

**STATEMENT BY
DR. PHILIP PERCONTI
ACTING DIRECTOR
UNITED STATES ARMY RESEARCH LABORATORY**

**BEFORE THE
EMERGING THREATS AND CAPABILITIES SUBCOMMITTEE
OF THE
HOUSE ARMED SERVICES COMMITTEE
ON
THE UNITED STATES ARMY RESEARCH LABORATORY'S ROLE
IN ADVANCING SCIENCE AND TECHNOLOGY FOR THE AMERICAN SOLDIER**

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Chairman Wilson, Ranking Member Langevin, and distinguished members of the Subcommittee. As the Acting Director of the Army Research Laboratory (ARL), thank you for the opportunity to discuss the critical support Army Science and Technology (S&T) provides in support of key military operations. My intent is to provide the Committee with an operational picture of the Army's S&T pipeline and then focus on ARL's unique role as the Army's corporate research laboratory. This will cover about 75 percent of the Army's S&T portfolio, and thus it does not include space and missile defense or the medical research programs.

Enabling Readiness Through Science and Technology (S&T)

Army Chief of Staff General Mark A. Milley has made readiness the Army's top priority, followed by the future force and taking care of Soldiers. As the preeminent ground combat force in the world, the Army's definition of readiness must include meeting today's urgent operational needs while ensuring decisive overmatch for the force of the future. Predictable and consistent funding is absolutely essential for the Army to build and sustain current readiness and progress toward a modern, capable future force. Without such funding the Army will have to reduce funding future readiness in modernization and infrastructure maintenance, and continue programmed end-strength reductions. As the Army's lead technology integrator, the Research, Development and Engineering Command's (RDECOM) strategy for understanding emerging threats and the operational requirements that next-generation systems will face are shaped by the strategic guidance from the Office of the Secretary of Defense (OSD); the technical and programmatic oversight of the Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASA(ALT)); the Army Materiel Command (AMC); and the various members of the Army requirements and acquisition communities.

RDECOM has developed a global S&T ecosystem in order to deliver capabilities that unburden, empower and protect the Soldier. This includes leveraging thousands of domestic and international partnerships within a global presence to identify, sponsor and collaborate on technologies important to the Army no matter where they are developed. At the same time, RDECOM collaborates with the Training and Doctrine Command's (TRADOC) Army Capability Integration Center (ARCIC) concept and requirement developers. RDECOM's scientists and engineers understand the science that underpins future technology development, realistic timelines and development costs. TRADOC, through the Capability Needs Analysis (CNA) processes, identifies the capability gaps and risks facing the current and future force.

Once needs are identified they are incorporated into ongoing and new research efforts across the Army S&T laboratory enterprise, which includes ARL and the Research, Development and Engineering Centers (RDECs) in their commodity areas: Communications-Electronics RDEC (CERDEC), Natick Soldier RDEC (NSRDEC); Tank Automotive RDEC (TARDEC); Aviation and Missile RDEC (AMRDEC); Armaments RDEC (ARDEC); and the Edgewood Chemical Biological Center (ECBC). Integrated technology solutions mature through these partnerships to transition to Programs of Record (POR) and ultimately to the force.

These capabilities and associated technology development efforts are not restricted solely to Army needs. RDECOM develops technologies to address the Army Warfighting Challenges, which are the enduring first-order challenges, the solution to which will improve the combat effectiveness of the current and future force. The Command also provides foundational capabilities for the Joint Warfighter across the entire spectrum of its operations. These capabilities include chemical-biological defense, combat feeding, combat vehicle prototyping, future vertical lift, ground and air active protection systems, and night-vision capability, among others.

