for future threat environments?**

I believe that the DoD effectively leverages the Intelligence Community to inform defense research prioritization and planning. In my current role as DASD(SE), I support the reinvigorated initiatives under Better Buying Power 3.0 focused on integrating acquisition, intelligence, and requirements more closely. One additional initiative is the Science and Technology Intelligence Needs Plan that informs the intelligence community on the Department's intelligence needs for S&T. If confirmed, I would ensure that dialogue between the Department and the Intelligence Community is open and transparent.

- **Department of Homeland Security on homeland defense and national security-related science?**

  I believe that the current level of coordination of DoD efforts with the Department of Homeland Security is adequate and effective and provides strategic leverage across the technology investments being made by the two Departments.

10.3 If confirmed, how would you work with other federal agencies and the Office of Science and Technology Policy to improve coordination?

If confirmed, I would work with other federal agencies and with the OSTP to ensure that DoD research and engineering are well coordinated with other government efforts.

11. Technology Strategy

11.1 What weaknesses, if any, do you see in the current Defense S&T strategic planning process?

I observe that the current Defense S&T strategic planning process is significantly labor intensive – which can create challenges in generating timely recommendations to support the Department's annual budget submission.

11.2 What do you believe are the key attributes for a good technology strategic plan that can be effectively utilized for programming and budgeting purposes?

I believe an effective technology strategic plan should include (1) specific, time-phased, and actionable recommendations for technology development and demonstration; (2) a clear mapping between technology activities and potential outcomes, demonstrating clear relevance to the Department's mission; and (3) specific quantified goals and targets to provide insight into progress.

11.3 If confirmed, how would you work to ensure that strategic plans are utilized during the budget planning and programming process?

If confirmed, I would work to make Reliance 21 and the Communities of Interest more strategic in their planning and more efficient and effective in implementation through directly, explicitly, and transparently linking Reliance 21 recommendations to ASD(R&E) budget inputs and recommendations.

12. Technology Transition

The Department's efforts to quickly transition technologies to the warfighter have yielded important results in the last few years. Challenges remain, however, in successfully transitioning new technologies into existing programs of record, fielded systems, and major weapon systems and platforms.

12.1 How would you assess the effectiveness of current transition systems?

The current system is most effective when transitioning technological capabilities to support existing programs of record. The S&T laboratories are well connected and responsive to the needs of the program offices. Initiatives such as the Rapid Innovation Fund and Foreign Comparative Test provide program offices with access to non-traditional small businesses and international businesses – sources of new and novel solutions.

The current system is less able to recognize and transition opportunistic capability – new and emerging technologies opportunities that emerge during development or which disrupt current acquisition plans. In these cases the Department needs to be more effective at assessing technical opportunity and creating opportunities to deploy more rapidly emerging capabilities to achieve maximum benefit with minimum impact. If confirmed, I would work to improve mechanisms for planned and opportunistic technology transition into DoD systems.

12.2 What challenges exist in technology transition within the Department?

A key challenge in technology transition is the mismatch between the risk acceptance posture of technology developers and that of acquisition program managers. Technology developers are motivated to take risk and to explore the art of the possible, while acquisition managers are motivated to minimize risk and to pursue stable, well-understood capabilities to minimize overall acquisition program risk. I believe that aligning incentives so as to motivate program managers continually to review technology options to improve performance and reduce cost, and to motivate technologists to harden, demonstrate, and de-risk emerging technologies, would significantly aid technology transition.

12.3 What would you do, if confirmed, to address these challenges?

If confirmed, I would vigorously support the Better Buying Power 3.0 direction to emphasize technology insertion and technology refresh in program planning. Initiatives under Better Buying Power that emphasize modular, open system

architectures, initiatives that support rapid technology insertion, and initiatives that promote increased use of rapid prototyping and experimentation to mature and de-risk technologies and demonstrate operational utility all help increase the Department's ability to transition research and development more quickly and effectively to operational use.

12.4 What is the role of the Assistant Secretary of Defense for Research and Engineering in facilitating communication between technical communities, acquisition personnel, and end users to speed technology transition?

I believe an effective ASD(R&E) must work closely with the requirements community, the acquisition community, the research and development community, and the operational communities to provide new technologies that sustain our technological superiority against potential future adversaries. The ASD(R&E) must coordinate across this broad set of communities: coupling technical opportunity to emerging requirements; informing technology development with operational feedback; and aiding transition of capabilities from research and development to acquisition. If confirmed, I would connect and coordinate these diverse communities to speed technology transition from concept to field.

12.5 Do you believe that we need to change the manner in which we fund technology transition in the Department of Defense? If so, what changes would you recommend?

