

UNCLASSIFIED

**NOT FOR PUBLICATION UNTIL RELEASED BY THE HOUSE ARMED SERVICES
COMMITTEE**

STATEMENT BY

THE HONORABLE HEIDI SHYU

UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

BEFORE THE UNITED STATES HOUSE OF REPRESENTATIVES ARMED SERVICES
COMMITTEE

ON

OUTPACING CHINA:

EXPEDITING INNOVATION TO THE WARFIGHTER

February 15, 2024

**NOT FOR PUBLICATION UNTIL RELEASED BY THE HOUSE ARMED SERVICES
COMMITTEE**

**Honorable Heidi Shyu's February 15, 2024 Testimony
for the 118th Congress' House Committee on Armed Services
Hearing on Outpacing China: Expediting Innovation to the Warfighter**

Chairman Rogers, Ranking Member Smith, and House Armed Services committee members, thank you for the invitation to provide testimony for this Committee hearing on Outpacing China: Expediting Innovation to the Warfighter. I'm honored and proud to be the Department of Defense's Under Secretary of Defense for Research and Engineering (USD(R&E)) and Chief Technology Officer. I am also pleased that my counterparts, the Under Secretary of Defense for Acquisition and Sustainment, Dr. LaPlante, and the Director of the Defense Innovation Unit (DIU), Mr. Doug Beck, are here today as we discuss our shared responsibility of delivering enduring technological advantage for our warfighters now and into the future.

The People's Republic of China (PRC) remains the only country in the world with the intent and, increasingly, the capability to reshape the international order to suit its authoritarian preferences. The advancement of the PRC's nuclear, space, and cyberspace capabilities poses a significant and urgent challenge. That's why it is our responsibility to ensure the U.S. military is equipped with the best technology.

As the Department's Chief Technology Officer, I am committed to delivering and investing in our technological advantage for years to come. This requires focus on the short-term challenges posed by the PRC in this decisive decade, while ensuring that America's science and technology base delivers benefits for our national security long into the future. The Department's approach, which was codified by the Secretary of Defense last year in the National Defense Science and Technology Strategy (NDSTS), prioritizes three strategic lines of effort: 1)

focus on the Joint Mission; 2) create and field capabilities at speed and scale; and 3) ensure the foundations of research and development.

As stated in the NDSTS, “The DoD cannot afford for useful research to languish in the laboratory, for bureaucratic processes to prevent engagement with innovative private companies, or to allow old paradigms to prevent collaboration with some of our most trusted partners.” The term “valley of death,” referenced by think tanks and tech executives alike, frequently refers to the difficulty of scaling technology adoption in the DoD. In the NDSTS the DoD has identified three valleys of death that are vital to the Department’s ability to scale technology and require the Department to build bridges: from lab-to-prototype, prototype-to-product, and product-to-scale – each are equally important and require tailored approaches to maintain a technological edge.

There is no monolithic solution to accelerating the Department’s development and acquisition of leading-edge technology. This task requires a suite of tools that are tailored to address common problems faced by companies and technologists motivated to contribute to national security. The valleys of death are as much about information as they are about capital – they require those tasked with equipping our military with the best technology to remain connected to the warfighters and industry at every stage of the process to iterate on, field, and scale capabilities as quickly and efficiently as possible. In close collaboration with my partners at the Under Secretary of Defense for Acquisition and Sustainment, DIU, the Military Services, the Joint Staff, and the Combatant Commands, the Office of the Under Secretary of Defense for Research and Engineering (OUSD(R&E)) is bridging these valleys of death in a multitude of ways so the warfighters can achieve technological overmatch in any potential conflict.

