RECORD VERSION

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ON REVIEWING DEPARTMENT OF DEFENSE SCIENCE AND TECHNOLOGY
STRATEGY, POLICY, AND PROGRAMS FOR FISCAL YEAR 2023: FOSTERING A
ROBUST ECOSYSTEM FOR OUR TECHNOLOGICAL EDGE

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Chairman Langevin, Ranking Member Banks, and distinguished members of the Subcommittee, thank you for your continued support and for the opportunity to discuss Army Science and Technology (S&T) strategy, policy and programs–all designed to realize U.S. Army modernization priorities, founded on a robust S&T ecosystem, to enable our soldier's technological edge. The Army's modernization enterprise, spearheaded by the Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASA(ALT)) and the Army Futures Command (AFC), includes a network of synchronized Laboratories and Engineering Centers located across the country and run by Combat Capabilities Development Command, the U.S. Army Corps of Engineers' Research and Development Center (ERDC), the Space and Missile Defense Command's Technical Center (SMDTC), and the Army Research Institute. Together with our partners from the other Services and the Office of the Secretary of Defense, Army Labs and Centers are working with academia and industry to develop new technology that is driving near and mid-term modernization to equip the Army of 2030, and performing the fundamental research driving the discoveries that will enable the Army of 2040 and beyond.

As the Deputy Assistant Secretary for Research and Technology, I support the ASA(ALT) as the Army Chief Scientist and the Service S&T Executive. I work very closely with my AFC colleagues to develop the Army's S&T strategy, plan and program resources, provide Army Headquarters oversight for the S&T budget activities 6.1 through 6.3, and manage technology maturation funds (6.4), manufacturing technology (6.7), and the Small Business Innovative Research (SBIR) program. ASA(ALT) and AFC work closely to develop Army S&T strategy, plan the Program Objective Memorandum submission, jointly govern the Army S&T Enterprise, and build deliberate transition plans.

The Army is building a balanced S&T portfolio for near and mid-term technology insertion, for technology breakthroughs and for Basic Research. Our S&T strategy pays

careful attention to supporting the signature modernization priority efforts, while simultaneously supporting research aimed at fundamental, long-term change. Overall, the Army's S&T portfolio has been strongly supported by the Army Senior leadership, OSD, and Congress. So far, the Army continues to hold the S&T budget top-line at zero percent real growth. I am very grateful for this subcommittee's continued support. Predictable and consistent funding is absolutely essential for the Army to achieve persistent modernization, and Science and Technology is modernization's foundation.

As the Army S&T Executive, I also serve as the interface to Under Secretary of Defense for Research and Engineering (USD(R&E)) representing Army S&T equities, and ensuring S&T alignment with our Sister-Service labs' to address existing and emerging OSD S&T priorities. For example, we are supporting the development of Climate Change plans focusing on research to reduce the emission of green-house gases. The Army's major emerging contribution is technology to electrify military vehicles, enabling a significant reduction in fuel usage through efficiency, while reducing the need for vehicles to idle to generate electrical power. The Army is developing advanced technologies that significantly reduce energy usage while increasing operational capability. For ground vehicles, our focus is on increasing operating range and available power as well as silent watch and mobility. To provide this capability, we have S&T investments in high power electric architectures, electrical components, energy storage and hybrid-electric powertrain technologies for tactical and combat vehicles. Demonstrations for hybrid-electric combat vehicles are planned in fiscal year (FY) 2025 with hybrid-electric powertrain for combat vehicles and plug-in hybrid-electric in FY 2028.