Technology development is sometimes challenged by the availability of non-program-specific applied technology funding used to mature technologically driven capabilities, to prototype and experiment with emerging system concepts, and to support bridging technology development to support the transition of technology to programs of record and the warfighter. While the Department has protected S&T funding levels, Advanced Component Development and Prototypes funds are increasingly consumed by the demands of modernization programs and other uses directly tied to specific acquisition programs. If confirmed, I would explore ways to provide the flexibility needed to improve technology transition.

13. <u>Systems Engineering and Prototyping</u>

13.1 Do you feel that the Department of Defense has sufficient systems engineering expertise in its current workforce or contractor base?

Based on my engagement across this community and with acquisition leadership in each of the Components, I believe that the current systems engineering technical capacity and capability supporting the DoD is sufficient. I also believe that this workforce possesses and has demonstrated strong technical capabilities. It will be important to ensure that the workforce is technically refreshed as new challenges arise, and as technical disciplines mature.

13.2 What will be the impact of further reductions in personnel to the ability to execute the systems engineering missions of the Assistant Secretary of Defense for Research and Engineering?

System Engineering oversight functions that are part of the Military Departments and OSD headquarters elements will likely be impacted by proposed across-the-board headquarter staff reductions, and additional efficiencies will need to be identified to meet mission requirements

13.3 What changes, if any, do you believe should be made in the Department's systems engineering organization and practices?

I have worked with the Military Departments to optimize organic systems engineering practices. These are now reflected in policy, the foremost example being the recently updated DoD Instruction 5000.02 that revised DoD systems engineering policy, and reflects a stronger engineering participation and technical risk consideration across the acquisition activities. Our current systems engineering organizations and practices are adequate but should evolve as engineering tools and methods are developed and matured.

13.4 What is the value of competitive prototyping in increasing the success of DoD acquisition efforts?

Competitive prototyping is most effective at increasing the likelihood of success of DoD acquisition efforts when it drives real risk reduction in the actual product that the Department will acquire and field. Under the right conditions, competitive prototyping can be expected to have several benefits to DoD programs, including: reduction of overall technical risk; validation of cost; validation of design; evaluation of the manufacturing process; and refinement of program requirements. Competitive prototyping imposes costs, since the Department must carry multiple offerors far enough through the design process to produce prototypes for evaluation. This cost penalty can sometimes reduce the advantage of competitive prototyping, making it most effective in cases where the cost/benefit ratio is clearly advantageous, where multiple design options merit further exploration, or where the competitive environment drives early return on lifecycle cost.

13.5 If confirmed, how will you work to increase the amount of systems engineering projects and competitive prototyping efforts that are undertaken by the Department of Defense and its contractor base?

In my current role as DASD(SE), I have supported robust systems engineering and risk-appropriate, cost-effective prototyping. If confirmed, I would continue to emphasize a robust systems engineering process across the Department's acquisition portfolio.

14. <u>Venture Capital Strategies</u>

In recent years, some components of the Department of Defense have attempted to follow the lead of the intelligence community by using venture capital firms to make investments in developing technologies.

14.1 What role do you believe that venture capital firms should play in DoD's investments in developing technologies, including in the Small Business Innovation Research program?

I believe that small, early-stage companies are a significant driver of innovation in our Nation–leveraging U.S. strengths in entrepreneurship, acceptance of risk, and access to technical talent and smart capital to create businesses that are shaping the commercial technology landscape. I believe the Department needs to be engaged with innovative early-stage firms throughout the country, to explore the relevance of applying cutting-edge commercial capabilities to meet the Department's needs and to encourage small innovative companies to see the Department as a smart and engaged potential customer for their ideas. The Department's Small Business Innovation Research program is a very effective means of engaging these companies. If confirmed, I would explore an alternative means to reach out to these companies, such as by using venture-capital-like approaches to engage companies early, with the objective that they consider the Department's requirements among the targets for their product development priorities.

14.2 What advantages and disadvantages do you see in the use of venture capital strategies?

Venture capital strategies could permit the Department to engage innovative companies in a natural way — by supporting their need for critical investment to support the development of innovative capabilities. This could provide the Department with access to innovation that we might not be able to reach through other approaches. Venture capital strategies, however, are inherently risky. Most early stage companies likely will not achieve breakthrough innovations, and a venture capital strategy must be patient enough to accept the risk profile associated with making a number of investments with the goal of seeing a fraction of them yield concrete benefit.

14.3 When DoD does decide to use venture capital strategies, what steps do you believe the Department should take to ensure that DoD funds are invested in technologies and companies that properly reflect national defense priorities, avoid the potential for conflicts of interest by industry partners, and ensure that the Department's investments are not diluted?

I believe it would be critical to evaluate carefully investments made through a venture capital strategies approach, and to assess whether leveraging a venture-capital strategy is truly the most effective and appropriate model for investing in a particular technology or engaging a particular company.

