STATEMENT OF MR. JAMES MAZOL

PERFORMING THE DUTIES OF UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

Introduction

Chairman Bacon, Ranking Member Khanna, and distinguished members of the committee, thank you for the opportunity to testify before you today on innovation within the Department of Defense (DoD). I am pleased to be here today Performing the Duties of the Undersecretary of Defense for Research and Engineering (USD(R&E)) and Chief Technology Officer (CTO) of the DoD. I am also pleased to be joined by my colleagues Doug Beck, the Director of the Defense Innovation Unit (DIU) and George Rumford of the Test Resource Management Center (TRMC). Each of our organizations play critical roles in the defense innovation ecosystem. The USD(R&E) is responsible for ensuring the U.S. military maintains its technological edge. For R&E, fulfilling our responsibility requires us to carry out two fundamental tasks. First, to oversee the Department's research and development investments and ensure their alignment with the overall strategic modernization plans and roadmaps. Second, to conduct rapid prototyping and experimentation activities with a focus on the Joint warfight.

America does not enjoy a comfortable lead time between identifying a threat and developing a countermeasure. For example, hypersonic and ballistic missile threats are proliferating across the globe, leading President Trump to direct the development of a Golden Dome for America missile defense shield to bolster missile defense capabilities for the homeland. Delivering such capabilities, and others critical to maintaining technology overmatch in relation to our adversaries, requires a fundamental shift in our approach to innovation. We must move at the speed of relevance. The DoD must sharpen our indigenous research, prototyping, and transition activities while embracing the dynamism and ingenuity of the commercial sector as a force multiplier for our national defense.

The USD(R&E) plays a significant role in helping deliver on Secretary Hegseth's priorities of rebuilding the military, reestablishing deterrence, and revitalizing the industrial base. R&E leadership across critical technology areas and in policy, basic research, prototyping, and industry engagement will ensure the U.S.'s technical advantage and will deliver on the Secretary's goals for the Department.

R&E leadership: Roadmaps and investment in Critical Technology Areas

As the CTO, my team ensures alignment of the Department's vast technology investments with the President's and the Secretary's overarching national security priorities. To implement this vision and exercise appropriate oversight, we have designated critical technology areas for targeted development. For each critical technology, R&E develops roadmaps, conducts rigorous program assessments, and plans technical activities with partners across the Services, the laboratories, the Office of the Secretary of Defense organizations, and private industry. Our goal is to ensure that every dollar invested, whether in research infrastructure, basic science, advanced engineering, prototyping, or even programs of record across the Services, directly contributes to delivering cutting-edge capabilities to our warfighters and maintaining our technological edge against strategic competitors. I would like to highlight several critical technology areas and the focus of our roadmaps and investments.

Microelectronics and Semiconductor Manufacturing

The DoD relies on a robust microelectronics industrial base to manufacture the components that enable advanced capabilities. The OUSD(R&E) manages the Trusted and Assured Microelectronics Program (T&AM) along with the Microelectronics Commons program. The T&AM program seeks to guarantee the Department's long-term access to measurably secure microelectronics, enabling overmatch in performance and increasing military operational availability. The program supports modernization activities that enable defense systems to keep pace with commercial advances and mitigate acute threats to the microelectronics lifecycle. The program reduces reliance on obsolete chips and sole-source foundries that provide the DoD with state-of-the-art chips. The Microelectronics Commons program is a national network to create direct pathways to commercialization for U.S. microelectronics research and designers from "lab to fab." These programs drive modernization of defense systems and work to mitigate persistent threats throughout the microelectronics supply chains, primarily by improving and onshoring microelectronics fabrication. There are eight established "Hub" leads across the country, comprised of over 1,200 total member companies, universities, or organizations, spanning 43 states.

Artificial Intelligence

Artificial Intelligence (AI) represents a technology leap that arises once in a generation, and capitalizing on this revolution for U.S. military capabilities is a key overarching priority for the CTO. Learning how to leverage and safely deploy AI capabilities to the maximum extent while leveraging private sector innovation and investments is paramount to meet our national security needs across the Defense ecosystem. AI itself is not a single technology to develop but is an overlaying capability that will pervade every system and will inform the way we research, develop, train, and fight. A recent transition success story involving AI-enabled capability is the Joint Fires Network, which gives our forces decision advantage and links multiple sensors to multiple shooters, enabling new kill chains for long range fires missions and precision strike missions.

