RECORD VERSION

STATEMENT BY

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DEPUTY ASSISTANT SECRETARY OF THE ARMY

FOR RESEARCH AND TECHNOLOGY

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Madam Chairwoman and Members of the Subcommittee, thank you for the opportunity to discuss the Army's laboratory system, and some of the concerns I have with sustaining the health of our enterprise.

As you know, the Army's Science and Technology (S&T) community has had, and will continue to have, a significant role in supporting the Warfighter. We have consistently delivered technology-enabled solutions needed for recent conflicts and we are committed to developing technologies that will enhance the Army's capabilities, which will be needed to prevent, shape and win future conflicts in an uncertain, complex 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 the technically excellent work force resident within them), and your continued commitment to ensure that funding is always 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.

The overarching vision for Army S&T is to invent, innovate and demonstrate technology enabled capabilities that empower, unburden and protect our Soldiers. Based on the past decade of war we know that technology makes possible dramatic success both in direct combat and in all other missions that our Soldiers must conduct in the various theaters of operation.

I hear often from the Soldiers themselves that technology saved their lives and was critical to their remarkable accomplishments. This feedback motivates our scientists and engineers, who use the funding provided by the Congress, to research, mature and develop advanced technologies – from armor to combat casualty care, from air vehicles to ground vehicles, from food to uniforms, from small arms to missiles, and from communications to training. They apply their accumulated knowledge and expertise, experimental data, and innovative products to solve problems, enhance performance, provide new desired capabilities, and forecast what capabilities are within the realm of the possible for our Army. Army S&T is committed to providing technologies to keep our decisive edge against adaptive enemies.

It is necessary for the Army to maintain a strong Army laboratory system. Our current S&T enterprise comprises 22 labs and centers spanning five commands, and located throughout the United States.[1] These labs and centers are home to roughly 19,000[2] dedicated federal civilians who are the core of the enterprise. By employing a world class cadre of scientists, engineers, technicians, analysts, and administrative support and providing them with the facilities and infrastructure necessary to accomplish their mission, we can ensure that the Army has the ability to address the specific challenges faced by Soldiers.

It is my job as Deputy Assistant Secretary of the Army for Research and Technology (DASA(R&T)) to plan for the long term health of Army S&T. I believe that there are three areas critical to our long term success: 1) People; 2) Infrastructure and Facilities; and 3) Programs. While I believe we are generally well-positioned to weather the current budget climate, I do have major concerns with the long term health of our S&T enterprise.

People

People are the Army's most valuable resource. I am proud to represent our science and technology workforce comprising government civilian scientists, technicians, engineers, wage grade workers, and support personnel, as well as Soldiers and contract personnel who offer a wide array of specialties and abilities that allow Army science and technology labs and centers to cover the full spectrum of research, engineering and operational support for the nation, especially the Soldier.

Developing and maintaining the world-class cadre of scientists, engineers, and technologists requires a four-phased approach:

1) using the hiring, evaluation and retention authorities associated with the laboratory personnel demonstration program to recruit and retain a highly qualified, success oriented, and dedicated workforce,

[1] The Army S&T Enterprise consists of the following laboratories and Research, Development, and Engineering Centers (RDEC) within 5 major commands: Army G-1 (Army Research Institute for the Behavioral and Social Sciences); Engineer Research and Development Center (Coastal and Hydraulics Lab, Cold Regions Research and Engineering Lab, Construction Engineering Research Lab, Environmental Lab, Geotechnical and Structures Lab, Information Technology Lab, and Topographic Engineering Center); Medical Research and Material Command (Aeromedical Research Laboratory, Institute for Surgical Research, Medical Research Institute of Chemical Defense, Medical Research Institute for Infectious Diseases, Research Institute of Environmental Medicine, Walter Reed Army Institute of Research);Research, Development, and Engineering Command (Army Research Laboratory, Armaments RDEC, Aviation and Missile RDEC, Communications and Electronics RDEC, Edgewood Chemical and Biological Center, Tank and Automotive RDEC, and Natick Soldier RDEC); and Space and Missile Defense Command (Space and Missile Defense Technology Center)

[2] The personnel data represented here and the remainder of the document are a tabulation of input received from the laboratories representing Fiscal Year 2010.

2) growing existing workforce capabilities through exchange programs and other authorities that provide for workforce development to help us maintain a vibrant, agile, well-educated cadre of Scientist and Engineers,

3) investing in research initiatives at the college and graduate school level to provide focus and generate expertise for the next generation of Army researchers, and

4) investing in educational outreach initiatives to build a diverse, Science, Technology, Engineering and Math (STEM) capable talent source for the future workforce.

