STATEMENT BY
MS. MARY J. MILLER

DEPUTY ASSISTANT SECRETARY OF THE ARMY

FOR RESEARCH AND TECHNOLOGY

BEFORE THE

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Mr. Chairman, Ranking Member Langevin, and distinguished members of the Subcommittee, thank you for the opportunity to discuss the Army's Science and Technology (S&T) Program for fiscal year (FY) 2014.

Over the course of these past almost twelve years of war, the world has seen first-hand the value and impact that technology brings to the battlefield and how capabilities, enabled by technology, are critical to our Soldiers and their success. The U.S. Army depends on its S&T Enterprise to research, develop, and demonstrate high pay-off technology solutions for hard problems faced by Soldiers in ever-changing, complex environments against an increasingly diverse set of threats. Uncertainty and complexity are at the heart of the Army's challenges. The Army of the future requires solutions that are both affordable and versatile and relies on the S&T community's contributions to ensure that they remain the most capable in the world. We are grateful to the members of this Committee for your sustained support of our Soldiers, your support of our laboratories and centers and your continued commitment to ensure that funding is available to provide our current and future Soldiers with the technology that enables them to defend America's interests and those of our allies around the world.

To ensure our effectiveness in meeting the Army's needs, the S&T Enterprise must remain innovative and agile, staffed with scientists and engineers who can develop solutions for identified problems while understanding the constraints that

Army operations require. The overarching vision for Army S&T is to foster innovation, maturation, and demonstration of technology that provides increased capability to the Warfighter. Our mission includes the transition of both the understanding and knowledge acquired while developing technology solutions as well as the materiel. While the very nature of S&T puts our focus clearly on providing capabilities for the future, we continue to exploit opportunities to transition solutions to the current force.

Strategy

As the war in Afghanistan draws down and budgets decline, it is clear that we, the Department of Army, have some significant choices to make. We are facing an environment in which we have procured a lot of military equipment over the past decade. Systems such as the Mine-Resistant Ambush Protected (MRAP) vehicles, which proved to be so valuable to saving the lives of Soldiers in both Iraq and Afghanistan, will now join the ranks of the Abrams, Bradley and Stryker as a part of our Army combat capability. The Army is assessing which urgently fielded war-time systems will come back and join the ranks of formal programs of record as a part of our enduring Army capability. These decisions will, by necessity, impact the Army strategy for future investment and research.

This is not the only impact, however. The National Military Strategy and its focus on operations in the Pacific Rim adds another level of complexity. As we expand our focus from the current fight to prepare for the future, we find ourselves in a situation where we may face a more capable enemy in an environment that is much more contested and complex. Our recent experiences, while challenging, have been against a less technically astute enemy. Our focus has been on mitigating those threats to the troops. The next fight may well be against a near-peer capability – one for which we have not fully prepared. We intend to avoid the old adage that we always prepare to fight the last war. We are investing now to understand our potential vulnerabilities and in developing capabilities that will help us be prepared for a more technically savvy opponent.

Given the current budget environment and prospects for funding in the future, it has become even more important than ever that we clearly understand our current capabilities and what we need in the future as we face ever evolving threats. With that in mind, the Army has initiated a comprehensive investment and modernization strategy to better facilitate informed decisions based on long-term objectives in a resource constrained environment.

The Army traditionally plans and budgets through the Program Objective Memorandum (POM) process. This five year look allows us to project with a fair level of certainty what we are doing in the next few years, but it does not lend itself well to making decisions with an understanding of how those same decisions impact the Army of the future. The desire to look more holistically across the lifecycle of programs and to facilitate better decisions was a key driver to establishing a new process within the Department of the Army.

To that end, the Assistant Secretary of the Army for Acquisition, Logistics, and Technology (ASA(ALT)) has initiated the Long Range Investment Analysis (LIRA) process where the Army looks out 30 years beyond the POM at the equipping and sustaining needs of the Programs of Record (PoRs). This longer-term approach covers the entire acquisition lifecycle, to include sustainment. With the renewed emphasis on assessing the impacts of near-term investment decisions on the life-cycle costs and desired capabilities of PoRs, it is increasingly important to have a sustainment strategy that is synchronized with the modernization strategy. It is essential to align S&T investments to support these PoRs and to understand where we can capitalize on opportunities for insertion of new, more affordable capability.

The LIRA feeds well into the ASA(ALT)'s desire for a more strategic modernization plan. This approach to modernization includes an awareness of existing and potential warfighting gaps, an understanding of emerging threats, knowledge of state-of-the-art commercial, academic, and government research, as well as a clear appreciation for the competing needs of limited resources.