In collaboration with ASA(ALT), RDECOM develops, aligns and synchronizes the Army's S&T portfolio to ensure acquisition programs capitalize on the most promising technology advancements. RDECOM's matrixed engineers provide critical technical

support to the Program Managers (PMs) and Program Executive Officers (PEOs) for approved programs, to include transitioning mature technology for system development and demonstration and, subsequently, to acquisition. RDECOM also provides critical engineering services to the PEOs and PMs with its Prototype Integration Facilities (PIFs). The PIFs design, prototype and integrate technologies to validate design in the development of hardware, conduct performance assessments throughout the life cycle, and rapidly integrate engineered solutions in response to Soldier/acquisition customer requirements. Operating as a single entity, the PIF Enterprise (PIFe) delivers competitive prototypes, and identifies manufacturing processes and efficiencies to ease the transition of designs to the factory and enables our PEO and PM partners to understand the “should” cost of production.

RDECOM provides critical lifecycle management support within the Army Materiel Command's (AMC) Materiel Enterprise. Working directly and indirectly with the Life Cycle Management Commands and the Army Sustainment Command, RDECOM synchronizes the continuous engineering support to modernize of technology already in the field.

By performing discovery research, technology development and engineering across the lifecycle, RDECOM develops the scientific and engineering expertise to enable the Army to be a smart buyer in its acquisition programs.

In addition, promising technology and knowledge will transition to the Warfighter through our industrial partnerships whereby novel concepts are embodied as field-ready materiel solutions. This also occurs by transitioning solutions through the nation's other R&D organizations.

The Army Research Laboratory

ARL's role in the Army S&T ecosystem is to act as the Army's corporate research laboratory by pursuing discoveries, innovations, and transition of technological developments that are geared toward acting on opportunities in power projection, information, lethality and protection, and Soldier performance.

ARL is made up of a diverse team of people who are excited, dedicated and focused on achieving the mission of empowering, unburdening, and protecting the Soldier and the Joint Warfighter. In FY15, ARL had a total workforce of 2,980, including active duty military and contractors. Of that, 1,849 are federal civilians with 1,316 classified as scientists and engineers. The laboratory currently has 150 post-doctoral researchers on staff, an increase from 48 in 2014, and 94 in 2015. The lab also employs 461 women and 135 veterans acquired through our competitive career program. Furthermore, the workforce is highly recognized. A sampling of the awards that laboratory employees received over the last two years include two Presidential Early Career Award for Science and Engineers; 47 elected Fellows to external scientific organizations; eight OSD Laboratory University Collaboration Initiative program winners; Lifetime Achievement Award by National Training and Simulation Association, and the Ralph P.I. Adler Award for Lifetime Achievement. ARL has also become a leader in S&T educational outreach and is shaping future generations of Americans in key markets across the nation to drive future discovery and innovation. ARL's robust Science, Technology, Engineering and Math (STEM) program is engaged in outreach initiatives from kindergarten through college. Programs such as Junior Solar Sprint, Gains in the Education of Mathematics and Science, eCYBERMISSION and Junior Science and Humanities Symposium are energizing youth throughout the nation.

As a Department of Defense Science and Technology Reinvention Laboratory, ARL has benefitted greatly from the congressional authorities granted in Public Law 110-417 Section 219 (a), Mechanisms To Provide Funds for Defense Laboratories for Research and Development of Technologies for Military Missions. These authorities give ARL an agile and fast capability to maximize our potential for the discovery, innovation and transition of leading-edge foundational research in support of strategic land-power dominance. The 219 authority for facilities revitalization enables ARL to maintain world-class laboratories. ARL fully utilizes the 219 authority, except in the transition of technologies, with \$31.3 million in FY 15 investments. These funds supported 22 projects in innovative research, two projects in workforce development and 18 infrastructure projects. In FY16, we have invested \$31.7 million in 20 innovative research projects, two workforce development projects and 19 infrastructure projects.

When combined with the Direct-Hire Authority (DHA), 219 Authority gives ARL the ability to attract, train and then retain the best and brightest engineers and scientists our country has to offer. In the last two years DHA has allowed ARL to hire 256 federal employees in critical fields such as neuroscience, electronics, computer science, and materials and aerospace engineering, as well as hiring physicists, biologists, chemists, mathematicians and social scientists.