Today in the Army's S&T workforce there are approximately 12,000 scientists and engineers (S&Es). Approximately 45% hold Masters Degrees or Ph.Ds, 15% are women, 17% are African American, and 14% Asian. Figure 1 shows the Army's demographics for years of S&E service:

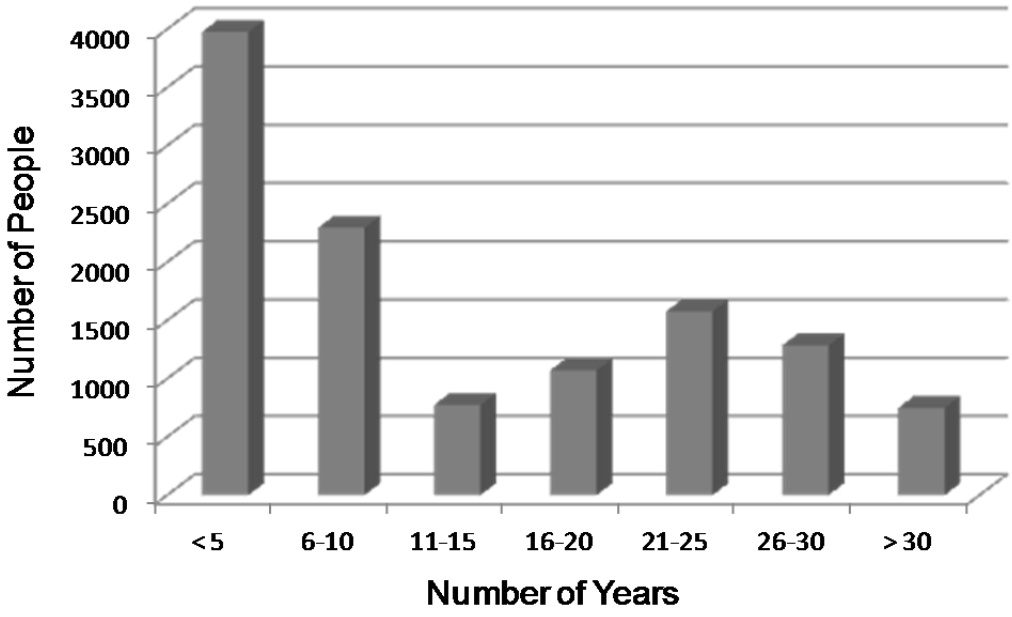

Figure 1: Years of Army S&E service

We have been able to stem the bow wave associated with the potential loss of senior S&Es by hiring initiatives over the last decade; however, given the current climate, we anticipate having to reduce or refrain from hiring.

As noted in a 2008 National Defense University Study,

> *"The growing tendency to view the in-house S&E workforce as just another set of performers suggests the absence of an understanding of why DOD (or the government) maintains in-house competence in science and engineering. In the absence of such an understanding, the competitive model provides a means to determine what the in-house workforce will do and at what level it will be funded. While the competitive model is very effective at making such determinations, it is not well suited as a tool for running the government. It hopelessly blurs the distinction between what is public and what is private, it puts the government in the awkward position of being in direct competition with its citizens, and it compromises the objectivity that the public should expect and demand of its government."*[3]

I am concerned that in this period of severely constrained budgets that will carry with it potential for manpower reductions, our S&T workforce may be expected to carry a disproportionate share of the reductions. A disproportionate loss of science and engineering talent could have devastating consequences for the Army. Our laboratory workforce is funded from many accounts – S&T (6.1-6.3 direct funding), acquisition (6.4 and 6.5 reimbursable funding), and funding from other government agencies (customers such as the Defense Advanced Research Projects Agency, the Defense Threat Reduction Agency, and the Defense Health Program). In order to ensure that the science and engineering workers are able to meet the needs of the Soldiers, we must ensure that any reductions in manpower are assessed against the workload and funding available.

We are grateful to the Congress for making permanent to the laboratories the Direct Hire Authority for people with advanced degrees. This, along with the Laboratory Personnel Demonstration Project, allows us to attract great new talent.

The Science, Mathematics and Research for Transformation (SMART) Scholarship for Service Program also provides opportunities to improve the flow of new, highly skilled technical labor into DoD facilities and agencies to enhance the technical skills of the workforce already in place. SMART offers scholarships to undergraduate, masters, and doctoral students who have demonstrated ability and special aptitude for excelling in STEM disciplines. Students are provided opportunities to continue their research in civil service roles following graduation. The Army has been participating in SMART since 2008. In 2011 the Army

[3] Timothy Coffey, "Building the S&E Workforce for 2040: Challenges Facing the Department of Defense." Center for Technology and National Security Policy, National Defense University, July 2008, page 18.

brought on 287 SMART awardees (259 in the category of new hires and 28 workforce retention candidates).

Some other personnel issues include losing top talent to industry, and either regional market shortages of certain types of employees or salary competition with regional industry.

But, in the difficult times ahead, we will have to find ways to ensure that we can retain these new recruits, avoiding the tendency to employ “last in/first out’ mentalities should we need to reduce manpower

Despite the many challenges, we have an amazing group of young scientists and engineers to serve as role models for the next generation. In 2011, Dr. Tad Brunye, from the Natick Soldier Research, Development and Engineering Center Cognitive Science researcher and Dr. Reuben Kraft, from the Army Research Laboratory were named by President Obama as Outstanding Early Career Scientists. 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. Brunye and Dr. Kraft to mentor the next generation.