I recognize that projections of this length are rarely accurate. However, going out 30+ years requires us to think beyond the easy answer of just doing what we are doing now but for a bit longer. It forces a new look at what else might need to happen. The world of 2040-2045 is clearly NOT going to look like the world of today. The threats we face and capabilities needed to address those threats may in fact look very different than what we have fielded today. To prepare for an uncertain future requires an approach to modernization that includes an awareness of existing and potential threats, an understanding of peer nation capabilities, knowledge of state-of-the-art commercial, academic, and government research, as well as a clear understanding of competing needs for limited resources. This is done through close collaboration with the Office of the Secretary of Defense (OSD) and the Intel Communities to not only assess foreign systems that we see under development but to conduct a technology watch that can provide indicators on what foreign countries are investigating that may become our next set of threats. This exercise challenges us to look at those eventualities.

This new way to approach our planning has put rigor into the analysis and forces the communities who pay for the development of materiel and the long-term sustainment of materiel to work together to maximize the Army's capabilities over time. From an S&T perspective, it clearly starts to inform the community as to when technology is needed for insertion as part of a planned upgrade. It also cues us as to when to start investing for replacement platforms. A great example of that is our aviation portfolio where we are conducting the S&T underpinnings of the next PoR planned to replace both the AH-64 Apache and UH-60 Blackhawk. The Army S&T community has already initiated the Joint Multi-Role Technology Demonstrator (JMR TD) effort as the foundation for the Army's Future Vertical Lift (FVL)-Medium PoR. This demonstrator program will create two flying prototypes that will help inform requirements for the FVL-Medium as well as define what should be asked for within the Request for Proposal. The S&T tech demo is being well coordinated with Program Executive Office (PEO)

Aviation and the Aviation Center of Excellence at Fort Rucker to ensure that we are working a solution that will fit and inform the Army's needs.

Aside from the obvious benefit achieved by laying out the Army's programs and seeing where we may have generated unrealizable fiscal challenges, this 30 year look has reinvigorated the relationships and strengthened the ties between the S&T community and their PEO partners. We have had significant engagements over these past seven months – working to identify technical opportunities and the potential insertion of new capabilities across this 30 year timeframe.

Goals and Commitments

There are some persistent (and challenging) areas in which the Army invests its S&T resources to ensure that we remain the most lethal and effective Army in the world. The challenges include the obvious (we need better force protection) to the less obvious (retrograde). All are consistent, however, with the message that we have gotten from the Training and Doctrine Command over the past decade. These are challenges that remain ever relevant to the Army and its ability to win the fight. The S&T community is committed to addressing these challenges which include:

- Enabling greater *force protection* for Soldiers, air and ground platforms, and bases (e.g., lighter and stronger body armor, helmets, pelvic protection, enhanced vehicle survivability, integrated base protection)
- *Ease overburdened* Soldiers in small units (e.g., lighter weight multi-functional material)
- Enabling *timely mission command and tactical intelligence* to provide situation awareness and communications in ALL environments (mountainous, forested, desert, urban, jamming, etc.)
- *Reduce logistic burden* of storing, transporting, distributing and retrograde of materials
- Create operational overmatch (*enhance lethality and accuracy*)

- Achieve *operational maneuverability* in all environments and at high operational tempo (e.g., greater mobility, greater range, ability to operate in high/hot environment)
- Enable *ability to operate in* Chemical, Biological, Radiological, Nuclear, and Explosives *(CBNRE)* environment
- Enable *early detection and treatment for* Traumatic Brain Injury *(TBI) and* Post Traumatic Stress Disorder *(PTSD)*
- *Improve operational energy* (e.g., power management, micro-grids, increased fuel efficiency engines, higher efficiency generators, etc.)
- Improve *individual and team training* (e.g., live-virtual-constructive training)
- *Reduce lifecycle cost* of future Army capabilities

In addition, to these enduring challenges, the S&T community conducts research and technology that impacts our ability to maintain an agile and every ready force. This includes efforts such as establishing environmentally compatible installations and materiel without compromising readiness or training, leader selection methodologies, new test tools that can save resources and reduce test time and methods and measures to improve Soldier/unit readiness and resilience.

S&T Portfolio highlights

To be able to address the needs of the Army of the future, the S&T Enterprise must maintain a balanced investment - one that ensures the growth and development of innovative S&Es and the pursuit of critical technology that will ensure the Army remains preeminent in the world. Currently the portfolio includes about 20% in far-term, basic research for discovery and understanding of phenomena; 40% in mid-term, applied research for laboratory concept demonstrations (proof of concept); and 40% in near-term, advanced technology demonstrations of subsystems and components in a relevant environment (experimentation).