14.4 What other strategies do you intend to employ, if confirmed, to ensure that the nation's most innovative companies work on Department of Defense research and engineering programs?

In April, Secretary Carter announced the Defense Innovation Unit-experimental, an activity in the San Francisco Bay Area to provide a mechanism to increase the Department's presence in an area of significant entrepreneurial innovation. Communication and outreach efforts are effective ways to attract and engage innovative companies. If confirmed, I would explore methods to increase the Department's engagement with and outreach to the most innovative companies across the Nation.

15. International Research Cooperation

15.1 In your view, how should increased globalization of defense technology affect DoD's research and technology development and investment strategy?

The increased globalization of defense technologies provides both opportunities and challenges for the Department. To the extent DoD can leverage technology developments in allied and friendly nations, DoD will be able to redirect resources to address other critical needs. This would also provide opportunities for DoD to increase commonality with these nations, creating increased efficiencies for all. However, globalization of defense technology creates challenges to our technological superiority through proliferation of advanced military capabilities.

15.2 What is your assessment of the value of cooperative research and development programs with international partners?

Our international cooperative research and development programs are based on equitable investment by all participants. In addition to reducing cost burdens, these cooperative programs enable us to interact with the best and brightest in many nations. Cooperative research and development programs deepen our defense relationships with our allies and other partner nations.

15.3 In your view, what are the obstacles to more effective international cooperation, and, if confirmed, how would you address those obstacles?

Successful international cooperative research and development programs require trusted partnerships between the nations involved in them. These require commitment by all parties, which includes providing adequate levels of funding and involvement. If confirmed, I would attentive to ensuring our proposed international cooperative efforts address these commitments.

15.4 How will increased international technology cooperation affect our domestic defense industrial base?

International cooperative research and development programs can provide opportunities for the industrial base to work with and develop relationships in other nations. This can lead to increased business opportunities through creation of trusted partnerships. It can also provide the Department with increased access to world-class research and researchers.

15.5 How should DoD monitor and assess the research capabilities of our global partners and competitors, and of the global commercial sector?

DoD maintains awareness of global S&T and commercial capabilities through our global technology watch efforts and through the Military Departments' regional and global international S&T offices. If confirmed, I would support and strengthen these critical tools for providing situational awareness of the competitive global S&T landscape.

16. Test and Evaluation

16.1 What are your views on the adequacy and effectiveness of the Department's development and operational test and evaluation activities?

I believe the Department's developmental test and evaluation and operational test and evaluation activities are adequate and effective. Test activities play a critical role in informing acquisition decision making and in identifying programmatic opportunities for application of additional engineering and risk mitigation resources.

16.2 What will be the impact of further reductions in personnel on the ability to execute the test and evaluation missions of the Assistant Secretary of Defense for Research and Engineering?

Further reductions in test and evaluation workforce capacity would require the Department to identify new efficiencies to effectively execute its T&E mission and will require careful planning and management attention. Developmental test and evaluation oversight functions that are part of the Military Departments and OSD headquarters elements will likely be impacted by proposed across-the-board headquarter staff reductions, and additional efficiencies will need to be identified to meet mission requirements

16.3 What changes do you anticipate will be made in the Department's developmental testing organization and capabilities?

I do not anticipate changes to the Department's developmental testing organization and capabilities. The establishment of the position of the Director of Developmental Test and Evaluation, now the DASD(DT&E), significantly

strengthened the Department's test discipline and practice, and I have had the privilege of working closely with the DASD(DT&E) in my current capacity.

16.4 What modifications would you recommend to the test and evaluation processes in the Department of Defense to more efficiently and quickly develop and deliver operationally effective and suitable technologies to the warfighter?

I believe that the test community needs to be engaged early and continuously with acquisition programs to ensure that opportunities for early, effective, and cost-efficient test are designed into program plans and that test activities produce actionable information to inform programmatic decision making. I also believe that strong DT&E can be an effective way to minimize risk, and to avoid discovery of issues in OT&E by identifying and correcting issues early in the design and development process. If confirmed, I would support efforts to improve the test community's early and continuous engagement.

17. Small Business Issues

17.1 If confirmed, how would you work to ensure that the Small Business Innovation Research (SBIR) program serves a useful purpose in meeting the Department's research goals?

The policy oversight and responsibility for the SBIR/STTR falls within the Department's Office of Small Business Programs. If confirmed, I would work closely with the Director of Small Business Programs to ensure that the program remains focused on innovation and technology advancement and aligned with the Department's overall research goals. The SBIR /STTR program is a major contributor in meeting the Department's research goals and fosters a broad and innovative small business industrial base to meet critical warfighter needs.

17.2 What recommendations would you suggest to the SBIR program to improve the transition of S&T capabilities into acquisition programs?