Army S&T contributes to the future success in STEM education with a cohesive, coordinated, set of K-12 programs under the Army Educational Outreach Program (AEOP). In the 2010-2011 AEOP received over 15,592 student online applications, engaged nearly 27,000 students as well as 984 teachers, involved 141 universities, and utilized the talent and time of many of our Army scientists and engineers.

Infrastructure and Facilities

World class scientists and engineers require better than adequate infrastructure and facilities to accomplish their mission. Within our S&T enterprise we have 2196 facilities. Of these, 1143 are within the continental United States. To give an indication of the extremes, we currently have one building constructed in 1828 to several buildings currently under construction. Approximately 72% of the facilities are over 25 years old and 48% are greater than 50 years old. Figure 2 shows a histogram of the number of buildings and the decade in which construction was completed.

It is also important to note that not only do our facilities support Army researchers, but many of our facilities are highly leveraged by industry. All industrial or government developed technologies submitted for Network

Integration Rehearsal/Network Integration Evaluation (NIR/NIE) are required to come into our Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) System Integration Laboratory at Aberdeen Proving Grounds, (APG) for instance.

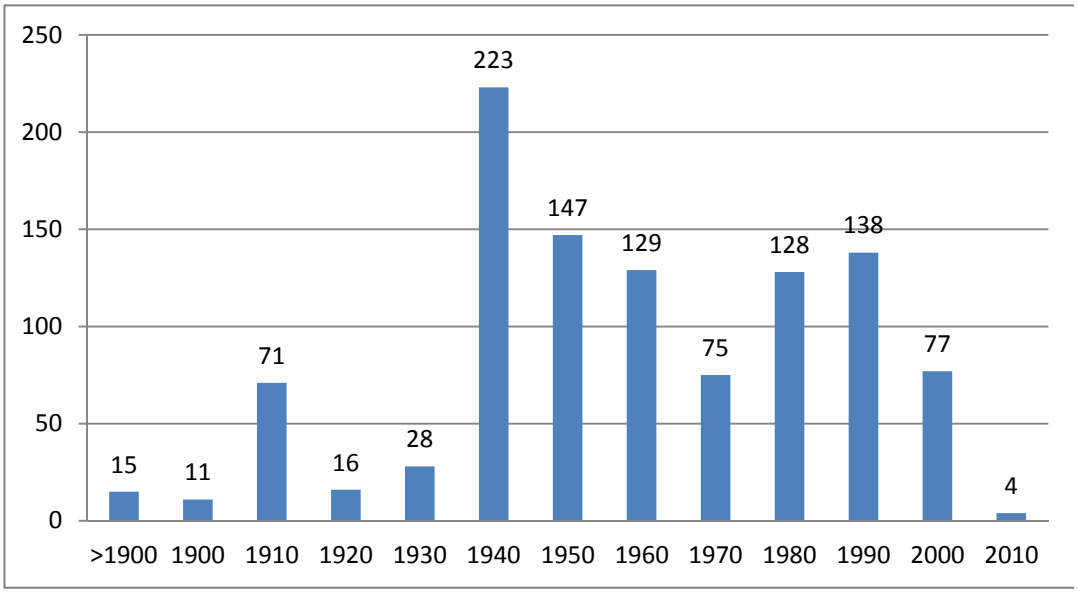

Figure 2: Number of facilities and the year in which they were established.

Our infrastructure (the buildings and associated mechanical systems such as HVAC, etc.) and facilities (the specialized laboratories and equipment housed within) are in critical need of modernization. Infrastructure and facility costs fall essentially into 3 categories: Sustainment, Restoration and Modernization (SRM); Operations; and Mission specific requirements. SRM and Operations are planned, programmed and executed by the Installation Management Command (IMCOM). Costs for SRM and Operations are assessed at the installation level, but, not broken out by tenant or, in our case, lab or center. Therefore, the actual costs associated with operating, maintaining and improving our laboratory infrastructure and facilities is not identified explicitly nor reflected in the funding distribution models.. The Common Level of Support (CLS) provided under IMCOM regulations falls short of providing the services and upkeep needed in a high-tech laboratory enterprise. At every laboratory or center we use a significant amount of our RDT&E dollars to supplement CLS.

We have calculated that our largest command, RDECOM should be receiving significantly more benefit from SRM than it is, based on the Office of the Secretary of Defense Facility Budget Model. For example, at APG the model

indicates that we should have received approximately $24.5 million per year but in Fiscal Years (FY) 2010 – 2012, we received only $5.2 million.

As the IMCOM budget is subject to constraints and the cost of installation management is subject to outdated models apportioning funds to SRM needs, we anticipate that the laboratories and centers will have to continue investing a significant amount of RDT&E dollars to maintain and operate our infrastructure and facilities at the levels required to conduct our mission.

This problem is often magnified by Defense Base Closure and Realignment (BRAC) Commission process. For example when Ft. Monmouth was closed and the majority of the workforce transferred to APG, funding for CLS at APG remained the same.