Our S&T program request for BA1-3 for FY2014 is $2.205 billion - a 0.2% decrease from our FY2013 request. BA3 programs decrease by $8.6 million, BA1 programs decrease by $7.3 million and BA2 programs increase by $11.2 million.

In FY2014 the Army is placing increased emphasis in research areas to support the Army's role in the National Military Strategy, such as vulnerability assessments, Anti-Access/Area Denial (A2/AD) technologies and long range fires. We are mindful however that the Army will continue to be called on for missions around the globe. The Army is currently deployed in ~160 countries conducting missions that range from humanitarian support to stability operations to major theater warfare.

The efforts of the S&T Enterprise are managed by portfolio to ensure maximum synergy of efforts and reduction of unnecessary duplication. There are currently six portfolios. Three are platform specific portfolios: Soldier, Ground, Air; the other three are enabling technology portfolios: C3I, Innovation Enablers, and Basic Research. Each affords the Army with unique capability. To facilitate this broad spectrum of capabilities, we are creating a culture of affordability and from a technology perspective have increased our focus on reducing lifecycle costs.

Soldier Portfolio

The Soldier portfolio is broad in nature – it extends from research in enhancing Soldier performance to improved Soldier equipment to new medical treatments. This portfolio touches all of the challenges listed above in some capacity. Focus areas include achieving technical advances based on future threats and environments in force protection, lethality, mobility, leader development, training, combat casualty care and rehabilitation medicine, as well as psychological and physical health treatments. In FY2014 we are requesting $376.7 million for our Soldier portfolio.

The efforts in this portfolio are designed to address future threat environments while maximizing the effectiveness of Squad performance as a collective

formation. They result in state of the art changes to equipment and training tools and inform changes to policies, personnel selection and classification, and individual and collective training.

Major initiatives include the integration of lethality assets, individual protection, and dismounted soldier power. In the coming years, improving mission performance in a complex and dynamic environment will rely on improving the integration of cognitive and physical performance with emerging technology solutions leading to the advancements necessary to reduce the Soldier's load. Successful recent efforts include a collaborative effort with PEO Soldier to improve the form and fit of the Improved Outer Tactical Vest (IOTV) for female Soldiers. The existing IOTV designs were cut for a standard male and impeded the ability for female Soldiers to operate weapons and equipment effectively. The S&T community assessed the needs of the female Soldiers and as a result developed better waist and torso adjustment straps and less bulky collar and throat protection.

In keeping with our holistic approach to Army challenges, research will address the entire chain of services and technologies which touch our Soldiers and Squads from pre-deployment to mission capabilities needed on the battlefield to their return to civilian life. Pre-deployment and return to civilian life research includes important areas such as Post Traumatic Stress Disorder (PTSD) and Traumatic Brain Injury (TBI) which continue to be a source of serious concern. The U.S. Army Medical Research and Materiel Command (MRMC) has ongoing efforts to address these devastating conditions. Basic research efforts include furthering our understanding of cell death signals and neuroprotection mechanisms, as well as identifying critical thresholds for secondary injury comprising TBI. When cells die they release signals in the form of proteins. These proteins can be measured using different biological assays, which can tell you what type of response a cell has mounted against different types of injuries to include TBI, so you can quantify the level of injury.

We are also focused on investigating selective brain cooling and other non-traditional therapies for TBI, and identifying “combination” therapeutics that substantially mitigate or reduce TBI-induced brain damage and seizures for advanced development and clinical trials. We have had some recent successes in this area, including completion of a Food and Drug Administration effectiveness study on a candidate neuroprotective drug for treatment of TBI and completion of a pivotal trial for a bench-top assay for use in hospitals for the detection of TBI.

Research in the area of personnel selection, classification and training must also be looked at in light of future threats and evolving mission scenarios such as cyber and robotic interactions. Technologies which support future mission capabilities needed on the battlefield include efforts to reduce chronic conditions which may result from load-related injuries. Material and equipment design efforts focus on innovative decision and mission planning tools and the integration of individual and squad weapons, weapon sights, munitions and fire control while mitigating cognitive and physical burden on the increasingly complex battlefield. Finally, we are working on new materials and modular armor designs to optimize individual protective equipment to fully consider survivability in relation to mobility, lethality, and other aspects of human performance. This work is aligned with PEO Soldier’s planned Soldier Protection Systems PoR which affords many opportunities for technology transition out of the S&T community.