Cybertechnology

The CTO leads Cyber Security Applied Research efforts to explore technical and scientific concepts that address challenges in the Joint Warfighting Environment with cyber effects and integrated non-kinetic options including electromagnetic warfare and information operations. The goal of our applied research and workforce development efforts is to ensure an asymmetric advantage across all domains (maritime, land, air, cyberspace, and space) while building a responsive cyber workforce and an academic science and technology pipeline for the Department's ongoing cyber talent needs. The majority of our cyber tool development efforts are accessible at higher levels of classification, but at their core, they assure the security and resilience of all DoD systems needed in the joint fight while also developing tools to find and exploit our adversaries' vulnerabilities.

Hypersonic capabilities

Offensive and Defensive Hypersonics technologies are a modernization priority and Critical Technology Area. We are concerned by China's growing hypersonics threat, but also aware of need for time-sensitive and precision strike options in various theaters contested by

Anti-Access and Area Denial capabilities. The hypersonics portfolio includes roadmaps to integrate and deconflict progress on boost-glide missiles; air breathing ramjet and scramjet missiles; exploring options for reusable hypersonic flight vehicles; reviewing advanced materials requirements; and manufacturing capabilities for these weapons. We collaborate closely with the TRMC to ensure that new classes of weapons have both the wind tunnels and range infrastructure necessary to develop, test, and field these systems. The Department must continue to increase the pace at which it develops and demonstrates new hypersonic technologies and concepts while also focusing on improving the affordability and producibility of current hypersonic systems.

Directed Energy

The Directed Energy (DE) Critical Technology Area is an example where intelligence-informed and threat-focused development is being driven by the OUSD(R&E). The nature of possible threats, including swarms of autonomous collaborative drones and salvos of ballistic and hypersonic missiles, requires new approaches to missile defense, base defense, and area defense. My office is working through multiple lines of effort at the Basic Research (6.1) level through the Advanced Component Development and Prototypes (6.4) level to mature directed energy capabilities. We are taking steps to improve our ability to scale production, with steps that include the Enduring High Energy Laser program, the High Energy Laser Scaling Initiative (HELSI), the DE Weapon System Modular Open Systems Approach Reference Architecture, and ongoing DoD Manufacturing Technology program investments, also managed by the OUSD(R&E). Through the HELSI, so far, we have transitioned three 300kW lasers to the Services, and we are on track to deliver one 500kW and one 1,000kW laser in fiscal year 2026. These ongoing efforts require the production of many advanced subcomponents including beam directors, optics, and amplifiers. A steady demand signal from DoD has incentivized industry to create the first production lines needed for military grade lasers.

Quantum Technology and Initiatives

Quantum sciences present an opportunity to deliver exquisite technologies for our warfighters. We are striving to transition quantum technologies into our nation's military capability portfolio for significant operational advantages. The OUSD(R&E) has identified three quantum application domains (quantum computing, sensing, and communications) as priorities with potential to yield operational applications in the near term. The Department is placing emphasis on developing and transitioning quantum sensors and atomic clocks because they are the most likely systems to deliver near-term operational utility, including applications for precision strike and synchronized joint attack scenarios. Quantum sensors using inertia, gravity, or magnetic fields will enable increased lethality, improved resilience to spectrum congestion, and an alternative position, navigation and timing tool for GPS-denied environments. The OUSD(R&E) is closely partnering with the DIU to mature, demonstrate, and field quantum sensing solutions for strategic level position, navigation, and timing applications. Due to the heightened sensitivity of quantum sensors, the Department is still in the early phases of grasping the breadth of possible applications for quantum technologies to deliver military advantages. With respect to quantum computing, the United States remains the world's most robust commercial investment ecosystem and private market for quantum computing. The OUSD(R&E), and especially DARPA, are pursuing ambitious programs to engage the domestic

and allied private sector on their quantum computing approaches and to understand the realm of computing capabilities for materials simulations and other defense applications.

