Statement by Mr. Stephen Welby

Assistant Secretary of Defense for Research and Engineering

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Third Offset Technology Strategy

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Introduction

Chairman Fischer, Ranking Member Nelson, and Members of the Subcommittee, I am pleased to have the opportunity to provide testimony on the Department of Defense's Third Offset Strategy and to join my colleagues from Defense Advanced Research Projects Agency (DARPA) and Strategic Capabilities Office (SCO). In my role as the Assistant Secretary of Defense for Research and Engineering (ASD(R&E)), the Chief Technology Officer of the Department of Defense, I am responsible for the Department's strategies and supporting plans to develop and leverage the technologies needed to ensure continued US technological superiority.

We are at a pivotal moment in history where the advanced technical capability and capacity that the Nation has relied upon to provide us with unmatched technological superiority on the battlefield (including capabilities in precision weapons, long-range ISR, space systems and stealth) are now being challenged by the military technology investments being made by increasingly capable and assertive powers. Other nations are increasing their investments in advanced capabilities, including anti-access/area-denial capabilities, which are intended to counter US technological strengths and deter the US from projecting power abroad to defend our national interests, maintaining international norms, and supporting our allies and partners.

Our nation has long pursued strategies that leveraged US technological advantage as a force multiplier. We continue to leverage advances in technology and new operational concepts to provide sustained advantage to US forces – shifting the landscape of future national security competition to our advantage by seeking asymmetric opportunities in technological and operational innovation.

A Focus on the Future

As the Department looks to the future, significant global challenges are on the horizon that will require renewed emphasis on sustaining US technological superiority. For the last 30 years the US and our allies have been able to count on a set of unique capabilities in combat that no regional adversary could bring to bear: long range precision weapons, airborne ISR for real time targeting, network centric integration of command and control, low observable systems, and integrated use of space assets. These technological capabilities enabled a US strategy of power projection – leveraging a limited forward presence with the ability to respond to provocation with follow-on forces that could be moved to theater and deployed with confidence in an opposed environment. Today, we are seeing a return to a more competitive environment – one where regional actors have studied US strengths and are capable of making the investments required to develop advanced systems designed to directly counter US technological strengths in a power projection environment. This evolution in our competitive technological posture will require the DoD to invest in the technological and operational innovations required to sustain our decisive conventional overmatch against regional adversaries.

As Secretary Carter has said, "Russia and China are our most stressing competitors. They have developed and are continuing to advance military systems that seek to threaten our advantages in specific areas. And in some case, they are developing weapons and ways of wars that seek to achieve their objectives rapidly, before they hope, we can respond."[1] Given our constrained budget resources, we must pursue a technological strategy to ensure our conventional deterrence remains as strong in the future as it is today. Accomplishing this goal is one of the most important strategic tasks facing the Department.

As it has been in the past, technological and operational innovation will be the key to future strategy. Maintaining and extending our competitive, technological, and operational advantages is not a purely quantitative contest with other nations. Rather, the US must seek asymmetric advantages – particularly those that take advantage of US strengths in military and commercial technological innovation. We must accelerate our approaches to identifying promising technological differentiators, our processes for mapping technological capability to operational advantage, and our methods of moving new capabilities from laboratory to field.

Future capabilities will be increasingly joint in nature; leveraging the ability to synchronize simultaneous operations in the space, air, sea, undersea, ground, and cyber domains. Emerging tools based on breakthroughs in computer science, advanced electronics, novel communications and sensors, and human-machine interfaces will enable new operational concepts that will enable faster and better decision making, coordinated operations at range and across the battlespace by manned, unmanned, and cyber operations.