Ground Portfolio

The Ground portfolio includes technologies for medium and long range munitions and missiles; directed energy weapons; combat and tactical vehicle; unmanned ground systems; countermine and counter Improvised Explosive Devices (IED) detection and neutralization; and base protection technologies. As with the Soldier portfolio, the ground portfolio addresses a number of the Army’s enduring challenges including force protection, improved mobility and overmatch,

increased operational energy and reduced life cycle costs. In FY2014 we are requesting $607.1 million for our Ground Portfolio

The Ground Portfolio has shifted to focus on developing A2/AD through Long Range Fires and Counter Unmanned Aircraft technologies. S&T is focusing on advanced seeker technologies to enable acquisition of low signature threats at extended ranges, along with dual pulse solid rocket motor propulsion to provide longer range rockets and extend the protected areas of air defense systems. We also continue to develop Solid State High Energy Lasers to provide low cost defeat of rockets, artillery, mortars and unmanned aircraft.

Also as part of A2/AD, we have increased funding for evaluation of austere ports of entry and infrastructure to better enable our ability to enter areas of conflict. We are maintaining technology investments in detection and neutralization of mines and improvised explosive devices to ensure freedom of maneuver.

In the past, we have designed vehicles with little consideration for accommodating Soldiers who have to operate in them. Now we are beginning to explore ways to design vehicles around Soldiers. Increasing protection levels of the platforms means impacting interior volumes reducing mobility, maneuverability, and freedom of movement for occupants, and leads to heavier platforms. The ongoing Occupant Centric Survivability (OCS) effort provides the mechanism to develop, design, demonstrate, and document an occupant centered Army ground vehicle design philosophy that improves vehicle survivability, as well as force protection, by mitigating Warfighter injury due to underbody IED and mine blast, vehicle rollover, and vehicle crash events. This design philosophy considers the Warfighter first, integrates occupant protection technologies, and builds the vehicle to surround and support the Warfighter and the Warfighter's mission. To this end, we are developing an OCS concept design demonstrator, as well as, platform-specific demonstrators with unique occupant protection technologies tailored to the platform design constraints. Subsystems and components designed and evaluated by this effort may transition to current and future ground vehicle Programs of Record. This focused effort will facilitate

the development and publication of standards for occupant centric design guidelines, test procedures and safety specifications.

Armor remains an Army-unique challenge and we have persistent investments for combat and tactical vehicle armor, focusing not only on protection but affordability and weight. We continue to invest in armor technologies to meet the Ground Combat Vehicle (GCV)'s objective protection requirements. Armor formulations developed at the Army Research Lab (ARL) and matured at the Tank Automotive Research Development and Engineering Command (TARDEC) have transitioned and been offered to the GCV vendors. In addition to the continued emphasis on lighter, more capable armor solutions, we are beginning to develop an architecture standard to enable the integration of active protection technologies onto ground vehicles, reducing the need for as much heavy armor plating.

We continue to develop technologies to increase available power to ground vehicles and improve fuel efficiency. Additionally, we are maturing architecture standards to manage electrical power and data, providing industry a standard interface for integrating communications and sensor components to ground vehicles.

Air Portfolio

The Army is the lead service for rotorcraft, owning and operating over 80% of the Department of Defense's vertical lift aircraft. As such, the preponderance of rotorcraft technology research and development takes place within the Army. The Air portfolio addresses many of the same challenges as the ground portfolio and its key initiative, the JMR TD program, is focused on addressing the A2/AD need for longer range and more effective combat profiles. Our vision for Army aviation S&T is to provide the best possible aviation technology enabled capabilities to deliver Soldiers, weapons, supplies and equipment where they are needed, when they are needed. For FY2014 we are requesting $162.6 million for our Air Portfolio.

In order to provide Soldier support over future Areas of Operation (AO) that may be sixteen times larger than current AOs, the Army needs a faster, more efficient rotorcraft, with significantly improved survivability against current and future threats. Operating in conditions of 6000 feet and 95 degrees (high/hot), this aircraft will need to transport and supply troops while providing close air support and intelligence, surveillance and reconnaissance capabilities.

As I mentioned before, a major effort currently underway within S&T is technology development for the Department of Defense's next potential “clean sheet” design rotorcraft - the JMR aircraft. Three different configurations of JMR aircraft have been designed - a conventional helicopter, a large-wing slowed rotor compound helicopter, and a tilt rotor helicopter. We are investigating various design excursions to fully explore the size and environmental characteristics of interest to the DoD including shipboard operations. As part of the JMR TD program, an industry/government Configuration Trades and Analysis (CT&A) effort (including Operations Analyses to assess concept effectiveness), is nearing completion. Four contracts were competitively awarded to assist in defining the trade space for Phase 1 of the JMR TD, Air Vehicle Demonstration. Two of the contractors will be downselected for the Phase 1 awards in September 2013, which will include the design, fabrication, and test of two flight demonstrator vehicles, with first flights to occur in 4Q FY17. The JMR TD objectives are to validate critical aircraft configurations, technologies and designs at the vehicle system level, and demonstrate vertical lift capabilities superior to those in the current fleet. Phase 2 of the JMR TD is focused on assessing Mission Systems Effectiveness. Six contracts have been awarded to conduct these trades. The overall JMR TD effort will use integrated government/industry platform design teams and exercise agile prototyping approaches.