In the past ten years, five construction projects in the S&T enterprise have been funded through the MILCON process. If we discount the MRMC Defense-wide MILCON projects, the amount of Army MILCON invested in the S&T is $61 million.

Building VB1 at the Space and Missile Defense Command Technical Center was constructed using a mix of programmed MILCON funding and Congressional Add funding. The Medical Research and Materiel Command (MRMC) received funding for three major projects through the Defense-wide MILCON account, and one in Defense-wide Unspecified Minor Military Construction. All other infrastructure and facilities improvements across our complex have been achieved through the use Congressional Adds or mission RDT&E funds through the minor military construction and "Section 219" authorities. In the last decade, there was $1,211 million in MILCON, $1,011 million in the BRAC process, and $235.5 million in Congressional Adds.

In addition, infrastructure improvements such as revitalization and recapitalization projects utilizing Section 219 funds accounted for $20.88 million in the past fiscal year. Eleven projects were completed including laboratory renovations and instrumentation upgrades that directly supported core competency areas within the respective laboratories. Critical infrastructure needs included the upgrade and modernization of administrative spaces, upgrade and acquisition of internal technical infrastructure, ventilation of weapons system spaces to reduce down time, HEPA filters and sand filtration systems, HVAC upgrades in energetic laboratory, and unexploded ordnance clearance of a 1950s vintage range.

Protecting the facilities and equipment we currently have is now our highest priority. If you visit some of our labs and centers, you can see examples of

specialized, expensive equipment being protected from leaking roofs and HVAC systems by sheets of plastic. We are working with air handlers past their useful life, switch gear past their useful life and made by companies no longer in business, and aging piping systems for plumbing, roofs and HVAC systems. Many buildings are simply deteriorating as 48% of the inventory is greater than 50 years old. Some 11% are 75 years and older. I am including with my testimony some pictures of deteriorating conditions, which I would ask be submitted for the record.

Making improvements to our infrastructure and facilities like this at the margins is not a long-term solution. In order to develop a comprehensive plan to modernize both our infrastructure and facilities, I am currently undertaking an in-depth assessment of what we have now. My office has recently completed an inventory of all Army laboratory facilities and in consultation with facilities experts and the United States Army Corps of Engineers we are developing a Statement of Work for a team to inspect the roughly 1,000 Army S&T facilities. While I appreciate the specific authorities provided by Congress in recent years, the fact of the matter is they will not come close to addressing a problem of this magnitude.

I intend to work with the Assistant Secretary of the Army (Installations, Energy & Environment) to find ways to address all the issues cited in this section.

Programs

One of my first priorities, when I became DASA (R&T) a year and a half ago, was to change the perception that Army S&T was irrelevant – and this remains one of my top goals. I embarked on a path to: 1) provide a discipline and structure to the way we plan and execute our S&T programs; 2) develop effective partnerships with key stakeholders, leaders and Users across traditional organizational stovepipes; and 3) better synchronize our programs with the priorities of the Secretary of the Army, the Army Force Generation (ARFORGEN) plan, and the fiscal processes of the Department of Defense. This path is leading to a significant change of the S&T culture and it is still a work in progress.

Over the past year we have developed several management initiatives to emplace a structure and set of tools, which will enable us to be successful in delivering capabilities to the Warfighter, and to develop a balanced portfolio based on prioritized needs and desired advanced capabilities. The first initiative was to restructure the way we think of and articulate the S&T program. We established a set of S&T Portfolios. The portfolio construct allows us to focus more on the desired capabilities for the domains in which the Army operates than

on the color of money in various commodity stovepipes. The main S&T portfolios are: Soldier; Ground; Air; and Command, Control, Communications and Intelligence (C3I). We also have a Basic Research portfolio. These align closely to the Army's capability portfolios. Our intent is to be able to show how our S&T programs and products support the Army's Capability Portfolio Review process. We are also integrating our efforts with the Department of Defense's seven S&T priorities.

The second initiative was to increase active engagement of the Army Leadership (Headquarters Department of the Army, the Training and Doctrine Command (TRADOC), the Acquisition community and the major commands) in activities that establish real priorities for Army S&T.

The third initiative was to focus on better, more comprehensive program planning. By doing more concepting, detailed schedule planning, and realistic program cost estimates before embarking on a path of research and development, we can better articulate the objectives of our programs, show the value of them, and track transitions to help us measure success.

Today I am proud to report to you that there has been a great deal of forward progress. We have built a much stronger partnership with Army Leadership, the Acquisition Executives and TRADOC. In the past year we established a strategic program planning process with participation of both our key partners and S&T leaders across all the laboratories and centers. Collaboratively we developed and validated the first (ever) set of S&T priorities to focus our near term research and development efforts. We started by generating a list of seven (7) problems that Soldiers and Small Combat Units are grappling with today and for which they will continue to need better solutions over the next several years. Then we collaboratively developed a set of challenges associated with those problems – twenty four (24) in all - to be used by the S&T community to plan programs that will address them or solve them by the end of FY 2017.