Delivering Technological Overmatch for the Decisive Decade

The Department must prioritize capabilities that we can deliver and scale in the next three years. To address this urgent issue, Secretary of Defense Lloyd Austin and Deputy Secretary of Defense Kathleen Hicks launched three flagship initiatives – the Rapid Defense Experimentation Reserve (RDER), which is led by the OUSD(R&E), the Competitive Advantage Pathfinders, which is led by the Office of the Under Secretary of Defense for Acquisition and Sustainment (OUSD(A&S)), and Replicator, which is led by DIU. RDER was established in the summer of 2021 and accelerates technology from prototypes to validated military capabilities. While RDER works directly with each Military Service, it is uniquely focused on areas crucial to joint warfighting in a highly contested environment, including countering kill chains, contested logistics, joint fires, command and control, and information advantage. My office works closely with the Joint Staff, Combatant Commanders, the Military Services, other Office of the Secretary of Defense (OSD) Components, and commercial and defense industry to identify promising prototypes.

The RDER process draws on the strengths of iterative feedback loops between warfighters and technologists throughout the testing and experimentation phase. As the people of Ukraine have demonstrated, the ability to quickly adopt emerging technologies is accelerated through rapid prototyping and fast iterations of development between technologists and warfighters. While commercially available components are crucial building blocks, often these systems are fit for military-specific use, demonstrating the value of mission engineering at the tactical edge. Using Agile development methods and working together with industry, RDER accelerates the transition of critical capabilities by two to four years. For each RDER technology candidate, our team builds a body of evidence comprised of requirements, modeling and

simulation, an integrated experimentation assessment plan, a military utility assessment, and a transition plan to the Military Services.

Once technology transitions from prototype to product through RDER, the OUSD(R&E) works closely with the OUSD(A&S), through the Competitive Advantage Pathfinders initiative, and the Military Services to spearhead rapid fielding at speed and scale. The tight coordination between RDER and Replicator is another example of rapid scaling. While RDER assesses and iterates on the military utility of innovative systems, the objective of Replicator is to focus on scaling production for a segment of those technologies – currently autonomous, attritable systems. RDER accelerates a capability from prototype to product while Replicator will aim to accelerate a capability from product to scale for autonomous, attritable systems.

RDER prototypes are being scaled to production. For example, the Global Autonomous Reconnaissance Craft (GARC) is an unmanned surface vehicle with multiple bolt-on capabilities that were developed through RDER, in partnership with the Navy and the DoD Small Business Innovation Research (SBIR) program, to enhance effectiveness in a contested environment. RDER assessed the GARC's operational readiness and alignment with the Joint Warfighting Concept and has qualified it for scaling through other mechanisms, such as the Accelerate Procurement and Fielding of Innovative Technologies (APFIT) program.

Thanks to many members of this committee, the APFIT program funds small and non-traditional companies through a competitive, merit-based process that enables rapid low-rate initial production and delivery of capabilities two to four years ahead of the traditional timeline. The APFIT program enables companies to immediately begin building production capacity and deliver low-rate initial production units. The APFIT program has funded small companies to scale up deliveries of mine detection sensors for unmanned underwater vehicles, anti-jam

antennas, and unmanned surface vehicles, all of which will be crucial capabilities for any conflict in a contested environment.

With \$14.2M in APFIT program funding, the small business performer for the GARC – Maryland-based Maritime Applied Physics Center – increased its production capacity from one manual line to eight automated production lines and accelerated GARC delivery by two years. The company is now better positioned to meet production needs.

Since its inception, the APFIT program has provided \$250M to 21 small business and non-traditional defense contractor executed projects across the Department. The majority of APFIT program projects began as SBIR contracts, while six projects began with program office funding and two projects were identified by DIU, illustrating the close coordination between early-stage science and technology funding, early-stage procurement funding, and small and non-traditional businesses.