Toward a Third Offset Strategy

Merriam-Webster defines an Offset as "something that serves to counterbalance or to compensate for something else."[2] An offset strategy is an approach to military competition that seeks to asymmetrically compensate for a disadvantaged position. Rather than competing head to head in an area where a potential adversary may also possess significant strength, an offset strategy seeks to shift the axis of competition, through the introduction of new operational concepts and technologies, toward one in which the US has a significant and sustainable advantage. A successful offset strategy devalues an adversary's current advantages and imposes costs to react to US efforts and help establish a long-term competitive advantage for US forces.

The US was successful in pursuing two distinct offset strategies during the Cold War. These strategies enabled the US to "offset" the Soviet Union's numerical advantage in conventional forces without pursuing the enormous investments in forward deployed forces that would have been required to provide overmatch soldier for soldier and tank for tank. These offset

[1] Remarks by Secretary Carter on the Budget at the Economic Club of Washington, DC, February 2, 2016
[2] http://www.merriam-webster.com/dictionary/offset

strategies relied on fundamental innovation in technology, operational approaches, and organizational structure to compensate for Soviet advantage in time, space, and force size.

The first of these offset strategies occurred in the 1950's, when President Eisenhower sought to overcome Warsaw Pact's numerical advantage by leveraging US nuclear superiority to introduce battlefield nuclear weapons – thus shifting the axis of competition from conventional force numbers to an arena where the US possessed an asymmetrical advantage. This approach provided stability and offered the foundation for deterrence.

The second of these offset strategies arose in the late 1970's and 1980's with the recognition that the Soviet Union had achieved nuclear parity. The Second Offset Strategy, informed by studies such as the 1973 Long Range Research and Development Planning Program, sought to create an enduring advantage by pursuing a new approach to joint operations – leveraging the combined effects of conventional precision weapons, real-time long-range ISR sensor capabilities capable of supporting real time precision targeting, and the joint battle networks that permitted these capabilities to be synchronized and executed over the full breadth of the battlespace. These integrated systems-of-systems provided a significant force multiplier by improving the efficiency and effectiveness of conventional strike systems, creating opportunities for synergistic effects across warfighting domains, and permitting US forces to more effectively and rapidly project conventional power globally with reduced forward presence. These conventional targeting and strike capabilities built on US advantages in weapons technology, sensor technology, aviation systems, software and computer architecture, and space-based capabilities (particularly space based communications and the global positioning system) to provide the ability to service targets with unprecedented accuracy. This combined suite of technologies reflected unique US technical capabilities at the time – capabilities that provided the US and its allies with an asymmetric advantage over Soviet forces.

It is important to note that neither of these two original offset strategies was solely about technological advantage. In each case, it was the right combination of technology-enabled operational and organizational innovation that provided decisive strategic and operational advantage and therefore bolstered conventional deterrence.

The capabilities of the Second Offset Strategy provided the US with decisive conventional overmatch against regional adversaries. As a result, the asymmetric advantage provided by these capabilities has been a central feature of the US doctrine for over three decades.

What has changed?

At the time of the introduction of the Second Offset Strategy in the early 1980's, the US was the only nation with the knowledge and capacity to develop, deploy, and successfully execute the intelligence, surveillance and reconnaissance capabilities, the space-based systems, and the precision weapons that supported this approach. Today, competitors such as Russia and

China (and countries to which these nations proliferate advanced capabilities) are pursuing and deploying advanced weapons and capabilities that demonstrate many of the same technological strengths that provide the technological basis for US advantage. This growing symmetry between US technical capabilities and near-peer potential competitors is particularly seen in the capabilities demonstrated during Russian power-projection operations in Syria.

There has been significant public discussion about anti-access/area denial (A2/AD) capabilities. These advanced capabilities include anti-air and anti-surface sensors and weapons systems designed to make it more difficult for the US to project power and operate at extended range. Potential adversaries have had over two decades to study the tools and operational concepts that underpin the US technology-enabled conventional strategy and have learned from our operational successes. With the globalization of technology and technological talent and with growing resources being applied to military modernization, potential competitors are seeking similar technological capabilities to those the US has deployed, and are optimizing them to blunt US advantage. The emergence of A2/AD capabilities, which leverage similar precision guidance and seeker/sensor technologies to those that underpinned the Second Offset Strategy, again demonstrate the recent emergence of increased symmetry in military technical capabilities. Potential competitors are beginning to catch up, potentially eroding the margin of conventional advantage enjoyed by US forces since the end of the Cold War.