R&E Advances Basic Research

As the CTO for the DoD, technology development and transition for near-term and current missions of the warfighter is not my only focus. I am also the champion for the Department's ecosystem of laboratories and the basic research apparatus that looks much further into the future to pursue early-stage scientific discovery which will prove to be the backbone of military capabilities many years from now.

Basic Research

Basic research programs play the critical role of exploring new scientific directions for revolutionary technology development in support of the DoD mission. Our efforts have two goals: direct and create research programs to explore frontiers of science that yield disruptive technologies and define future DoD priorities; and improve the research ecosystem through policy, collaborations with academia, industry and international partners; and workforce development efforts to strengthen the future of research and the caliber of scientists the DoD may have access to in the future.

Our Basic Research Initiatives Program primarily focuses on the first goal of driving research programs to the most strategically impactful areas for future defense application. Closely collaborating with the Director of the Basic Research Office within the OUSD(R&E), we drive the direction of the Department's basic research investments by developing programs to increase collaboration between the university and industry sectors in areas that align with our defense priorities. Programs such as the Academic Research Security and Laboratory University Collaboration Initiative capitalize on the unfettered, curiosity-driven research and innovative spirit of universities by focusing their energy and ideas on defense research.

Accomplishing our second goal of strengthening the research ecosystem is done primarily through scholarships and grants in Science, Technology, Engineering and Mathematics (STEM) fields. I would highlight our SMART Scholarship program which strengthens our nation's defense industrial base through cultivating and developing exceptional STEM talent to join the DoD workforce. SMART accounts for a significant percentage of new talent coming to the DoD or the DoD/Service laboratories as employees upon completion of their programs. In order for the United States to remain a world leader in science and technology and attract exceptional scientists, engineers, and academics to the DoD, we must continue to create opportunities for the next generation of scientists and engineers across the country, ensuring that these development programs closely align with DoD priorities.

The DARPA

DARPA has the mission of removing the possibility of technical surprise for U.S. forces by our adversaries while seeking to provide the United States with asymmetric technical surprise through high risk-high reward basic research into what is technically possible. DARPA executes its high-risk model because of the existence of the Military Service science and technology

organizations that diligently pursue more evolutionary requirements-driven research. While the Military Service laboratories frequently provide the "Plan A" baseline for program advancements, DARPA offers a disruptive "Plan B," that, if successful, creates leap-ahead capabilities, accelerated timelines, and/or dramatically reduced costs.

Improving the Ecosystems of Innovation

As the Department's CTO, it is critical to advance the R&E enterprise in its capacity to drive innovation. Innovation does not stop at the invention of new weapons or the transition of defense capabilities to warfighters; it includes creating a dynamic environment where the power centers of innovation are focused to maximize defense outcomes. To do this, we must utilize the strength, flexibility and innovation of the U.S. commercial sector if we wish to bolster the DoD and improve warfighter lethality. Partnering closely with the DIU to ensure the demand signals coming from the DoD enterprise to industry are clear, actionable, and reliable is an important part of this mission. OUSD(R&E) will continue to lead key tenets of the DoD innovation ecosystem including the Small Business Innovation Research (SBIR), the Small Business Technology Transfer programs (STTR), and the Office of Strategic Capital (OSC) to strengthen the defense innovation ecosystem through private-sector engagement.

SBIR/STTR Reauthorization

OUSD(R&E) provides policy guidance and oversight for the Department's SBIR and STTR programs, as well as executing a portfolio of programs derived from the Research, Development, Test and Evaluation, Defense-Wide appropriations. From a policy standpoint, we have pursued innovations to increase thresholds for awards that match the Department's named critical technology areas, we have pursued flexibilities in the numbers of phase II awards to ensure companies have the best opportunity for a phase III award, and we have implemented important research security and vetting measures in partnership with our technology protection program office to secure and protect intellectual property. We have also implemented more "open topic" format requests for proposals to widen the aperture for new entrants into the SBIR/STTR programs, lowering barriers to entry and increasing participation across the entire small business ecosystem engaged with DoD. Through the Department invests over $3 billion each fiscal year in innovative technologies to meet critical needs of the warfighter. Continuing to leverage this investment with responsible stewardship of taxpayer funds while addressing risk through research security and policy improvements is a priority for the OUSD(R&E).