One of the biggest causes of aircraft loss comes from accidents while operating in a Degraded Visual Environments (DVE). To address this, we are currently conducting a synchronized, collaborative effort with PEO Aviation and the S&T community to define control system, cueing, and pilotage sensor combinations which enable maximum operational mitigation of DVE. This effort will result in a

prioritized list of compatible, affordable DVE mitigation technologies, and operational specification development that will help inform future Army decisions. This program is tightly coupled with the PEO Aviation strategy and potential technology off-ramps will be transitioned to the acquisition community along the way, when feasible.

Unmanned systems have a potentially broad impact on how the Army conducts close air support. Army S&T is focused on improving the capability of unmanned systems to be a force multiplier through the introduction of unmanned and teaming operations technologies with the potential to offer game changing future capabilities. Efforts include advancing human systems interface and algorithms for synergistic and intelligent manned unmanned teaming, and image/data processing algorithms to allow objective driven perception. In FY14 we plan to initiate a new applied research program to develop micro/small scale unmanned air systems. This new effort will allow for the transition of technology from the Micro-Autonomous Systems Technology Collaborative Technology Alliance basic research effort.

While many of our rotorcraft research efforts are focused on the development of technology for transition to new platforms in 2025 and beyond, we are also maintaining an investment to keep the current fleet effective. One recent transition success has been the Advanced Affordable Turbine Engine (AATE), a 3000 shaft horsepower engine with 25% improved fuel efficiency, and 35% reduced lifecycle costs. In FY2013, final bench testing will be completed and the AATE program will transition to PM Utility for Engineering and Manufacturing Development under the Improved Turbine Engine Program, which will re-engine our Blackhawk and Apache fleet.

C3I Portfolio

The C3I portfolio provides enabling capability across many of the challenges, but specifically seeks to provide mission command and tactical intelligence -- working to ensure Soldiers from the sustaining base to the tactical edge have trusted and responsive sensors, communications, and information adaptable in

dynamic, austere environments to support battlefield operations and non-kinetic warfare. For FY2014 we are requesting $320.0 million for our C3I Portfolio.

New efforts in this portfolio include development of secure wireless personal area networks for the Soldier. We are also re-investing in Electronic Warfare (EW) vulnerability analysis to perform characterization and analysis of radio frequency devices to develop detection and characterization techniques, tactics, and technologies to mitigate the effects of contested environments (such as jamming) on Army C4ISR systems.

Given the potential challenges that we face while operating in a more contested environment, we are placing additional emphasis in assured Position, Navigation and Timing, developing technologies that allow navigation in Global Positioning System (GPS) denied/degraded environments for mounted and dismounted Soldiers and unmanned vehicles such as exploiting signals of opportunity. Improvements will be studied for high sensitivity GPS receivers that could allow acquisition and tracking under triple tree canopy, in urban locations, and inside buildings, which is not currently possible. We are developing an Anti-Jam capability as well as supporting mission command with interference source detection, measurement of signal strength, and locating interference sources, enabling the Army to conduct its mission in challenging electromagnetic environments.

The C3I Portfolio also houses our efforts in cyber, both defensive and offensive. Defensive efforts in cyber security will investigate and develop software, algorithms and devices to protect wireless tactical networks against computer network attacks. Effort includes technologies that are proactive rather than reactive in countering attacks against tactical military networks.

We are developing sophisticated software assurance algorithms to differentiate between stealthy life cycle attacks and software coding errors and design and assess secure coding methodologies that can detect and self correct against malicious code insertion. We are also investigating theoretical techniques for improvements in malware detection that can detect malware variants

incorporating polymorphic and metamorphic transformation engines. We will research and design sophisticated, optimized cyber maneuver capabilities that incorporate the use of reasoning, intuition, and perception while determining the optimal scenario on when to maneuver, as well as the ability to map and manage the network to determine probable attack paths and the likelihood of exploitation. Additionally we will investigate dynamically and efficiently altering tactical network services, ports, protocols and systems to inhibit red force ability to perform malicious network reconnaissance to determine location of critical networking services.