Toward a Third Offset Strategy

The emergence of increasing symmetry in national security environment suggests that it is again time to begin considering the mix of technologies, system concepts, military organizations, and operational concepts that might shift the nature of the competition to US advantage. Such a set of capabilities would provide the basis for a Third Offset Strategy. As was true of previous offset strategies, a Third Offset Strategy would seek, in a budget constrained environment, to maintain and extend US competitive technological and operational advantage by identifying asymmetric advantages that are enabled by unique US strengths and capabilities. A Third Offset Strategy would ensure that our conventional deterrence posture remains as strong in the future as it is today and would establish the conditions to extend that advantage into the future.

Today, the Third Offset Strategy is not a formal document that lays out a single course for future capabilities. Instead the term describes the broad nature of capabilities the Department expects to realize over the coming years by pursuing developments in advanced technologies by conducting experimentation with prototype systems to inform future options, through an increased emphasis on war gaming to help understand how new concepts can provide enduring advantage, and by emphasizing the need to innovate across the entire DoD enterprise, and through an emphasis on delivering new and enhanced capability to the warfighter in the coming years.

The Department anticipates that that the capabilities delivered through a Third Offset Strategy will:

- Enable the Joint Force to fight and deliver effects from a distributed posture at extended ranges
- Enable the Joint Force to leverage range, precision and speed to seize and maintain the initiative
- Enable the Joint Force to leverage dispersal and new forms of operational sanctuary to increase survivability
- Enable the Joint Force to achieve mass in the form of ensembles of many low-cost, collaborating "effectors"
- Enable the Joint Force to develop new forms of distributed maneuver and close combat techniques that combine kinetic, electronic warfare and cyber-enabled operations
- Enable the Joint force to operate battle networks much less vulnerable to cyber and electronic attack

Under a Third Offset Strategy, a combination of these capabilities, combined with the continued maturation of current US capabilities and strengths, will extend and enable US capability to project power and deliver dominant overmatch if called upon – rendering ineffective potential adversary investments in A2/AD capabilities and advanced weapons systems. These envisioned third offset capabilities will provide the underpinnings for future conventional deterrence and will provide the basis for support to US partners and Allies into the future.

Deputy Secretary of Defense Work has emphasized the importance of advanced software-enabled capabilities to any Third Offset Strategy.[3] Emerging capabilities in artificial intelligence and autonomy offer significant advantage to the Joint Force – enabling the future force to develop and operate advanced joint, collaborative human-machine battle networks that synchronize simultaneous operations in space, air, sea, undersea, ground, and cyber domains. Artificial intelligence will allow new levels of autonomy – the limited delegation of decision-making authority – within joint battle networks, leading to entirely new opportunities for human-machine collaboration and combat teaming.

With the goal of achieving future operational advantage, the Department is pursuing developments in five distinct areas enabled by recent developments in advanced algorithms and software intelligence:

[3] Deputy Secretary Work's interview with David Ignatius at "Securing Tomorrow" forum at the Washington Post Conference Center in Washington, DC, March 30, 2016

- Autonomous Learning Systems – systems capable of processing large data sets to identify emergent patterns and models in near real time and/or that have the delegated authority to recommend or make decisions based on analysis of these data sets, especially in applications that require faster than human reaction times (e.g., cyber defense, electronic warfare, missile defense, and active vehicle protection systems
- Human-Machine Collaboration – new capabilities that team human decision makers with software-enabled support systems to exploit the advantages of both for better and faster decisions
- Assisted Human Operations – using software enabled systems to enhance human perform in combat (e.g., wearable electronics and combat "apps")
- Manned-Unmanned Combat Teaming – advanced system-of-systems that employ innovative cooperative activities between manned and unmanned systems to provide new operational capabilities
- Cyber and Electronic Warfare (EW) Hardened and Networked-Enabled Semi-Autonomous Weapons – weapon systems that can locally communicate and coordinate their behavior for improved effectiveness in communications denied environments