The problems and associated challenges constitute a fundamentally new approach to planning and managing our S&T investment. In this first year we concentrated on the top ten (10) challenges, selected by Senior Army Leadership. The laboratories and centers teamed up to develop the first Technology Enabled Capability Demonstration (TECD) programs. Typically a TECD will mature and bring together several new technologies, couple them with existing systems/technologies, and demonstrate integrated technology-based solutions that either measurably enhance performance and effectiveness of an existing capability or enable a new and necessary capability. Nine (9) TECD programs were formulated and approved in this first round. Most of the 9 new

TECD programs will begin in FY2013 and funding for them is reflected in our FY2013 Budget Request. The community has already begun collaboratively planning the set of fifteen (15) remaining programs that will be brought forward to Army leadership for validation within this fiscal year. We will be addressing any shifts in the budget required to accomplish this second set of TECDs in the FY2014 budget cycle.

My goal is to have approximately fifty (50) percent of the Army's Budget Activity (BA) 3 funding dedicated to TECDs. We will be scrutinizing these programs constantly; requiring their Technology Program Managers (TPMs) to focus on cost, schedule and transition of deliverables; and we will be generating new problems/challenges as necessary to respond to the changing needs of our Soldiers.

TECDs are focused on near term Army priorities. They are a good first step. But, in order to maintain a balanced portfolio, we must also have clearer priorities for the mid and far term investments. Therefore, this year we are also working to define and develop a set of programs to meet the mid-term needs of the Acquisition community. Having these needs identified and then prioritized by leadership will enable us to better focus the remainder of our BA 3 dollars and a portion of our BA 2 dollars on near- to mid-term solutions to critical emerging needs. Simultaneously, we are identifying technologies that have high potential to "Bridge Gaps" or achieve "Leap Ahead" capabilities. If we lead the way in developing a set of critical technologies in our BA 2 and BA 3 programs at the same time when acquisition programs may be slowing down due to budget constraints, we believe that we will be better positioned for the future. We are thinking of calling these programs Science and Technology Enabling Programs (STEPs). Finally, we are going to establish a set of priorities for Basic Research. It is my goal to use the collaborative processes (similar to those used to create the TECDs) to get clear priorities, problems and challenges against which better programs can be formulated and executed to achieve the most advanced capabilities possible, as soon as possible, with the resources you make available to us.

As we shift to a priority based, programmatically managed, more collaborative S&T culture within the Army, our Scientists and Engineers have not stopped working the existing efforts across the entire spectrum of the funding lines and the technology areas. Even as they are taking on the new challenges I have given them, they continue to deliver on projects that research, mature and demonstrate needed technology devices, components and subsystems –many of which will feed future STEPs or TECDs. Many of our major efforts will be described later in this testimony.

The FY 2013 Budget Request

I believe the FY 2013 Budget request submitted to the Congress provides the correct levels of investment for our enterprise. Our S&T program request for BA1-3 for FY2013 is $2.2 billion - a 3.2% decrease from our FY2012 request. BA3 programs decrease by $86 million, while BA1 and BA2 programs increase by $7 million and $6 million, respectively.

In FY2013 the Army is placing increased emphasis (and investment) on ground and aviation vehicle survivability, research in focal plane arrays, and alternative fuels for ground vehicles. We will accept some greater risk (reducing funding) in lethality, unmanned/autonomous ground vehicles, and military engineering. As we adjust to an era of decreasing or flat budgets, Army S&T must be capable of doing more with less and correctly managing the risk associated with shrinking budgets by identifying and focusing on the highest priorities for the future. I believe that the S&T management strategy, described previously, allows us to do just that.

In FY2013 we requested $386.1 million for our Soldier portfolio, $626.9 million for our Ground Portfolio, $141.3 million for our Air Portfolio and $323.0 million for our C3I Portfolio. We also requested $444.1 million for Basic Research.

In the request there is $14.0 million for the BA4 Technology Maturation Initiatives line, which was established in FY 2012 to better enable the Army to meet the goal of ensuring competition while maturing S&T efforts to Technology Readiness Level (TRL) 6 or higher prior to Milestone B in support of the Weapons System Acquisition Reform Act of 2009. Funding in this line is expected to help us cross the “valley of death” for some high potential technologies or subsystems.

To make the decisions concerning which efforts should be funded with this precious resource, we established an S&T BA4 Executive Steering Group (ESG) and a rigorous, but streamlined, process for evaluating, prioritizing and selecting proposed projects. The project selection criteria include: potential to reduce programmatic costs/risks, potential for quick transitions, and synchronization with acquisition plans and programs. Last fall, the ESG selected the first five (5) projects for funding in FY2012. These projects will be continually monitored to ensure that they stay on track to provide the deliverables to the proper PMs/PEOs within the next couple of years. Of course, it is too early to make any conclusions regarding the success of this new approach, but the ultimate test of success will be whether or not we achieve planned transitions and reduce costs through early competitive prototyping. I am confident that we have a strong

process in place now, which provides the Army with an improved mechanism for establishing a closer alignment between S&T and acquisition programs; however, in the FY2013 Budget Request, we did decide to maintain a modest investment in this line until we have some data on the effectiveness of the projects against the objectives.