The Assault Breaker II program (ABII) and the Joint Fires Network (JFN) are other examples of how the Department is using iterative development and testing to accelerate capabilities at the speed of relevance. The ABII program has two objectives: First, to design warfighting operational constructs based on new and emerging technologies and capabilities; and, second, to develop an advanced modeling and simulation environment to support analysis of true cross-domain, Joint Warfighting constructs. Through the ABII program, the Department has matured theater scale all-domain systems-of-systems modeling and simulation capabilities and used the results of these capabilities to drive DoD requirements and refine the Department's tactics, techniques, and procedures. The ABII program works closely with Combatant Commands to obtain warfighter feedback, ensuring that solutions are operationally relevant. ABII program modeling and simulation are intimately linked with the development and

maturity of JFN, which is a high priority capability for the United States Indo-Pacific Command (USINDOPACOM) that links sensors to shooters across the Military Services. JFN allows geographically dispersed commanders to simultaneously share a common understanding of the battlespace, fed by sensors from any platform which can provide targeting guidance to any weapons system. The OUSD(R&E) initiated research and development for JFN that resulted in initial demonstration of distributed command and control to the USINDOPACOM in 2023. Rapidly providing software capabilities to the USINDOPACOM is a major priority for me. The JFN team, in partnership with the OUSD(A&S), drafted the software requirement, which was validated in just a few months, where this process has historically taken three years. The JFN team was hailed at their Joint Capabilities Board for record speed.

Succeeding Through Teamwork: Allies and Partners in Expediting Innovation

As the Department bolsters integrated deterrence by sharpening our technological edge, we must also recognize the asymmetric advantage presented by our unmatched network of allies and partners. The Foreign Comparative Testing (FCT) program, AUKUS Pillar II, and the North Atlantic Treaty Organization (NATO) Defense Innovation Accelerator for the North Atlantic (DIANA) are all examples of how the DoD is harnessing deep relationships across the globe to identify promising prototypes for accelerated fielding. The FCT program finds, assesses, and fields mature technologies developed in foreign countries that share our nation's interests to deliver affordable, near-term solutions to warfighting capability gaps. My office evaluates FCT program products in relevant environments to assess whether the product needs additional development and testing, or if it is ready for the warfighters. All FCT program efforts require foreign companies to partner with a U.S.-based defense company for domestic production and fielding, yielding dividends for the U.S. defense industrial base.

Last fiscal year my office collaborated with the United Kingdom and successfully tested their wideband countermeasures for fourth generation fighters, an active expendable decoy with radio frequency capabilities to thwart missile threats. The Air Force, the Navy, and the Air National Guard plan to procure these countermeasures since they significantly expand the mission envelope of our older fighters. Also last year, my office successfully tested an infrared-guided 2.75” rocket developed by the Republic of Korea to counterattack watercraft. These “fire and forget” rockets, launched from an unmanned surface vessel, successfully engaged multiple moving targets and have demonstrated long-range unmanned engagement capability. This capability supports freedom of maneuver in contested littoral areas across the globe. And with Norway, in close collaboration with the OUSD(A&S), my office is testing solid rocket motors for 155mm artillery rounds, which triples the range of current munitions. These extended range munitions would be crucial in supporting Ukraine and for any future fight against a near peer competitor. There are currently 98 ongoing FCT program projects with 23 partner nations.

The United States’ allies and partners are a vital part of the effort to deliver warfighting capabilities to our service members ahead of any potential conflict. In the Indo-Pacific, the Department is accelerating the development and delivery of advanced capabilities with Australia, including through AUKUS Pillar II with the United Kingdom. As Secretary Austin announced in December, AUKUS partners will undertake a series of integrated trilateral experiments and exercises that will build bolster our integrated deterrence and ensure that the Indo-Pacific remains free from coercion and aggression. These exercises will lead to the validation of trilaterally connected autonomous platforms from the sea floor to the stratosphere, and ultimately enable trilateral production, acquisition, and fielding of these systems. The first exercise will take place in Australia in 2024.

Amid Russia’s full-scale invasion of Ukraine, NATO has realized that its technological advantage is stronger if the Alliance works together on advanced dual-use capabilities. For the United States European Command, NATO DIANA, which can now receive U.S. financial contributions thanks to your support and the authorities in the National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2024, is an effort to accelerate the development of solutions to dual-use and emerging disruptive technologies. U.S. companies compete alongside European companies in a merit-based selection process to advance security solutions for the Alliance. The first NATO DIANA cohort includes 44 companies, six of which are American. To ensure a strong innovation ecosystem across the alliance, I nominated Ms. Barbara McQuiston from the OUSD(R&E) to be the inaugural Chair of the NATO DIANA Board of Directors and she was overwhelmingly elected by our NATO allies. Thanks to your leadership in the Armed Services Committees, the NDAA for FY 2024 authorized the Department to contribute funding to NATO DIANA.