The recent Better Buying Power 3.0 included efforts focused on improving the transition of SBIR-developed S&T capabilities into acquisition programs. Last year the Department included transition goals and incentives in DoD Instruction 5000.02. If confirmed, I would pursue reinforcing these initiatives to continue to improve SBIR transition with guidance, education, and training across the Department.

17.3 What recommendations would you suggest to the SBIR program to improve its ability to attract non-traditional defense contractors, such as small startup companies, into the program?

If confirmed, I would explore avenues to continue to improve the ability of DoD to attract non-traditional defense contractors through a comprehensive outreach and

communication strategy. Annually the Department reviews over 10,000 SBIR/STTR proposals, of which approximately one-third are from newly formed businesses engaging with the Department for the first time. The Department recently has significantly increased its outreach to minorities, HUB zone, and underserved states, and I believe these efforts should be fostered and expanded.

17.4 What guidance or direction do you consider necessary regarding transition of the research results of SBIR programs to major weapon systems and equipment?

I believe the Department has adequate guidance and direction to support transition of SBIR results to major systems acquisition, but these efforts require continuous emphasis by Department advocates identifying and leveraging opportunities for transition.

17.5 What emphasis would you place, if confirmed, on participation by the acquisition community in setting research priorities for the SBIR and in accepting new solutions into existing programs of record?

I believe the acquisition and S&T communities must be strongly engaged in setting research priorities for the SBIR program to ensure the relevance of these efforts to the Department's research goals and to foster transition from SBIR to programs of record. If confirmed, I would emphasize these efforts.

17.6 In your judgment, are modifications needed to the Department's SBIR program to ensure it meets the Department's goals and is updated to support research costs of the small business community?

I am currently unaware of the need for any modifications to the Department's SBIR program.

18. Defense Laboratories

18.1 What is your overall assessment as to the technical capabilities and quality of Defense laboratories relative to their Department of Energy, FFRDC, industry, academic and foreign peers?

I believe that DoD laboratories are a critical and unique component of the Department's research and engineering enterprise. They provide the science, technology, and engineering expertise to DoD that allows our Nation to maintain a technological edge over potential adversaries. DoD technical expertise also plays a prominent role in developing technologies that benefit the Nation as a whole. While Department of Energy, FFRDCs, industry, academic, and foreign laboratories make vital contributions, they cannot replace the unique capabilities and expertise of the in-house Defense laboratories and their unique focus on, and access to, U.S. warfighter needs. Furthermore, subject matter expertise developed

in the DoD laboratories provides the knowledge necessary to evaluate and mold technologies developed by private industry and academia to meet DoD's unique needs. The DoD laboratories' complete focus on the warfighter and the mission make them unique, irreplaceable assets.

18.2 What are your views on the most effective management approach for personnel at these facilities?

I believe that the most effective management approaches for the Defense laboratories are ones that provide laboratory leadership with the flexibility needed to shape their workforce to meet the rapidly changing needs of the warfighter. The authorities currently granted to defense laboratories as Science and Technology Reinvention Laboratories are appropriate for managing the personnel at DoD laboratories and, with the support of Congress, are continually being refined to meet the changing laboratory workforce management needs of the DoD.

A review of defense laboratories operations shows various deficits in personnel management, infrastructure renewal, physical plant recapitalization rate, support services adequacy, etc. Some analyses have indicated that these deficiencies result from excessive centralized control.

18.3 Do you support significantly increased delegation of operating authority to the lab director?

I believe empowering individual leaders at the lowest appropriate level is part of the necessary flexibility for effectively managing a laboratory. There is a complementary need for some centralized coordination in order to ensure that resources are expended both efficiently and effectively. I currently am unaware of a need significantly to increase delegation but, if confirmed, I would study this issue and recommend changes as appropriate.

18.4 If confirmed, what steps, if any, will you take to improve the quality, technical capabilities, and mission performance of the Defense laboratories?

If confirmed, and building on the work of Better Buying Power 3.0 to look at laboratory return on investment, I would assess the current quality, technical capabilities, and mission performance of the Defense laboratories. I would then work in collaboration with the heads of the DoD components, and through them, the laboratories to implement any needed changes.

18.5 Would you support transitioning certain laboratory capabilities into FFRDCs or Government Owned-Contractor Operated facilities?

I am currently unaware of any capabilities that should be transitioned to FFRDCs or Government Owned-Contractor Operated facilities. If confirmed, I would make any needed recommendations as part of the assessment of laboratory capabilities.

19. <u>Laboratory Personnel Management</u>

The Department's research and development laboratories perform unique functions in serving national security missions and do not readily fit into the general operational management structure.