We are continuing to transform the Army S&T business model—moving away from walled-off, "siloes-of-excellence" to a model that emphasizes early collaboration and frequent communication between the Requirements, S&T, Acquisition, Testing, and Sustainment communities; our academic and industry partners; and most importantly

our soldiers. Under the joint leadership of the ASA(ALT) and the Commanding General AFC, and as a recent AFC Cross Functional Team (CFT) director, I can tell you first hand that these communities are collaborating in unprecedented ways. Army scientists and engineers are changing the way warfighting concepts and requirements are envisioned, which are, in turn, shaping longer term research projects and goals. Program Executive Offices are maturing an unprecedented number of technologies emerging from S&T with reduced risk to performance, schedule and cost, and AFC CFTs are driving the entire enterprise to expediently deliver on our signature modernization programs to meet the demands of joint multi-domain operations. We are also changing the way the Army transitions technology from S&T programs to Programs of Record. As you know, this has long been a difficult issue, and while we have had significant successes, some of which I will detail later, we always strive to do better. To that end, we have developed new policies on Transition Agreements (TA). These TAs bring together the Program Executive Office (PEO)/Program Manager (PM), AFC/CFT and the S&T community early in the development of Budget Activity 3, 4 and 7 programs and mutually define key criteria.

By formalizing these types of agreements early in the development cycle, we can better ensure successful transition of tangible technologies that will ultimately provide increased capability for the warfighter. It is one more tool in our kit to bridge the "Valley of Death," when a maturing technology fails to transition due to lack of funds or programmatic support from key stakeholders.

We have had a number of recent transition successes, two of which I highlight below. The tactical network cannot rapidly adapt to dynamic changes based upon threat and mission scenarios. Current radio systems are built as individual solutions requiring the warfighter to manually execute the Primary, Alternate, Contingency, and Emergency (PACE) communications plan in the event of degradation, interference, or system failure. There is no predictive or proactive capability to understand network states under evolving operational conditions and enemy attacks and threats. Modular Radio

Frequency (ModRF) eliminates the manual PACE process and significantly reduces the complexity and time to configure and manage radios and networks. ModRF is a software capability installed on computing elements with access to multiple transports that stitches various radio networks into one seamless network, enabling an automatic PACE function for traffic across networks at the brigade level and below.

Army S&T transitioned automated PACE software to PM Mission Command for integration into the Mounted Mission Command v3.1 Program of Record, with a planned fielding in FY 2023. The ModRF tools will automate many manual processes, reducing solider cognitive burden and enabling communications in contested environments. The always-on optimized communications provided by ModRF will enable rapid maneuver and the ability to maximize windows of superiority in Multi-Domain Operations.

For rotorcraft, current platform architecture, system engineering approaches, and acquisition processes limit our ability to counter emerging threats and obsolescence quickly. Our Integrated Mission Equip (IME) for Vertical Lift Systems delivers the capability to evaluate and enforce vendor solutions for a Modular Open Systems Approach, establishes the digital backbone and infrastructure to enable mission systems capabilities to evolve independent of the air vehicle, addresses challenging airworthiness and cyber security requirements, and provides a flying testbed for the maturation of integrated Multi Domain Operation capabilities. Under this effort, we have transitioned Architecture Validation approaches, developed inputs to Enterprise Architecture Framework, and validated Future Attack Reconnaissance Aircraft/Future Long Range Assault Aircraft Request for Proposal requirements. We have achieved and demonstrated Technology Readiness Level 5 for Architecture Verification Environment, completed trade studies, and identified innovative hardware and software products that directly influence experimentation activities. IME provides immediate value through frequent incremental transitions.

As previously mentioned, our Basic Research program enables the foundational work that will define the technological capabilities of the Army of 2040 and beyond. Our researchers and academic partners perform cutting-edge research in a variety of critical areas to the Army, including quantum sciences, synthetic biology, and artificial intelligence. We want Army scientists and engineers working side-by-side with the best and brightest scientists, engineers, and entrepreneurs from across the Nation as early as possible in the discovery and innovation cycle. Recognizing this, the Army Research Lab (ARL) has built a network of regional labs and innovation hubs giving us access to the broadest spectrum of scientists in colleges and universities across the country. In FY 2023, we are initiating three new efforts in our Basic Research portfolio:

- The Semiconductor Modeling Consortium is an ARL-industry-academia consortium focused on modeling of semiconductor devices.
- The Consortium for Quantum Sensing is an ARL-industry partnership to investigate novel approaches to quantum sensing, complimentary to our university quantum research center efforts.
- Convergent Manufacturing for High Performance Material Interfaces will investigate fundamentals of high performance material interfaces to support future applications in convergent/additive manufacturing.