Another new source of funding for S&T is the Rapid Innovation Fund (RIF), established by Congress in FY2011. We are using, and intend to continue using, this additional funding to attract small and non-traditional businesses, so that we can identify and incorporate what they produce to help our TECD TPMs solve the twenty-four (24) challenges. We recently released a Broad Agency Announcement (BAA) asking for white papers in support of the top ten (10) Army priority challenges. The response was enormous - nearly 1,000 white papers were received. My staff, along with subject matter experts from the Army labs and the acquisition community, reviewed each of these proposals and selected over ninety (90). We are asking these selectees to submit full proposals; against which we will use the FY2011 and FY 2012 RIF funding to award contracts. These contractual efforts will be managed as part of the appropriate TECD by the TPMs. The plan is to issue another BAA in FY2012 seeking technologies that can contribute to solving the remaining fifteen (15) priority challenges. I believe that this new initiative (the RIF) is providing value to the Army and opening up more collaborative opportunities for small and non-traditional businesses. In addition to providing a link to the TECDs for small businesses, the huge number of white papers received has given us further insight into innovative technologies of which we may have not been otherwise aware – and it is our intent to fund more of the highest quality proposals with core funds. While we are still in the initial phase of this program, I have confidence it will be ultimately successful in reaching companies with innovative ideas and getting them on a path for Army's acceptance of their products into subsystems and systems.

The Army Small Business Innovation Research (SBIR) program is another way for us to tap the ideas of non-traditional defense businesses. 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 Fiscal Year 2011, the Army SBIR office generated one hundred thirty-nine (139) topics based on input from laboratories, TRADOC and the PEOs. In response to these topics, small businesses submitted over 3000 proposals, which were evaluated by the Army SBIR office and which resulted in more than six hundred (600) Phase I and Phase II awards valued at approximately $200M.

Although the SIBR program is strong, there is a real need to streamline the topics generation process and reduce the overhead and labor associated with

generating, selecting and contracting SIBR efforts. I believe we can lean the process, increase the program success rates and, most importantly, improve the transition of products that are developed under Army SIBR contracts. Therefore, I have directed that, beginning this year, SBIR topics/projects align with TECDs, S&T Challenges and highest priority Program Executive Office (PEO) needs. By tying more of these efforts directly to S&T priorities and managing each project as part of a TECD program, the FY 2013 SIBR projects may have greater transition rate and increased relevance.

Beginning in FY2012 the High Performance Computing Modernization Program (HPCMP) and office transitioned from the Office of the Secretary of Defense (OSD) to my office for management. HPCMP is, and will remain, focused on supporting the needs of the tri-services and other agencies. HPCMP comprises three (3) elements - it: 1) operates six (6) DOD Shared Resource Centers; 2) operates and maintains the Defense Research and Engineering Network; and 3) develops Software Applications. DOD scientists and engineers use HPCMP resources in support of many disciplines, including physics, chemistry, materials, acoustics, and aerodynamics. While there have been some bumps in the road in the transition process, the Army remains fully committed to managing and executing this critical capability. In FY2013 we have requested $180.6 million in RDT&E and $57.7 million in procurement to conduct this program, managed by the U.S. Army Corps of Engineers.

Across all of our portfolios, we maintain our focus on power and energy. As we develop technology enabled capabilities, we must work to reduce the burden in both weight and logistics that comes from increased energy consumption by the plethora of electronic equipment we need in our operations. Since FY2002, S&T power and energy research has concentrated on maturation and demonstration of components, materials, and devices to reduce size, weight and power, as well as, extend the useful life of components. We are now shifting our focus to concentrate on subsystems and systems. Our objectives are to improve efficiency and reduce consumption while increasing functionality and developing smart energy-saving designs. Power and energy issues must be resolved to achieve the objectives of most of the twenty-four (24) challenges. 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 FY2013 Budget Request we have, interspersed among our portfolios, $160.9 million for power and energy projects.

S&T Portfolio highlights

Soldier Portfolio

In keeping with the vision of Soldier as the Decisive Weapon, the Soldier S&T portfolio researches underpinning human science and matures and demonstrates technologies for Soldier and Squad Lethality, Survivability, Mobility, Leader Development, Training, Combat Casualty Care and Clinical and Rehabilitation Medicine capabilities. The efforts in this portfolio are designed to maximize the effectiveness of Squad performance as a collective formation. These efforts result in state of the art equipment, shelters, clothing, food, training tools, logistic support, combat trauma therapies, and other medical technologies. Major initiatives include Protection, Dismounted Soldier Power and an overarching focus on the human and material science advancements necessary to Lighten the Soldier's Load. 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 technology solutions.