On the offensive side of cyber operations, we will develop integrated electronic attack (EA) and computer network operations (CNO) hardware and software to execute force protection , EA, electronic surveillance (ES) and signals intelligence (SIGINT) missions in a dynamic, distributed and coordinated fashion, resulting in the capability to engage a multitude of diverse multi-node, multi-waveform, multi-platform and cyber (internetworked computers) targets while maximizing overall network efficiency and effectiveness, and preserving blue force/non-combatant communications.

We will demonstrate protocol exploitation software and techniques that allow users to remotely coordinate, plan, control and manage tactical EW and Cyber assets; develop techniques to exploit protocols of threat devices not conventionally viewed as Cyber to expand total situational awareness by providing access to and control of adversary electronic devices in an area of operations.

Innovation Enablers

The Innovation Enablers portfolio includes many of the activities that are not directly tied to programs of record, yet enable the Army to be successful. It is within this portfolio that we conduct the research that helps to ensure that we have training ranges upon which our Soldiers can train as they fight, support our High Performance Computing Centers which facilitate highly complex research and system design, and conduct Technology Maturation Initiatives that partner

the S&T community directly with PEOs to conduct experimentation that not only informs realistic requirements but also drives down programmatic risk. For FY2014 we are requesting $302.0 million for our Innovation Enablers Portfolio.

Under this portfolio we focus on many of those technologies which, while not specific to warfighter functions, are essential to ensuring that Warfighters can conduct their missions. As the largest land-owner/user within the DoD, it is incumbent upon the Army to be good stewards in their protection of the environment. Within this portfolio, we develop and validate lifecycle models for sustainable facilities; create dynamic resource planning/management tools for contingency basing,; develop decision tools for infrastructure protection and resiliency; and assess the impact of sustainable materials/systems This includes the development of geo-environmental intelligence /advanced sensing capabilities and predictive computational tools for fate, transport and effects of existing and emerging chemicals and materials used by the Army as well as new formulations for munitions and obscurants that have minimal environmental impacts. We also focus on developing sustainable and environmentally friendly practices that not only reduce or eliminate Soldier exposure to hazardous and carcinogenic materials but also minimize environmental impacts during maintenance and depot activities such as painting and plating.

In addition, we conduct blast noise assessment and develop mitigation technologies to ensure that we remain “good neighbors” within Army communities and work to protect endangered species while we ensure that the Army mission can continue. Ensuring current and future use of the Army’s training ranges will become even more important as they will be where Soldiers get their experience, vice deployment in theater. As a result, we are even developing planning and response tools to determine impacts on mission critical natural infrastructure and adaptable training land configuration technologies to ensure our Soldiers are given maximum access to training ranges and lands. This supports the Army’s ability to address evolving mission requirements while protecting our current resources.

Basic Research

Underpinning all of our efforts and impacting all of the enduring Army challenges is a strong basic research program. The vision for Army basic research is to advance the frontiers of fundamental science and technology and drive long-term, game-changing capabilities for the Army through a multi-disciplinary portfolio teaming our in-house researchers with the global academic community. For FY2014 we are requesting $436.7 million for Basic Research.

Two high pay-off areas of research investment are Neuroscience and Materials Science. Neuroscience is a high priority research area -- understanding the brain's structure and function is a top foundational research theme for the Obama Administration and the National Academies. The Army is leveraging the opportunities afforded by the large medical research base in neuroscience to move neuroscience from the bench to the battlefield. Making this transition will enable a broad range of scientific discoveries that fundamentally shift how we understand how the brain (and thus Soldiers) works.

A new area of promising research is our effort in Multi-scale Modeling of Materials. The goal of this research is to realize the capability to design materials at the atomic level to provide the exact properties we need for an end product. In other words, we plan to demonstrate a comprehensive "materials by design" capability for electronic and protection materials. The pay-off could be protection materials with 1/3 savings in weight of current systems, and batteries with triple the energy density, 30 percent longer lifetimes, and 20-30 percent more efficiency all at a lower cost.

Another new area of basic research investment in FY14 is Cyber Security, where we are standing up a Cyber Security Collaborative Research Alliance (CRA), a competitively selected consortium, to advance the theoretical foundations of cyber science in the context of Army networks. This CRA consists of academia, industry and government researchers working jointly with the objective of developing a fundamental understanding of cyber phenomena so that laws, theories, and theoretically grounded and empirically validated models can be

applied to a broad range of Army domains, applications, and environments. The overarching goals of cyber security are to significantly decrease the adversary's return on investment when considering cyber attack on Army networks, and minimizing the impact on Army network performance related to implementing cyber security. The CRA research creates a framework that effectively integrates the knowledge of cyber assets and potential adversary capabilities and approaches, and provides defense mechanisms that dynamically adjust to changes related to mission, assets, vulnerability state, and defense mechanisms.