Our university partnerships provide the Army access to this country's world-class Science, Technology, Engineering and Mathematics talent, and we are committed to developing the next generation of STEM leaders. The Army's Educational Outreach Program (AEOP) helps to develop STEM talent across the spectrum from kindergarten through college. AEOP offers students and educators a collaborative, cohesive portfolio of Army-sponsored STEM programs that effectively engage, inspire, and attract the next generation of scientists and researchers, and expose them to DoD careers. AEOP has a strong focus on reaching traditionally underserved communities. Of the 221 colleges and universities represented in the program, 54 are Historically Black Colleges and Universities/Minority Institutions (HBCU/MIs), and more than half of the female participants were from underserved backgrounds and are potential first generation college graduates. Of course, as with all educational programs, COVID-19 caused

disruptions over the past several years. However, we were able to successfully pivot to virtual programs and served approximately 28,000 teachers and students across the country. America's strength is derived from its ability to bring together a diverse group of people, with their thoughts and their ideas. The Army simply cannot accomplish its mission without the skills, dedication, and contributions derived from providing access to all Americans. We use our Basic Research portfolio to the fullest extent possible to facilitate such access.

The Army continues to expand collaboration with the HBCU/MSI community. We have started two new initiatives to expand research capabilities and build lasting partnerships: an HBCU/MSI-focused prize competition for students and faculty, and an Army HBCU/MSI Faculty Immersion Program. The prize competition will feature an Army research grant accelerator, where winning faculty and students will be awarded research grants sponsored through the Army Research Office. The Faculty Immersion Program will allow HBCU/MSI faculty to work in Army labs, followed by a period of supported research at their home institution. This new, two-year immersion program places HBCU/MI junior faculty in an Army laboratory and a doctoral university (very high research activity (R-1) institution) for six months of training and experiences followed by eighteen months of Army-relevant research at the participant's home institution. Two junior faculty have been selected for the inaugural program, which focuses on artificial intelligence and machine learning (AI/ML). A selection committee composed of AFC/DEVCOM and USACE/ERDC subject matter experts (SMEs) evaluated the candidates and will serve as the technical administrators of the program.

Like our Sister-Services, we are fundamentally reshaping the Army's interaction with small businesses with an emphasis on non-traditional vendors, using the SBIR program. The AFC Army Applications Lab's Special Program Awards for Required Technology Needs program and the Army's Applied SBIR program are reducing the barriers to entry for SBIR awards and prizes by connecting small businesses with Army Acquisition Professionals using cohort and transition broker team models to connect small

businesses performing research and development to Army Program Managers with well-defined needs. Each transition broker team is focused on one technology area that is shown to be a major technology ecosystem within private industry. These models reduce the barrier to entry through hands-on explanation of some of the more challenging aspects of working with the Army for proposal submission, which can often seem like an insurmountable bureaucratic process. More importantly, these models are yielding more predictable, reliable, and cost effective pathways for technology adoption by helping small businesses focus on PEO-identified capability gaps, and identifying tech insertion points and funding opportunities. Recent SBIR topics have seen a ten-fold increase in submissions, some with up to 200 firms per topic, using a simplified and more intuitive application process (according to the firms). The Army fully supports reauthorization of the SBIR program, and I thank you for your continued support of this important tool.