In keeping with our holistic approach to Army challenges, this effort looks to address the entire chain of service from pre-deployment to return to civilian life including training, health promotion, rehabilitative medicine and treatment for Post-Traumatic Stress Disorder (PTSD)/Traumatic Brain Injury (TBI). Efforts seek to reduce load-related injuries and chronic conditions, address the cognitive and physical burden through better decision and mission planning tools, and optimize individual protective equipment to fully consider survivability in relation to mobility, lethality, and the human dimension. This effort is truly collaborative, involving researchers from the Natick Soldier Research, Development and Engineering Center, the Army Research Lab, the Medical Research and Materiel Command, the Army Research Institute, the Armaments Research, Development and Engineering Center, the other Services and DARPA, as well as our academic, industry, and international partners.

PTSD and TBI 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. We are also focused on investigating selective brain cooling and non-embryonic stem cells derived from human amniotic fluid as 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 an FDA 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 using candidate biomarkers for the detection of TBI.

Ground Portfolio

The Ground portfolio includes technologies for medium and large caliber weapons, munitions, missiles, directed energy weapons, vehicle ballistic and blast protection, vehicle power and mobility, unmanned ground systems and countermine & counter Improvised Explosive Devices (IED) detection and neutralization and deployable small base protection.

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 Occupant Centric Survivability (OCS) Program 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 & 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. We are also publishing standards for occupant centric design guidelines, test procedures and safety specifications.

In FY2013, we are also continuing the effort started last year in Underbody Blast (UBB) Protection. Some recent successes include performing vulnerability identification and resolution on most Program Manager (PM) programs such as JLTV, MRAP, Stryker, HET, and FMTV, and advising PM customers on the feasibility and performance of potential blast protection technologies while balancing cost, payload, mobility and mission requirements. We have developed tools and methods which have led to system level evaluations through modeling & simulation resulting in improved Live Fire Test and Evaluation, faster delivery of technologies to theater/customers and necessary characterizations of threats, systems and environment. Our efforts continue to look at a full range of technologies to address this issue, from modeling and simulation and physiological studies to seats, restraints and energy-absorbing materials.

We are also continuing our investments and efforts in Deployable Force Protection (DFP). Our military units operating remotely at small bases are more vulnerable to enemy attacks because they have less organic equipment, fewer

personnel, shorter kinetic reach, less hardened areas, significant bandwidth limitations and are difficult to reinforce, resupply and support with repairs. We are developing force protection technologies that have a low logistics footprint, are easily operated with limited manpower and training, and are quick to set up and take down. This will allow for enhanced protection capabilities, while leaving Soldiers with more time to perform their mission.

In conjunction with the U.S. Special Operations Command Central (USSOCCENT) and the Combating Terrorism Technical Support Office, we recently assessed several systems and recommended an integrated force protection kit to support Village Stability Operations. The kit is being provided to the 7th Special Forces Group for operational assessment in theater and was created in a collaborative effort to accelerate delivery. The kit provides protection and allows operators to focus less on establishing personal security and more on the mission. We have also developed a low-logistics armoring system to expediently establish protection for critical assets, such as the Tactical Operations Center (TOC), mortar pit, and weapon/sensor systems. Unlike any other, this system also provides expedient overhead cover that protects against direct-hit rocket, artillery, and mortar threats. Members of the DFP team worked with troops and Centers of Excellence on design and employment options. The 2nd Battalion, 1st Brigade, 82nd Airborne Division will deploy with a number of modular protective mortar pit and overhead cover systems to be used in an operational assessment in theater. Use of these systems will result in savings of countless hours that are typically associated with establishing mortar pits and protection and will increase the associated level of protection for Soldiers.

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 is focused on seven broad areas of research: platform technology; operations and support; survivability; rotors and flight controls; engines & drives; weapons and sensors; and unmanned systems. 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.

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.

A major effort currently underway within S&T is technology development for the Department of Defense's next potential “clean sheet” design rotorcraft - the Joint Multi-Role (JMR) aircraft. In FY2011, the Army, Navy and NASA agreed to use a common toolset and database and are collaboratively sharing design responsibility for the JMR-Medium, an aircraft intended to replace our Blackhawk/Seahawk and Apache fleet. Three different configurations of JMR aircraft have been designed by the Government - a conventional helicopter, a large-wing slowed rotor compound, and a tilt rotor. There are seven design excursions being investigated that fully explore the size and environmental characteristics of interest, including shipboard operations. Additional near-term plans include conducting a small scale wind tunnel test of an unpowered tilt rotor to validate forces and moments, confirm Computational Fluid Dynamics (CFD) estimates, and update design parameters. Additional CFD/Computational Structural Dynamics assessment and results integration will be done as part of expanding the design methodology and toolset. We plan to use the BA4 line to allow a second demonstrator to be developed for JMR.

Additionally, the DoD HPCMP CREATE Air Vehicle Project is coordinated with this activity and endeavors to increase the fidelity of the design process with the future goal of being able to conduct a complete detailed design environment.

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 FY2012, AATE transitioned 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 key to successful operations in an increasingly complex battle space is the capability for seamless and timely communications across all echelons of the system, from headquarters to the Soldier. A major effort in the C3 portfolio is combining enhanced mission command capabilities for the Soldier and small unit with improved mobile networks.