Investing in Enduring Technological Advantage for Decades to Come

While the Department develops the technology that will help us win any competition in this decisive decade, we must also address the valleys of death that hinder the delivery of longer-term capabilities – most notably the valley of death from research to prototype. Creating bridges to transition capabilities out of the laboratory into the hands of the warfighters and the commercial sector is key to ensuring enduring technological advantage for decades to come.

One of the most notable players in this effort in the OUSD(R&E) portfolio is the Defense Advanced Research Projects Agency (DARPA). DARPA is the world’s premier innovative organization that spawns disruptive ideas and creates leap-ahead technologies to prevent surprise. DARPA has laid the foundation for some of society’s most transformational

technologies including the internet, miniaturized global positioning system, smart phones, mRNA vaccines, stealth, commercial space access, and autonomous vehicles. DARPA is the epitome of high-risk/high-reward, taking big bets that – if successful – completely change the trajectory of what is possible, giving our warfighters and national security leaders entirely new capabilities and options. Today, DARPA has approximately 250 active programs, 70 percent of which are using or advancing artificial intelligence (AI) in some fashion. A few years ago, DARPA developed tactical clocks with performance superior to existing technology at sufficiently low size, weight, and power to permit extended deployment on battery-powered platforms. This is tremendously helpful for position, navigation, and timing in highly contested environments. The technology transitioned to DoD in 2020 to continue development, resulting in commercial products available for use today.

Most DARPA programs have broad application and may not transition directly to military capability, which is why DARPA encourages researchers to explore entrepreneurship when possible. DARPA's Embedded Entrepreneur Initiative (EEI), which started as a pilot program in 2019, facilitates access to commercial markets and investment and is an effective tool in addressing the valley of death from lab-to-prototype faced by DARPA research. As of this January, EEI assisted more than 50 pre-seed stage research teams to raise \$675M in private investment and obtain over \$304M in government awards with zero adversarial investment. Programs such as EEI allow the Department to propel technology forward in the U.S. commercial sector that may be early-to-need or underdeveloped for military use. After maturation in the private sector, these technologies are prime candidates for organizations like DIU to ingest back into the defense innovation ecosystem, due to their dual-use nature.

My office is catalyzing private investment to build stronger bridges across all three valleys of death in many other ways through the Office of Strategic Capital (OSC), which Secretary of Defense Lloyd Austin established in December 2022. Thanks to you, this year's NDAA gave the DoD new loan, loan guarantee, and technical assistance authority and established OSC in statute. Pending FY 2024 appropriations, OSC will execute these authorities for the Department with new financial tools to strengthen the critical technology supplier and manufacturing base and counteract adversarial investments. OSC aims to use the United States' comparative advantages in capital markets and economic competition to crowd in private capital for critical technology supply chains needed by the Department. OSC's activities are built upon best practices from more than 130 active federal credit programs that use loans and loan guarantees versus contracts or grants, where appropriate, minimizing cost to the taxpayer. Already, OSC is working with the Small Business Administration as it provides loan guarantees for private investment in critical technology areas essential to national security.

My office is aligning incentives through public-private partnerships as well, coupling the long-term outlook of the Department's science and technology investments with the economic incentives of the private sector. Manufacturing Innovation Institutes – or MIIs – are game-changing catalysts intended to build enduring advantage for the joint force by connecting innovative industrial ecosystems with emerging technology and domestic market sectors. MIIs demonstrate the powerful benefit of public-private partnerships between the Government and the defense industrial base by propelling cutting-edge manufacturing technology out of the laboratory and into industry, securing supply chains and growing the nation's skilled workforce. BioMADE, for example, is an MII that serves as a public-private partnership between Government, academia, non-profit organizations, and industry to address the spectrum of

challenges associated with biomanufacturing of non-medical products. BioMADE has created a sustainable, secure, and resilient domestic manufacturing ecosystem to produce high value and strategically important materials and supplies, including fine, novel, and performance-driven chemicals, materials, and catalysts.