ARL's discoveries and innovations have led to the transition of new knowledge, ideas and concepts that inform and shape requirements for new warfighting capabilities. ARL discoveries, knowledge and technologies inform and provide material for more advanced development at the RDEC level. Jointly with the RDECs, we plan research programs that are aligned and synchronized to meet emerging Army requirements. ARL takes on the highest risk, research-intensive engineering projects, while our RDEC partners support the needs of existing PORs using established engineering principles, and provide disruptive technology innovations through extramural (6.2 - 6.3) research programs. ARL and our RDEC partners work to give Army acquisition decision makers the confidence to know that technology is ready for demonstration and transition to industry for manufacturing. S&T enables readiness for today's Army and is now developing capabilities for the Army of the deep future.

ARL's Approach to Winning in a Complex World

In a world where the only constant is change, the most reliable indicators point to a future where U.S. and coalition land forces will have to project power across air, land, maritime, space and cyberspace in contested and denied environments against traditional, unconventional and hybrid adversaries.

To address this complex operating environment, ARL underwent a top-down review of its mission and vision that resulted in a new technical strategy that identifies the scientific, technical and analytical areas that ARL believes to be of vital importance to the Army of the future. The review is serving as the framework upon which the laboratory's S&T investments are based. The ARL Research Management and Leadership Strategy creates a shared vision of the future technical landscape, defining

ARL's long-term scientific agenda, encouraging more cross-directorate research and collaboration across the organization, academia, and industry. Major emphasis is placed on getting the right science and then getting the science right by identifying knowledge gaps, prioritizing research to address those gaps and then in a systematic way identifying the resources to ensure the facilities and equipment, and most importantly the expertise are available to perform the research.

The strategy also establishes eight S&T Campaigns that operate in concert to provide ARL with a robust technological framework – Extramural Basic Research; Computational Sciences; Materials Research; Sciences-for-Maneuver; Information Sciences; Sciences-for-Lethality and Protection; Human Sciences; and Assessment and Analysis.

The S&T Campaigns provide the framework for strategic planning and resourcing to ensure people, facilities and equipment are properly aligned, with emphasis on collaborative research. The campaigns are synchronized across the enterprise to execute nine Essential Research Areas (ERAs) the laboratory must address to support the Army of 2050. These areas take into account key campaign initiatives and core campaign technical competencies or enablers, across ARL's entire S&T portfolio. Every S&T Campaign supports one or more of the ERAs; however, the ERAs do not cover ARL's entire research portfolio, and they are not meant to. The ERAs provide the context and the impetus for the research ARL must do to meet the S&T objectives for the Army of 2050 and the Army's efforts towards DOD's third offset strategy. The ERAs are Human Agent Teaming; Artificial Intelligence and Machine Learning; Cyber and Electromagnetic Technologies for Complex Environments; Distributed and Cooperative Engagement in Contested Environments; Tactical Unit Energy Independence; Manipulating Physics of Failure for Robust Performance of Materials; Science for Manufacturing at the Point of Need; Accelerated Learning for a Ready and Responsive Force; and Discovery.

Equally important, ARL works together with the other services' labs using a number of initiatives to align our plans and programs, to eliminate redundancy and to provide

mutual support wherever possible. Much of this work occurs through the OSD Communities of Interest (COIs). COIs provide a forum for coordinating S&T strategies across the DoD, sharing new ideas, technical directions and technology opportunities, jointly planning programs, measuring technical progress, and reporting on the general state of health for specific technology areas. A great example of the service labs working together is the Tri-Service Quantum Science and Engineering Program that will exploit expertise at the joint service laboratories to prototype a scalable quantum network, develop and entangle practical quantum memories, and demonstrate a high-sensitivity sensor application across the network.

Discovery and Innovation at ARL

The Army needs a high-quality, inquisitive, agile foundational research program with focus on the deep future. Both the changes resulting from globalization and the needs of the future Army are uncertain.