Recent advances in advanced algorithms and software intelligence are expected to have significant impact in education, health care, and many commercial sectors in the coming decade. We anticipate US leadership in these areas to offer potential benefit in national security capabilities as well. We anticipate these emerging capabilities to ultimately support specific Service and Joint combat tasks and manifest themselves uniquely in domain-specific ways in support of new operational and organizational constructs.

As the Department develops a Third Offset Strategy, it is critical to prepare for a future security environment of continuous technological competition – one that will require sustained emphasis on the US maintaining its ability to out-innovate our competitors. This focus on innovation will require the Department to be open to all potential sources of technical advantage – leveraging our traditional industrial base, academia, and non-traditional suppliers to achieve competitive advantage. Speed of delivery from concept to fielding will be critical in this environment and will likely create a demand for new flexible architectures, more agile capability delivery models, and improved mechanisms for incremental capability and technology insertion. These factors will create a significant demand for a highly skilled defense science and technology workforce with an increased emphasis on ensuring the Department can attract and retain highly sought after talent.

FY 2017 Investment in Third Offset Strategy Capabilities

In testimony[4] supporting the Fiscal Year 2017 Defense Budget Request, Secretary Carter identified more than $3.6 billion of investment in FY 2017 and $18 billion in investment across the Future Year Defense Plan (FYDP) to help spur research, development, test and evaluation, and procurement of advanced capabilities our military will need to deter and if necessary fight and win high-end conflicts in the future. These investments directly support the objectives of a Third Offset Strategy.

While relatively modest compared to the Department's overall program, these investments will enable the development of leading-edge, asymmetric capabilities and help spur development of operational concepts to counter advanced adversaries. This approach is similar to the development and implementation of the Second Offset Strategy in the early 1980's – the initial Second Offset Strategy investments were a fraction of DoD's budget, but they ultimately led to the development of the joint guided munitions capabilities that have been used in every American conflict since Desert Storm.

The investments in the Fiscal Year 2017 Defense Budget Request include new capabilities that can be fielded rapidly through modifying and upgrading existing systems, material concepts that could immediately enter accelerated development, and technology-driven concepts that could have a significant impact on the Joint Force's conventional capabilities over the longer term. They also emphasize the critical importance of focusing on cost so that we will be able to introduce disruptive capabilities into the Joint Force at scale.

Many of the capabilities being developed to support a Third Offset Strategy remain classified, and therefore it is only possible to break down the $18 billion dollar investment publicly in six broad categories:

- First, to address the dual challenges of getting into theater (or the anti-access challenge) and operating under guided munitions threat (or the area-denial problem), the Department proposes investing more than $3 billion over the FYDP in weapons and concepts for surface-strike and air-to-air combat to negate competitor investments in these areas. These include upgrades to a number of existing weapons and enhancements to on-going efforts to develop new weapons.

- Second, to insure our ability to prevail in future guided munitions salvo competition, the Department proposes investing nearly $500 million over the FYDP for improvements in

[4] Secretary of Defense's written statement before the Senate Armed Services Committee on March 17, 2016

cost-effective approaches to defend, disperse, and protect key operational capabilities and operational locations.

- Third, the Department proposes investing more than $3 billion over the FYDP to ensure we will continue to have the most lethal submarine and undersea force in the world. These investments will leverage new payloads, better sensors, and new undersea systems to enhance deterrence and ensure we continue to own this domain.