BioMADE's innovations are solving critical challenges for our national security. For example, biomanufacturing can reduce the supply chain risks associated with rubber. It takes seven years to produce latex from a rubber tree, whereas advancements in biomanufacturing have allowed industry, with support from the Department, to produce natural rubber from a species of dandelion that can be harvested in six months. There are nine DoD-sponsored MIIs across the country, and each are creating new ways to more efficiently manufacture goods essential to national security. The Department's strategic commitment of over \$950M for MIIs has resulted in approximately \$2B of committed non-federal cost share and over \$1.2B of committed federal project work.

A longstanding cornerstone of the bridge from lab-to-prototype is the SBIR/Small Business Technology Transfer (STTR) program, which provides funding to small innovative companies. Prior to receiving an award, all proposals from small businesses are assessed for foreign affiliations or relationships to foreign countries through the awarding DoD Component's due diligence program, mitigating the risk of malign foreign influence. While SBIR/STTR Phase I contracts provide seed money for concept exploration and feasibility studies, SBIR/STTR Phase II contracts provide funding to build a lab prototype or develop software to demonstrate concept. The majority (58%) of SBIR/STTR contracts in FY 2023 were awarded in trusted AI/autonomy, space technology, and integrated sensing and cyber, three of the Department's Critical Technology Areas. After receiving SBIR/STTR Phase I and II awards,

small businesses pursue commercialization or follow-on SBIR/STTR Phase III contracts. While the SBIR/STTR program is focused on funding ideas that are ripe for commercialization, much of this technology is also quickly transitioning to military use cases. Since SBIR/STTR Phase III contracts are not funded by SBIR/STTR program funds, but rather by a program office or private party that identifies a need for the innovative technology, the transition from SBIR/STTR Phase II to Phase III is a crucial, though incomplete, metric for success. In FY 2022, DoD obligated \$2B in SBIR/STTR awards, resulting in over \$950M in SBIR/STTR Phase III research, development, testing, and evaluation contracts alone the following fiscal year.

Lastly, I want to highlight a program that is a testament to the DoD's investment in onshoring the production of cutting-edge microchips, an issue that is top of mind for us all. Thanks to bipartisan congressional leadership from this committee and funding from the CHIPS and Science Act of 2022, the Department established the Microelectronics Commons, a national network of innovation hubs that provides \$2B from FY 2023 to FY 2027 for onshoring microelectronics development and prototyping to bridge the laboratory-to-fabrication divide. Consistent with President Biden's Investing in America agenda, these eight innovation hubs are distributed across the United States and will reduce barriers to innovation, mature emerging microelectronics technologies, enhance existing microelectronics infrastructure, and foster a pipeline of domestic talent and innovative ideas. The Microelectronics Commons innovation hub members include more than 430 organizations, over 100 of which are academic institutions, and have participation from across 35 states, the District of Columbia, and Puerto Rico. This national effort will accelerate the prototyping of advanced microelectronics that will bolster the nation's military technological advantage. And with the newly authorized DoD loans and loan guarantees, OSC, in coordination with the Department's interagency partners, can ensure that

those prototypes are scaled into domestically-produced dual-use products critical to national and economic security.

The Department's tool kit must remain robust, yet tightly coordinated, to catapult ideas and capabilities across each valley of death. And OSD, the Military Services, and Defense Agencies must remain laser focused if our nation is to meet our pacing challenge. In the face of this urgent need, I am confident that our national defense science and technology enterprise will continue to deliver the most advanced military capabilities to our warfighters and help preserve the rules-based international order for decades to come. Thank you for the opportunity to appear in front of this committee today, and I look forward to your questions.