We had a number of technology spin-offs and transitions from basic research this past year. An example is in Helmet Mounted Displays. A researcher from the Institute for Creative Technologies, an Army funded University Affiliated Research Center, created a game-changer in the world of virtual reality (VR) headsets by providing a 3-D, wide field of view, tracking enabled VR headset at a cost of $300 (in contrast to an Army Helmet Mounted Display device that costs $70,000). The VR device called Oculus Rift won Wired Magazine's best of the Consumer Electronics Show (CES) 2013 and the Electronic Entertainment Expo (E3) best of award. Oculus Rift disrupts the supply chain and creates the option for a low cost tool developed by Army-sponsored research that the Army will leverage for training. The hope is that the Oculus Rift will be the first of many commercial applications that will be incorporated into our Army systems - increasing competition and decreasing costs.

Cross-Portfolio Activities

Across all of our portfolios, we maintain our focus on power and energy. As we develop technology enabled capabilities, we work to reduce the burden in both weight and logistics that comes from increased energy consumption by the increasing amount of electronic equipment we need in our operations. The Army modernization investment in operational energy provides efficient, reliable and maintainable systems that increase capabilities and maintain dominance. Our objectives are to improve efficiency and reduce consumption while increasing functionality and developing smart energy-saving designs. Our existing

programs are integrated with, and complementary to, the operational energy strategy of the Assistant Secretary of the Army for Installations, Energy and the Environment. In the FY2014 Budget Request we have, interspersed among our portfolios, $145.3 million for power and energy projects, in addition to efforts such as efficient vehicle design and light weight materials which also impact the Army's energy usage.

The Army continues to make use of the Rapid Innovation Fund, established by Congress in FY 2011. We are currently funding 48 efforts in a variety of areas and have an additional 43 proposals under review. I believe that this initiative is providing value to the Army and opening up more collaborative opportunities for small and non-traditional businesses, and we plan to solicit further proposals for FY 2013 in the near future.

The Army Small Business Innovation Research Program (SBIR) program is another way the Army gets access to innovative ideas and products. The SBIR program is designed to provide small, high-tech businesses the opportunity to propose innovative research and development solutions in response to critical Army needs. In FY11, the Army SBIR office generated 139 topics based on inputs from laboratories, the Army Training and Doctrine Command and the Program Executive Officers (PEO). In response to these topics, small businesses submitted over 3000 proposals. The Army SBIR office approved more than 600 Phase I and Phase II awards. Since 2000 there have been 575 Phase III Army SBIR projects put under contract for a total obligated value of $1.4 billion (Phase III SBIRs are Phase II projects that have been picked up by either the government (PEO/PM) or industry).

The S&T Enterprise Workforce

Without the world-class cadre of over 12,000 scientists and engineers and the infrastructure that supports their work, the Army S&T enterprise would be unable to support the needs of the Army. To maintain technological superiority now and in the future, the Army must maintain an agile workforce. Despite this current environment of unease within the government civilian workforce, I'm proud to say

that in 2012, the Army was recognized by Thompson Reuters as one of the Top100 Global Innovators, with over 300 patents documented in the previous three years. We have an exceptional workforce. But we must continue to attract and retain the best science and engineering talent into the Army Laboratories and Centers and this is becoming more and more challenging. Our laboratory personnel demonstrations give us the flexibility to enhance recruiting and afford the opportunity to reshape our workforce, and I appreciate Congress' continued support for these authorities. With one exception (the Army Research Institute (ARI) for the Behavioral and Social Sciences), all of our laboratories and centers are operating under this program (ARI was never designated a Science and Technology Reinvention Laboratory and given its small size, has not sought to enter into a demo system). These initiatives are unique to each laboratory, allowing the maximum management flexibility for the laboratory directors to shape their workforce and remain competitive with the private sector.

In terms of infrastructure, we completed a survey of our laboratory infrastructure and find that it is aging, with an average approximate age of 50 years. However, we do acknowledge that much of the Army is in a similar position. Despite this, we continue to make improvements to our infrastructure at the margins, and where possible we have used MILCON, through your generous support, Defense Base Realignment and Closure Commission (BRAC), and unspecified minor construction to modernize facilities and infrastructure. This is not a long-term solution. While the authorities that you have given us have been helpful, they alone are not enough, and we are still faced with the difficulty of competing within the Army for scarce military construction dollars at the levels needed to properly maintain world-class research facilities. This will be one of our major challenges in the years to come and I look forward to working with OSD and Congress to find a solution to this issue.