- Fourth, the Department proposes nearly $3 billion over the FYDP to advance the development of human-machine teaming, collaborative decision making, and efforts to disaggregate complex systems into many, lower-cost systems operating together to enable cooperative ensemble operations. When demonstrated, these capabilities will create radically new options for delivering combat power from disaggregated systems and will create significant operational and strategic dilemmas for potential adversaries.

- Fifth, we are investing more than $1.7 billion over the FYDP in cyber and EW capabilities including advances in cognitive systems that can sense, learn, and react automatically, and generate effective countermeasures against new or unknown threats in real time, ensuring our ability to operate within the cyber and EW domains while denying them to the adversary.

- Sixth, we are investing more than $500 million over the FYDP to expand war gaming, test new operational concepts, tactics, techniques and procedures, and fund demonstrations of advanced capabilities. A major focus will be exploring new operational concepts and capabilities for ground combat.

These summary investments include only the scope of programs that are supporting prototyping, experimentation, and operational demonstration and do not include the significant investments being made across the Department's Research and Engineering enterprise. Within the Service laboratories and DARPA, critical supporting technologies are being developed that will extend and enhance our ability to address future military challenges, shift the cost curve to improve affordability, or anticipate and create technological surprise. These core S&T investments maintain and extend the underlying foundational technical advantage on which current and future system innovations are based.

The Role of the Research and Engineering Enterprise

The Department's goal to sustain and advance our Nation's technological superiority for the 21st Century's national security environment requires sound research and development investments. The enhanced use of prototyping, demonstration, and experimentation will help the Department to more rapidly mature and assess the impact these technologies can have on our

future force. Our investments focus on protecting essential US advantages in design, development, and manufacturing capabilities that would be very difficult to reconstitute if lost. These investments deliver the knowledge and tools necessary to preserve our advantage in a future global environment and provide the Department with the ability to make a strategic choice in the future to shape the nature of military competition.

The DoD Research and Engineering community works to create options for how the Department will meet our Nation's future national security needs and serve as an agile innovation engine for the Department. We must continue to focus on speeding the development and application of technology to meet acquisition program needs and must leverage ideas from inside and outside the Department; adapting and shaping them to solve military problems.

The ASD(R&E) serves as the Chief Technology Officer of the Department and provides oversight, guidance and direction to Service and Defense Agency science and technology investments. Through the Reliance 21 process, we coordinate the efforts of the Services to maximize return on investment and avoid unnecessary duplication of effort. Research and Development areas coordinated through the Reliance 21 process include efforts in Counter-Improvised Explosive Devices; Counter-Weapons of Mass Destruction; Biomedical; Command Control Communications; Computers and Intelligence; Human Systems; Cybersecurity; Autonomy; Engineered Resilient Systems; Electronic Warfare; Sensors; Air Platforms; Ground and Sea Platforms; Weapons Technologies; Space; Advanced Electronics; Energy and Power Technology; and Materials and Manufacturing Processes. Core work in each of these areas offers potential to impact and influence thinking relevant to a Third Offset Strategy, and the Department continues to mature and update roadmaps for critical technology maturation across the Services in each of these areas.

The core science and technology efforts of ASD(R&E) and the service laboratories are principally focused on creating and enabling long-range opportunities for the Department's future materiel options. While these organizations also support the current fight and provide near-term support to ongoing operations, acquisitions, upgrades and support programs, their principal focus is on the mid- and long-range needs of the Department – creating the supporting technology and concepts to shape the Department's future.