The xTech Program is the flagship Army-wide prize competition, designed to identify and assess technology solutions using rapid vetting of non-traditional small businesses, startups, and innovators. The xTech Program eliminates the "pay-to-play" roadblock faced by many cash-strapped businesses by providing: rapid, non-equity dilutive seed prizes, comprehensive feedback from Army experts, and direct exposure to Army and commercial stakeholders through networking, education, and mentorship. Since 2018, the program has vetted over 2,500 small business technologies from all 50 states for potential use in Army systems, provided feedback on over 23,000 proposals by 2,000 Army Subject Matter Experts, and awarded $16 million in seed prizes that led to over $70 million in follow-on contracts. xTech has grown the ecosystem of non-traditional innovators and increased collaboration across the S&T, Advanced Development and User communities. We have also recently started focused xTech efforts with the HBCU/MI communities, and 20 international partners.

Army labs are powered by an S&T workforce that is diverse, technically competent, and highly educated. It is vital for the health of the enterprise to develop and retain a

knowledgeable, high performing S&T workforce through a robust recruiting program, timely onboarding (including clearances) of S&T employees, and the reshaping of skill sets to meet emerging challenges. The congressionally-provided special personnel hiring authorities have been critical for Army laboratories to remain agile and competitive with the private sector. In the past year, Direct Hiring Authority has allowed Army labs to hire approximately 650 civilian employees (55% of scientist and engineer hires) in critical fields such as bioengineering, neuroscience, computer science, and materials engineering, as well as hiring physicists, biologists, chemists, mechanical engineers, and social scientists. Thank you for your continued support of these direct-hiring authorities.

I would also like to highlight some recent awards and recognitions given to our workforce. Over the past year, two Army scientists have won the DoD Laboratory Scientist of the Quarter. This award recognizes extraordinary service by DoD scientists and engineers that demonstrate exceptional work that furthers the mission of the DoD.

Dr. Kevin Masser, a DEVCOM ARL materials scientist, received the award for his accomplishments in polymer networks, and novel contributions to Army programs and missions, including advancements in transparent armor materials and novel vehicle hatch protection solutions. His expertise and the outcomes of his work solved a key source of transparent armor delamination, which costs the Army $19 million annually. Dr. Marshall Schroeder, a DEVCOM ARL materials scientist, received the award for his accomplishments in the development of innovative battery chemistries and efforts to transition these fundamental breakthroughs to U.S. Army platforms. Dr. Schroeder led efforts to establish a new frontier in energy storage research, pioneering new chemistries in rechargeable multivalent-ion batteries. These aggressive new battery chemistries present more cost-effective, sustainable, volumetrically energy dense, and intrinsically safe energy storage platforms compared to existing Li-ion technology. Accomplishments like these are just one reason I am very proud of our amazing workforce.

To attract and retain world-class scientists and engineers, Army labs must have world-class research facilities and equipment. Due to myriad contributing factors, many research and test facilities have become obsolete and require revitalization and recapitalization. We are making slow, but steady progress by relying on a spectrum of congressional authorities to resource and modernize facilities. Army laboratories have benefitted greatly from the authorities granted in sections 4123 and 2805(d) in Title 10 of the U.S. Code. Last year, the Army laboratories invested $173 million in support of section 4123 projects. Of that total investment, $78 million (45%) supported 93 infrastructure revitalization or recapitalization projects. This authority provides the Laboratory Directors greater flexibility in the allocation of resources for laboratory infrastructure construction and facilitates the Army to maintain world-class facilities; however, section 4123 infrastructure projects must comply with the $6 million cost limitation in section 2805(d), Laboratory Revitalization. This is a significant limitation to Army laboratories' ability to meet larger infrastructure, repair, and sustainment projects, particularly given the recent rise in inflation.

In conclusion, I would like to thank the members for their time and oversight of Defense Laboratories and Engineering Centers. Your continued strong support of a world-class science and engineering workforce, modernized research lab and center infrastructure, and innovative technology transition programs ensures that the Department has the tools for continued success. The acquisition and exploitation of new scientific knowledge is crucial to the advancement warfighting capabilities and we must safeguard these endeavors as a critical national resource. Army S&T is at the forefront of acquiring knowledge essential to its land warfare mission and of developing technology-enabled capability that will transition to meet the warfighter dominance needs of the future. Thank you.