Office of Strategic Capital (OSC)

The OSC is an incredibly important and relatively new tool for the Department. The OSC was established to align efforts across the Department and with other Federal government agencies to develop, integrate, and implement proven partnered capital strategies to shape and scale investment in critical defense technologies. One of the great strengths of our Nation's economy is the investment acumen and skillsets of successful and experienced fund managers. With the establishment of OSC, the Department recognized that our country's financial sector

seeks maximum value and returns for investors while minimizing risk, and our financial sector does not automatically seek technology development for defense capabilities, unlike China, whose approach of civil-military integration has attempted to align the entire "private sector" towards military capability advancement. The OSC can drive down risk for investors, provide injections of capital to emerging technology companies, and incorporate other strategies that result in great value for investors, with the added benefit of addressing critical defense technology, component, and materiel needs. Such strategies can involve risk, particularly investments in novel technology companies. However, funds can mitigate that risk by taking a portfolio approach while other commercial-based programs, such as SBIR/STTR, provide opportunities to fuse government research and development funding with private capital from defense ventures and private equity firms.

Enabling technology maturation and transition (prototyping and experimentation)

Engineering serves as the foundation for technology development, and prototyping and experimentation serve as the catalysts for transition leading to acquisition and sustainment. As the CTO, I lead Joint-focused prototyping initiatives to advance innovative or novel technology development, drive down technical and integration risk, and demonstrate new capabilities. Studies of the Department's acquisition outcomes have shown that implementing rigorous foundational engineering activities early in the capability life cycle, paired with prototyping and demonstrations, leads to improved cost, schedule, and performance results. The development of advanced prototypes, coupled with rigorous testing and evaluation in representative environments, has rapidly fielded important warfighting capabilities. When joined with appropriate, timely resource planning, prototyping and experimentation has, and will continue to, enable the Department to bring operational capabilities to the force more quickly than traditional acquisition pathways.

Accelerate the Procurement and Fielding of Innovative Technologies (APFIT)

Experience has proven that the defense planning and budgeting cycle cannot guarantee timely resourcing needed by innovative companies generating break-through technologies. The Department has benefitted from flexibility in funding options in these situations when timely investments are critical to accelerate transition and fielding. Often, aspiring vendors with needed technology solutions for the Department cannot wait two years for the Services' planned budget to become appropriated funds available for contracts. The OUSD(R&E) can play an important role in addressing the mismatch between typical budget cycles and innovation cycles that present immediate opportunities. The APFIT program was designed to address this gap. The program serves the secondary purpose of increasing the size of the defense industrial base while also providing procurement funding for innovative projects, often to first-time suppliers, whose technologies have reached fieldable technology readiness levels and are ready to transition to operational use. The APFIT program continues to successfully enable innovative companies to

bridge funding timelines and get technology into production up to two years sooner than otherwise possible.

Defense Innovation Acceleration, Rapid Prototyping Program, and Experimentation Campaigns

When mission-enabling capabilities are not mature enough to warrant transition efforts, the OUSD(R&E) conducts a portfolio of prototyping efforts to first mature and then demonstrate these technologies in relevant operational environments through experimentation and exercise venues. This iterative process, in conjunction with the APFIT program, has successfully accelerated and transitioned autonomous capabilities from non-traditional defense contracts for combatant commanders, has pioneered new data links for novel kill chains, developed resilient communications in contested environments, and built a new class of ultra-long-dwell intelligence, surveillance, and reconnaissance aircraft, to name just a few successes. This iterative process of prototyping and experimentation addresses joint warfighting gaps by driving a process of ideation, experimentation, learning, and transition to quickly support multi-domain operations. These efforts can leverage joint and coalition experimentation opportunities in the Indo-Pacific theater now, with additional opportunities to add collaborative experimentation with other allied nations in the future.

While certain capabilities are ready for multi-service, collaborative experimentation, some new entrants require demonstration in a smaller venue to qualify. We have established the Technology Readiness Experimentation series to address this need by enabling technical evaluation that provides real-world data, which is then used to inform future warfighting concepts development and define the constituent technologies that will comprise a larger experiment or exercise.

Conclusion

Thank you, once again, for the chance to testify before the Committee. I look forward to working with Congress as we strive for new ways to strengthen our Nation's innovation, scientific discovery, and technological development.