In 2015, DoD conducted a classified ASD(R&E)-led long range research and development planning program (LRRDPP) to identify critical technologies and future system concepts that the Department should consider to inform material options for the future force. This study engaged experts from across the Department to identify novel system concepts and emerging technical capabilities that could have significant impact on DoD's posture relative to emerging near-peer competitors in the 2030 timeframe. This long-range study reviewed hundreds of inputs received from the commercial, not-for-profit, and academic sectors through a broad public request for information. The LRRDPP study also reviewed ongoing R&D efforts across Service laboratories, DARPA, and Department of Energy labs. The study delivered detailed

recommendations for acceleration and shaping of new and existing DoD investments with the goal of providing technology options for demonstration in the 2020 timeframe. The Department's Fiscal Year 2017 Budget Request was informed by the LRRDPP study and other associated analytical efforts. The LRRDPP study was an effective means of injecting potentially technologically enabled disruptive concepts into the Department's budget deliberations – both to challenge current thinking and to provide long-range options for accelerated technology maturation for cutting-edge, asymmetric capabilities with the potential to enable new operational concepts.

DARPA similarly has an eye toward shaping the nation's future technology and technical options, but the DARPA portfolio is differentiated from the Service S&T portfolios by a distinctive focus on high-risk, high-payoff opportunities. Because DARPA's core mission is to make pivotal early investments in breakthrough technologies for national security, the Agency is always looking beyond the challenges of the moment to anticipate and create options for the future. The interaction between Service S&T community and DARPA is robust – with direct Service participation in DARPA programs and Service transition of DARPA-led efforts into the operational fleet. Through these interactions, the unique innovative culture of DARPA serves to catalyze and accelerate advanced capability adoption within the Services.

SCO was created in 2012 by Dr. Carter during his tenure as Deputy Secretary of Defense. SCO reports directly to the Deputy Secretary of Defense and is engaged in identifying and prototyping near-term solutions to counter the threat of near-peer competitors. SCO executes this mission by engaging directly with the COCOMS and Service leaders to identify opportunities to re-purpose, modify, or enhance existing Service capabilities to perform new missions. SCO efforts often cross service boundaries and mission areas – rethinking how tools procured by a Service for one mission might be repurposed and extended to provide alternatives and options in a fundamentally different mission area – often within a different Service. SCO's focus on demonstrating "good enough" and "sometimes game-changing in the near-term" solutions provide options to fill critical gaps and offer a rapid response to emerging threats – creating "breathing room" in which the Service S&T community and DARPA initiatives can deliver more fundamental, long-term solutions to provide sustained advantage.

As the Department pursues technology enablers for a Third Offset Strategy, each of these groups plays an important role. SCO is principally focused on the near-term – prototyping capabilities that, if successful, could be procured and implemented within the time horizon covered by the current President's budget submission. DARPA and the Department's core S&T enterprise are focused on concepts and enablers that, if successful, will have more fundamental shaping influence in the mid- to long-term. DARPA's portfolio consists of a selected set of fundamentally disruptive technology options, while the Services' S&T portfolios cover the full space of sustaining and emerging military relevant technologies.

Conclusion

As DoD develops a Third Offset Strategy, the Department's Research and Engineering enterprise is well prepared to develop, shape, and create technology options to inform future operational concepts. The core mission of the Research and Engineering community is to study emerging threat capabilities, develop, shape, and evaluate emerging technological opportunities and to think creatively about alternative future capabilities. At each of our laboratories, engineering centers, and test facilities our best and brightest researchers come to work each day thinking about how to ensure that our military preserves its technological edge well into the future.

Our goal must always be to ensure that our Soldiers, Sailors, Airman, and Marines always have the scientific knowledge, the right technology, the advanced systems and tools, the decisive technology, and the material edge to succeed when called upon. Our Research and Engineering enterprise measures its success in the security of our Nation and the success of our warfighters.

The Fiscal Year 2017 President's Budget request will enable us to drive a culture of technical innovation across the Department, will help us prepare for an increasingly competitive global National Security environment, and will foster a whole-of-department coordinated effort across Army, Navy, Air Force, DARPA, and other DoD research and engineering organizations.

Let me close by thanking the committee for its strong interest in and support of the Department's research and engineering efforts as we work to discover, design, and deliver the technological capabilities our warfighters will need to shape the future.