19.1 Would you support increasing the flexibility of the laboratories on personnel matters?

The quality of the Department's research and development laboratories is completely dependent on the ability of the labs to attract, recruit, and retain top-notch technical talent with skill sets critical to military innovation. Increased flexibility in personnel matters is an important factor in recruiting and retaining the high-caliber workforce needed by the DoD's laboratory enterprise. I support making maximum use of available direct and flexible hiring authorities for scientists and engineers, as well as allowing full use of all Science and Technology Reinvention Laboratory personnel authorities in order to compete to attract the best and brightest talent to the DoD laboratories.

19.2 What particular workforce challenges does the Assistant Secretary of Defense for Research and Engineering have?

Recruiting and retaining a world-class technical workforce is a pressing challenge for the defense research and engineering enterprise. The DoD mission requires specialized scientific and engineering skills and the Department needs to compete effectively to identify and leverage this limited talent pool. I believe that attracting, developing, and retaining talent with critical twenty-first century skills in domains such as advanced microelectronics, cybersecurity, embedded software development, and data analytics will be a significant challenge to the Office of the ASD(R&E) over the next decade.

An additional long-term challenge for the defense research and engineering enterprise is the "graying" of the workforce, within the Office of the ASD(R&E), across the Military Departments and Defense Agencies, and within the defense industrial base. The senior workforce possesses significant skill and experience, but over the near term the R&E enterprise will see an accelerated loss of experience as a significant portion of its workforce retires. If confirmed, I would be attentive to these challenges.

19.3 How do the personnel flexibilities of the Office of the Assistant Secretary of Defense for Research and Engineering compare to those of DARPA or the Defense Laboratories? Should the Office of the Assistant Secretary of Defense for Research and Engineering be permitted to use the same hiring flexibilities as these organizations?

I believe personnel flexibility is critical for recruiting and retaining the best and the brightest to our laboratory enterprise. DARPA and the Science and Technology Reinvention Laboratories (STRLs) have special authorities with regard to personnel flexibility, that do not apply to the Office of the ASD(R&E), I believe that these personnel procedures, including those applicable to OASD (R&E), have been adequate for the needs of the DoD, although I note that increased flexibility can prove useful for any part of the DoD.

20. Scientific and Technical Conferences

20.1 A recent GAO study indicated that the lengthy and burdensome approval processes for legitimate conference attendance requests at the Department of Defense have severely curtailed attendance at academic conferences. Has the work and mission of the laboratories and the Office of the Assistant Secretary of Defense for Research and Engineering been hindered by conference approval processes and travel limitations?

Collaboration with scientific colleagues is key to the success of DoD laboratory and Office of the ASD(R&E) personnel, as is the ability to share technical findings with the broader research community. Scientific exchange is one of the primary vehicles for the exchange of new ideas and is a vehicle through which new concepts and technological innovation bloom. Academic and technical conference participation for the DoD professional workforce, including scientists and engineers, is an essential element of the S&T mission and a critical means of achieving and maintaining global technological superiority.

While the Defense Laboratories and the Office of the ASD(R&E) continue to meet their mission, the conference approval processes and travel limitations have hindered this type of important collaboration. If confirmed, I would work with the USD(AT&L), the Deputy Chief Management Officer, and the Components to explore means to reduce unnecessary impediments to technical collaboration.

20.2 Has the application of the new conference approval processes since the issuance of OMB Memorandum M-12-12 "Promoting Efficient Spending to Support Agency Operations" improved the effectiveness of the DoD research and engineering community in executing its designated missions?

The September 23, 2015 memorandum from the Deputy Secretary of Defense and the associated DoD Conference Guidance Version 3.0 issued simultaneously by the Deputy Chief Management Officer recognize the importance of participation in technical meetings, symposia and conferences to the DoD Science and Engineering community. These revised policies have significantly streamlined approval authorities for technical conference attendance and are intended to remove unintended barriers to technical collaboration, while maintaining appropriate management visibility and management to control travel costs. I expect that

implementation of this revised policy will address previous concerns over burdensome local implementation of M-12-12 policy.

20.3 Does the application of the conference approval process in DoD align with best practices of the commercial sector or leading public and private academic institutions?

Recent revisions to conference approval policy are intended to align DoD practice more closely with best practice of leading public and private institutions. If confirmed, I will monitor and assess impacts of this recent policy change on the research and engineering workforce.

21. Technical and Acquisition Workforce Issues

21.1 In your view, does the Department have adequate technical expertise within the government workforce to execute its designated acquisition and technical development missions?

I believe the current scientific and engineering workforce numbers and skill mix are sufficient to meet DoD's current acquisition and technical development needs, but several trends raise future concerns. The first trend is the large number of employees in the technical workforce nearing or at retirement age. We expect that approximately half of the technical workforce will be eligible to retire in the next 10 years. The second challenge is with the most recent hires: those with 0-5 years of experience. Studies indicate that the individuals in this age group may expect to change jobs every 3-5 years. Consequently DoD will need to compete with industry to retain the newest employees. Finally, in fast moving technical areas, the Department will need to refresh, retrain, and upgrade the skills of its acquisition and technical development workforce. If confirmed, I would carefully monitor workforce data for early indications of excessive turnover and/or accelerated loss of key skills.