Army S&T enterprise cannot survive without developing the next generation of scientists and engineers. We are lucky to have an amazing group of young scientists and engineers to serve as role models for the next generation. Last year, Dr. Maria Urso, a researcher at the U.S. Army Research Institute of

Environmental Medicine's Military Performance Division at Natick Soldier System's Center in Natick, Massachusetts, was named by President Obama as one of the nation's Outstanding Early Career Scientists. She received the award for her scientific contributions in the area of cellular mechanisms of musculoskeletal injury and repair and for her incredible service to both military and civilian communities. The Presidential Early Career Awards for Scientists and Engineers are the highest honor bestowed by the United States government on science and engineering professionals in the early stages of their independent research careers, and we are lucky to have researchers like Dr. Urso to mentor the next generation.

The Army S&T Enterprise contributes to the future success in Science, Technology, Engineering and Math (STEM) education through the Army Educational Outreach Program (AEOP) which is comprised of 17 outreach efforts, either through direct oversight or through active participation. In the 2011-2012 academic year AEOP was able to place less than half of the student online applicants, engaged nearly 53,000 students as well as 835 teachers, involved 17 Army laboratories or installations, and 111 universities or colleges and utilized the experience and personal commitment from many of our Army scientists and engineers. Mostly executed under the Army Educational Cooperative Agreement (COA) which brings together government and a consortium of organizations working collaboratively to further STEM education and outreach efforts nationwide, AEOP provides a cohesive and coordinated approach to STEM education across the Army. Major accomplishments in FY 12 included ongoing annual in-depth evaluative assessments of 7 programs and recommendations for evidence-based program improvements. We completed a marketing campaign that centralized all the individual programs into a single branding to leverage resources as well as promote a continuation of Army STEM experiences that work together to build a highly competitive STEM literate talent pool for Army scholarship and workforce initiatives. We continue to enhance the online, comprehensive application tool located on the AEOP website which will be complete in FY13. The application tool will provide important data that assess

attitudes, motivation, qualifications, and experiences that gauge program effectiveness. The website and the online application tool as well as the COA will work together to provide a coherent and coordinated approach to address the STEM workforce shortfall throughout the Army. For FY2014, we are concentrating on further program assessment, implementing evidence-based program improvements, strengthening additional joint service sponsored efforts, and identifying ways to expand the reach and influence of successful existing programs by leveraging partnerships and resources with other agencies, industry and academia.

Finally, we are increasingly mindful of the globalization of S&T capabilities and expertise. Our International S&T strategy provides a framework to leverage cutting edge foreign science and technology enabled capabilities through Global S&T Watch, engagement with allies and leadership initiatives. Global Science and Technology Watch is a systematic process for identifying, assessing, and documenting relevant foreign research and technology developments. The Research, Development and Engineering Command's (RDECOM) International Technology Centers (ITCs) and Medical Research Materiel Command's OCONUS laboratories identify and document relevant foreign S&T developments. We also selectively engage our allies when their technologies and materiel developments can contribute to Army needs and facilitate coalition interoperability. These bilateral leadership forums with Israel, Canada, Germany and the United Kingdom provide both visibility of and management decisions on allied developments that merit follow-up for possible collaboration.

Summary

The underpinning all of Army S&T efforts is a strong research program that builds an agile and adaptive workforce and technology base to be able to respond to future threats. Investments in S&T are a critical hedge in acquiring technological superiority with revolutionary and paradigm-shifting technologies. This includes the development of the next generation of Army Scientists and Engineers.

Investing wisely in people with innovative ideas is our best hope for new discoveries to enable the "Army of the Future."

In this fiscally constrained environment, we will emphasize S&T areas that address truly Army-unique challenges and leverage everything else. We will collaborate across the Services, National Labs, academia, industry and partner Nations, to solve common challenges. As good stewards of the taxpayers' dollars, it is critical that we use finite government resources to maximize development of technologies to meet Army-unique challenges and constraints, and it is important that we complement what the private sector is already developing. Most importantly, our investments today must translate into capabilities we successfully field to the Army of the future.

As the ASA(ALT) said in her February 28, 2013 testimony to the House Armed Services Committee on Sequestration, "…the Army will provide Soldiers with the best equipment available as needed; their sacrifice deserves no less. All equipping programs and priorities will be negatively affected by the application of sequestration. Likewise the defense industrial base will be adversely impacted and critical skill sets will be lost." These words apply equally to the Army's S&T program – forcing us to take a hard look at our investments and undoing much of the work that we have set in place to increase our efficiencies.

This is an interesting, yet challenging, time to be in the Army. Despite this, we remain an Army that is looking towards the future while taking care of the Soldiers today. I hope that we can continue to count on your support as we move forward, and I would like to again thank the members of the Committee again for all you do for our Soldiers. I would be happy to take any questions you have.