The Army of 2050 will operate in a rapidly changing environment of hitherto unparalleled complexity. In response, under the leadership of Dr. Thomas Russell, ARL implemented a new Open Campus business model in 2014 to pursue leading-edge foundational research with an emphasis on collaboration that enables the continuous flow of people and ideas between government, academia and the private sector. This model creates a 21st century research culture that is agile and effective, that could serve as a model to transform the entire U.S. Defense Laboratory Enterprise away from a high-walled, closed and “siloeed” research community, to one that emphasizes mutual reliance and interdependent collaborative research as a critical element of national security.

Open Campus focuses on three major initiatives to create the S&T ecosystem necessary to meet future national security challenges: 1) modern government workforce management and policies for the 21st century; 2) shared facilities among government, academia and the private sector; and 3) a collaborative S&T ecosystem that encourages an entrepreneurial and innovative cultural environment. Through the Open Campus framework, ARL scientists and engineers work side-by-side with colleagues from academia, government and industry at ARL facilities. In turn, ARL’s scientists and

engineers participate as visiting researchers at collaborators' institutions to fully leverage the expertise, capabilities and facilities of ARL and its partners. ARL is committed to a goal of having 10–15 percent of its research staff on rotational assignments outside the laboratory at partner locations, with at least that number of collaborators actively participating at ARL locations.

ARL is working aggressively to create the framework necessary to support these new avenues of global collaboration. ARL's use of Cooperative Research and Development Agreements has expanded dramatically with academic, corporate and small business institutions. It is being established at the institution-wide level, rather than with single investigators, to protect the intellectual property of all partners, while dramatically streamlining the collaboration process. Over the last year, the number of agreements with academia and industry has doubled, from 60 to over 180, with 175 more in negotiation. These agreements have leveraged over \$23 million from the Army's collaborative partners. The total number of Open Campus participants has also doubled from over 200 to beyond 500 participants who are collaborating onsite in ARL laboratories. The implementation of enhanced, layered security practices has allowed more than 54 international collaborators from 19 countries to work alongside Army researchers within the installation.

This is in addition to the sizeable portion of funding that is allocated to contracts with small businesses. Over the past three years, ARL has awarded more than \$637 million in contracts to small businesses in 40 states and the District of Columbia. Additionally, ARL fully supports the Small Business Innovation Research and the Small Business Technology Transfer programs. Over the past three years, ARL has provided nearly \$122 million to small businesses in 30 states through these programs.

Conclusion

Future land power dominance will rely heavily on significant S&T advances. This is particularly true in support of power projection, protected information, lethality and protection superiority, and Soldier performance augmentation, areas that will serve as the technological cornerstones that ensure the Army's control of the battlespace.

Exploitation of emerging S&T discoveries, innovations and transition of developments in these critical areas will enable a ready and robust expeditionary Army force that is uniquely positioned to shape events in peace, and prevent or rapidly end conflict.

Through preventing conflict, shaping the operational environment and winning the nation's wars, the future Army – America's principal land force – will provide future commanders with decisive land power across the range of military operations in the homeland and abroad.

A trained Army requires modern equipment to win – the third component of readiness. An unintended consequence of the current fiscal environment is that the Army has not equipped and sustained the force with the most modern equipment and has already begun to fall behind near-peer competitors.

Within fiscal constraints, the Army is investing in modernization, while rebuilding readiness and producing a more capable, leaner and globally responsive Army. We will continue working with our partners to align research, development and engineering efforts to develop the technologies that support the Army's priorities. We will focus S&T investment priorities to provide the innovative technologies to close capability gaps, address emerging threats, reduce acquisition and sustainment costs, and change the nature of the fight.

On behalf of my colleagues, thank you. Your work is vital to ensuring ARL remains the Nation's premier laboratory for our land forces. You are essential partners in executing our mission for America's Army.