21.2 What efforts will you undertake, if confirmed, to improve the technical capabilities of DoD in critical areas, such as systems engineering, information assurance, social and cultural sciences, and software engineering?

The DoD Science, Technology, Engineering and Mathematics workforce represents a diverse set of very specific technical skills. Critical, high demand skills such as systems engineering, cyber security and information assurance, large data analytics, social and cultural modeling, and software engineering are areas that require particular and continued attention. Other domains, such as nuclear engineering, aerospace engineering, naval architecture, and energetics, in which DoD - unique skill sets are required, also merit specific attention. As DASD(SE), I have worked closely with leaders across the engineering community to address critical technical capabilities needed by the DoD workforce. Mitigation actions have included improved training and education, development of guidance and best practices, and

investment in the development of new methodologies to address DoD challenges. If confirmed, I would continue to work with the engineering and scientific communities to address these needs to ensure we have a workforce that can meet current and future DoD challenges.

22. Defense Advanced Research Projects Agency

22.1 What is your view of the appropriate relationship between the Assistant Secretary of Defense Research and Engineering and the Director of DARPA?

The Director of DARPA reports to the USD(AT&L) through the ASD(R&E), I believe this the appropriate relationship. In my current position, I have an excellent, strong, and ongoing relationship with DARPA.

22.2 What do you believe is the proper research mission for DARPA?

Since its founding, DARPA has a long history of being an effective engine of transformative innovation. DARPA's ability to apply innovative solutions to address some of the most difficult problems that face the DoD, now and in the future, has been the cornerstone of its success. The agile, flexible, and inventive nature of the agency's organizational culture has been successful in driving the pace of technology development for the National Security enterprise. I believe the proper role for DARPA is to conduct high-risk, high-payoff research for the Department, and to share that work with the Military Departments and others within the government.

22.3 What adjustments do you expect to make, if confirmed, to the current style of DARPA research program management and investment strategy?

If confirmed, I would work closely with DARPA, as well as the Military Departments and other DoD Components, to provide a balanced technology portfolio across the Department. Based on my current awareness of the DARPA research program and investment strategy, I do not see a need to make significant adjustments to the agency's current strategy.

22.4 What do you believe are the key characteristics of an effective DARPA director?

I believe an effective DARPA Director should have the ability to develop and communicate a vision of the DARPA research program, have the ability to attract exceptional technical talent to the agency, have the ability to motivate teams internal and outside the agency to take on challenges of national importance, be able to connect and bridge DARPA research to the operational and acquisition community, and be prepared to take on the most critical technical challenges that face the Department.

22.5 What, in your view, is the appropriate relationship between DARPA and the Service S&T programs?

I believe that the DARPA and the Military Department S&T programs should be coordinated, supportive, and complementary. DARPA is particularly focused on pushing the envelope to develop high-risk, high-payoff, leap-ahead advances, while the Military Department S&T programs draw upon and further develop these and other technological advancements to maintain the broad and deep technology base required to develop innovative capabilities for the warfighter. DARPA's strategy allows the agency to pursue opportunistic thrusts to dramatically advance particular technical capabilities, while the Military Department S&T programs seek a more balanced risk portfolio.

22.6 What, in your view, is the appropriate relationship between DARPA and the Service laboratories?

I believe that the programs relationship between the Military Department laboratories and DARPA is one of being partners in developing technology solutions for the warfighter.

23. Science, Technology, Engineering and Mathematics (STEM) Education

23.1 Do you believe that DoD specifically and the Nation as a whole is facing a crisis in STEM education?

As the government's largest employer of federal scientists and engineers, the Department has a large stake in identifying and attracting necessary STEM talent. This, in turn, means the Department depends on the Nation's success in producing a capable, competitive talent pool in STEM fields.

STEM education and maintenance of a vibrant STEM workforce are national security imperatives. Today's military capabilities reflect the great reach and impact that scientists, engineers, and technologists have made on our national security and economy. DoD's future STEM capacity, however, is at risk. In 2008, the percentage of engineering graduates among all university graduates in the United States remained among the lowest in the world, at 4.4 percent (by comparison, China was among the highest at 31 percent). The Department of Labor predicts that in the next decade, 80 percent of jobs will require STEM skills, yet according to the Department of Education, less than 25 percent of college students pursuing bachelor's degrees will be specializing in STEM fields. Excellence in is imperative to national security and the Nation's economic well-being; however, as much of DoD's workforce approaches retirement, DoD and industry will face a significant challenge in attracting superior STEM talent.