We are providing solutions to improve command and control, situational awareness, and dynamic communications, while maintaining appropriate military

security not found in commercial devices. In order to exploit the full range of capabilities that smart devices offer the Soldier, we need an improved network in an on-the-move (OTM) environment; handheld devices with tools and functionality to provide Soldiers with the necessary decision and communications capabilities in an intuitive interface; and appropriate security protocols for the battlefield.

Our mobile network research efforts are increasing network efficiency and reliability, increasing OTM connectivity and bandwidth utilization, and allowing for reliable message delivery in difficult communications environments. These efforts are leveraging investments by commercial industry and DARPA.

Our mission command efforts are aimed at providing Soldiers and small units with the kinds of data-driven decision tools once available only to higher echelons. As our defense strategy moves to a smaller, more agile force, it is critical that small units and individual Soldiers have access to accurate and relevant situation awareness information including geospatial and meteorological data, combat ID and battlespace awareness, as well as full spectrum decision support tools. Just as critically, we have to design these tools taking into account human cognitive abilities and limitations.

Finally, the most useful tools for the Soldier are worthless if they are not properly secured. These security issues include approved encryption for Secret and Below, identity management, security policy management, exploitable applications and securing the infrastructure. Our efforts in this area include authentication of approved applications and prevention of installation of rogue applications, providing Secret voice and data connections across disparate technologies including handheld devices, and developing a mutual authentication mechanism between users, handheld devices, and the network core.

Beyond the specific security efforts for mobile battlefield communications, the C3 portfolio also directs our broader cyber security S&T efforts, which I know the subcommittee has a particular interest in. Our work in a resilient cyber security framework will provide a more secure foundation in which participants, including cyber devices and software, are able to work together in near-real time to anticipate and prevent cyber attacks, limit the spread of attacks across participating devices, minimize the consequences of attacks, and recover systems and networks to trusted states. Within this framework, security capabilities are built into cyber devices and software in a way that allows preventive and defensive courses of action to be coordinated within and among communities of defense in depth architectures. The power to detect and mitigate threats is distributed among participants and near-real time coordination is

enabled by combining the innate and interoperable capabilities of individual devices with trusted information exchanges and shared, configurable policies.

In the area of software assurance, analyzing software code for security vulnerabilities and malware is a manually intensive effort requiring a high degree of skill and experience. Our development efforts focus on automating the software code analysis for C++ programs and JAVA source code; developing a compliance checker to ensure that the software has been developed in accordance with required standards; reducing false positives; and testing binary objects and images for logic bombs and unexecuted regions. We also have research efforts in hardware assurance, including trustworthy computing foundations, physical tamper and chip level protection schemes.

Basic Research

Underpinning all of our efforts is a strong basic research program. Beginning this year, we are developing a process similar to the TECDs to define a set of priorities for Basic Research and identify challenge statements against which programs can be proposed and approved. The key emphasis for the Army is to provide the necessary basic research (through the skills of our workforce and our investments) to achieve and provide for technically enabled capabilities that meet the specific needs of the Soldier and the Army mission. In Army Basic Research, we are looking to lead the S&T enterprise. We look for guidance from many sources – requirements and desired capabilities from TRADOC and our Soldiers; commissioned studies from the National Academies and RAND; workshops and collaborations with our sister services; and we are in the midst of re-thinking how we approach, describe, and provide strategy for the overall program.

We know that for most of the 20th century, physics was the fundamental driver for nearly all leaps in technology. And while physics will always play a large role in that, over the last 20 years we have seen big changes in and big advances from biology and bio-inspired technology. As we move forward we need to watch very closely and invest selectively to determine what technology is going to come from that and how are we going to develop that to assist the Soldier. With that in mind, we are beginning to think of and align our basic research efforts in three areas: Long-Term Exploration; Long-Term Disruptive Technology investments; and Long-Term Enabling Research.

Long-Term Exploration efforts look to discover or invent new technologies and capabilities relevant to the Army mission - we explore with a purpose. Our Long-Term Disruptive Technology investments are researching technologies which will change the rules of the playing field for our Warfighter. Long-Term Enabling

research looks for innovative ways to move the inventions and discoveries into components and subcomponents and technologies that our labs and research partners can exploit. By this we enable future S&T applied research, advanced tech development, and capabilities. Taken together, this basic research provides the solid foundation for Army S&T.

These are exciting and challenging times for the Army's S&T program. We are changing the Army S&T business model to be an enduring, sustainable, successful enterprise, and aligning our strategic planning to the budget process to achieve efficient, top-down S&T leadership investment focus. We are identifying critical Army problems that we can solve in the near and mid-term, using the best talent and skills wherever they exist. Finally, we are enhancing the visibility of Army S&T priorities to provide partnering opportunities to jointly solve problems and enhance our Warfighter capabilities. As you can imagine, this is a tremendous undertaking, and would not be possible with the support we have received from Congress. I hope that we can continue to count on 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.