23.2 In your view, how will this affect DoD's ability to pursue its missions?

I believe that the health of the STEM talent pool directly affects DoD's ability to pursue its mission and goals. The Department seeks to ensure continued success at recruiting STEM talent, enhancing STEM education, and providing opportunity to the children of military families, and assuring a STEM-capable workforce through strategic outreach

23.3 What role do you think DoD should play in supporting STEM education?

I believe the Department should be actively engaged at all levels across the Science, Technology, Engineering and Mathematics education continuum—pre-college through graduate--and, more importantly, work with the Office of Science and Technology Policy, the National Science Foundation, the Department of Education,

and other Federal components involved in national security, to generate a "whole of government" approach to address national security STEM workforce development.

23.4 How do DoD's efforts fit in with the larger STEM education program consolidation initiative announced by the President?

DoD efforts span a broad educational continuum, from elementary through graduate school and into workforce development. The Department's STEM efforts align with the Administration's larger STEM education program consolidation initiative in numerous ways. DoD collaborates with the lead Federal agencies−the Department of Education (pre-kindergarten through 12th grade STEM education), and the National Science Foundation (undergraduate through graduate STEM education). It also works with the Smithsonian Institution (informal STEM education) as well as with other Federal agencies on a regular basis through the Federal Interagency Working Groups (IWGs). For example, DoD contributed to the development of the Federal STEM Education 5-Year Strategic Plan and IWG charters, and it continues to provide significant input about its programs to joint-agency efforts in support of enhancing evaluation and increasing the impact of the Federal investments in STEM education. DoD actively advises and assists with implementation of the Federal STEM Education 5-Year Strategic Plan.

24. Health of R&D enterprise

24.1 What is your assessment of the current health of the DoD's R&D enterprise as a whole?

In general, I believe the health of the DoD's R&D enterprise is good, but there are signs of stress as a result of reduced DoD manpower and budget. DoD is seeing some indications that retention of younger employees is a potential concern. Another trend is a growing number of employees in the technical workforce nearing or at retirement age. Approximately half of the technical workforce will be eligible to retire in the next 10 years. The cumulative effect of downsizing, reduced opportunities for technical collaboration, and uncertainty about future funding stability may be having a negative impact on the overall health of the R&D enterprise by decreasing the Department's reputation as an employer of choice.

24.2 Are rules currently in place to govern DoD R&D conducive to a healthy enterprise?

I believe current statutory authorities, rules, and regulations have been sufficient for a healthy R&D enterprise, but the Department finds itself in competition for critical technical talent and is challenged by the flexibility of the current processes.

24.3 DoD has recently taken criticism for not devoting enough funding to constructing and upgrading facilities for R&D. If confirmed, how would you address that issue?

If confirmed, I will assess the effectiveness of existing authorities in addressing concerns over constructing and upgrading facilities for R&D.

24.4 How would you work to reduce the overall costs of the R&D enterprise, while still maintaining the integrity and quality of the Department's R&D work? In which areas would you strive to build efficiency?

I have not assessed the efficiency of the current R&D enterprise. Under the Better Buying Power 3.0 initiative, the Department is taking a holistic look at costs and overhead across the R&D enterprise, with the goal of improving performance and efficiency. If confirmed, I would strongly support this effort.

24.5 How do you think continued budgets under sequestration will affect DoD science and technology funding?

I believe the threat of sequestration significantly affects the Department's ability to perform effective long-range S&T planning. To date, the Department has made a concerted effort to prioritize and protect S&T funding in its budget requests. If, however, the full effect of sequester were triggered in any year, I believe that there would be an immediate reduction to S&T budgets.

25. <u>Defense Innovation Initiative</u>

25.1 Former Secretary Hagel recently established a broad, Department-wide initiative to pursue innovative ways to sustain and advance the country's military superiority and improve business operations. How has the Department integrated that initiative with Research and Engineering?

One of the lines of effort under the Defense Innovation Initiative is focused on identifying emerging technology and material opportunities that offer opportunity to strengthen DoD capabilities in a competitive future national security environment. The effort, called the Long-Range Research and Development Planning Program (LRRDPP), was named in reference to the seminal 1973 study that identified many of the key military thrusts of the last 30 years. Since November 2014, I have been leading the 2015 LRRDPP study, which has engaged technical experts across the Department's research and engineering enterprise, as well as seeking separate input from academic, not-for-profit, and other private sector sources to identify emerging opportunities for future military innovation. The classified LRRDPP study, when fully completed early next year, should identify opportunities to accelerate and demonstrate new system concepts that can inform future materiel plans. This effort will also identify key research and engineering areas for assessment and prioritization in future research and engineering planning.

25.2 How would you further those efforts?

While the current LRRDPP effort has been a valuable assessment of emerging technology and system opportunities, I believe the Department needs to establish a stronger capacity to conduct regular, periodic, independent assessments of broad emerging defense and non-defense technology opportunities, both to inform our DoD's science and technology investment priorities and to ensure that the Department is continuously experimenting with new and emerging technologies that can inform and improve the effectiveness and efficiency of critical military capabilities.

25.3 How would you increase the effectiveness of the Long-Range Research and Development Program Plan (LRRDPP)?

The initial LRRDPP effort focused largely on future weapon, air combat, maritime, and space capabilities to counter emerging peer and near-peer state actors. It did not include an assessment of technology-enabled future land combat. Earlier this year, the Deputy Secretary of Defense requested an LRRDPP follow-on study, with the participation of key technology and operational experts from the U.S. Army, U.S. Marine Corps, and U.S. Special Operations Force communities, of emerging technical opportunities for future land combat. This effort is currently under way.

26. <u>Trusted Foundry Program</u>

26.1 What is the status of the "Trusted Foundry" program for providing a secure source of microchips for sensitive defense systems?

The Defense Microelectronics Activity (DMEA) manages the DoD Trusted Foundry Program. This program provides the Department and other government agencies with access to trusted microelectronics design and manufacturing capabilities necessary to meet the confidentiality, integrity, availability, performance, and delivery needs of U.S. Government customers. DMEA accredits suppliers as "trusted" in the areas of integrated circuit design, aggregation, brokerage, mask manufacturing, foundry, post processing, packaging/assembly, and test services. These services cover a broad range of technologies and are intended to support both new and legacy applications; both classified and unclassified. There are currently 72 DMEA-accredited suppliers covering 153 services, including 22 suppliers that can provide full-service trusted foundry capabilities.

26.2 What is being done to respond to the recent announcement that IBM plans to sell its Foundry capabilities to a foreign controlled company based in the United Arab Emirates?

In July 2015, Global Foundries purchased IBM's U.S.-based Trusted. DoD, the IC, and the Department of Energy assessed how the loss of access to the Trusted Foundry's specialized IBM technology, IP, and R&D knowledge would disrupt their current and future national security programs. Based on this assessment, the DoD determined that continuity of supply of unique trusted products over the short- and mid-term is critical, and that a revised strategy is needed to ensure long term access to trusted state of the art microelectronics.

For the short- and mid-term, DoD continues to work directly with GF to ensure appropriate accreditations can be in place for the successor company to serve as a DoD Trusted Supplier. For the long term, the DoD is taking a broad look toward future, state-of-the-art needs, projections for the commercial microelectronics marketplace, and technology solutions that may enable access to commercial fabrication facilities, to inform alternative approaches to ensuring access to trusted, state of the art microelectronics.

26.3 How might the Department mitigate the risks of losing that capability to a company with foreign ownership?

The Department is studying long-term options and alternatives to the current Trusted Foundry approach. The DoD is taking a broad look toward future, state-of-the-art needs, projections for the commercial microelectronics marketplace, and technology solutions that may enable access to commercial fabrication facilities, to inform alternative approaches to ensuring access to trusted, state of the art microelectronics. The vision for these new approaches involves shifting the burden of hardware assurance from policies that restrict access to the commercial sector, to technologies and processes that enable cooperation. Options include improved hardware and software assurance tools for analyzing provenance and functionality, new technology capabilities to enable trust from untrusted sources, and continued maturation of the broader trusted supplier network that DMEA certifies. DoD and other federal agencies are contributing to these analyses, to identify sustainable approaches to securing the microelectronics supply chain of the future.

26.4 How does the Trusted Foundry program support a secure supply chain for field-programmable gate array (FPGA) chips?

The current Trusted Foundry program does not address FPGA chips; it provides access to custom-manufactured application specific integrated circuits (ASICs). FPGAs are frequently a more affordable alternative to ASICs, but unlike ASICs, they are commercial-off-the-shelf items produced for a broad market of users. FPGAs have unique trust issues. They are globally designed and manufactured, and unlike ASICs there are currently no U.S.-based foundries supplying FPGAs for DoD use.

It is DoD policy to employ protections that manage risk in the supply chain for components or subcomponent products such as FPGAs. The Department has issued guidance on supply chain risk management practices to address components such as FPGAs. If confirmed, I would support efforts to continue to mature these practices as we learn more about their effectiveness.

27. Congressional Oversight

27.1 In order to exercise its legislative and oversight responsibilities, it is important that this Committee and other appropriate committees of the Congress are able to receive testimony, briefings, and other communications of information. Do you agree, if confirmed for this high position, to appear before this Committee and other appropriate committees of the Congress?

Yes.

27.2 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 Assistant Secretary of Defense for Research and Engineering?

Yes.

27.3 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?

Yes.

27.4 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 the Committee regarding the basis for any good faith delay or denial in providing such documents?

Yes.