STATEMENT BY

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DEPUTY ASSISTANT SECRETARY OF THE ARMY

FOR RESEARCH AND TECHNOLOGY

AND CHIEF SCIENTIST

BEFORE THE

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Madam Chairwoman and Members of the Subcommittee, thank you for having me here today to discuss the fiscal year (FY) 2011 Army Science and Technology (S&T) Program and the significant role we have in supporting the Warfighter while developing the technologies that drive our Army's transformation. We're grateful to the members of this Committee for your sustained support of our Soldiers especially in this time of war, and for the funding of investments that will provide our future Soldiers with the equipment and capabilities to defend America's interests and those of our allies around the world.

The Army's S&T investment strategy is shaped to foster innovation while we accelerate and mature technologies that enable Future Force capabilities and exploit opportunities to rapidly transition technology to the Current Force. The S&T program retains flexibility to be responsive to unforeseen needs identified through current operations. We have rapidly responded to a broad range of needs by leveraging our technology investments in future capabilities and our workforce expertise to address emerging issues.

I would like to take the opportunity today to focus on some important areas of investments for our future force, as well as important issues relating to the most critical part of the Army S&T enterprise--our workforce. Our major investments in the core S&T program are best understood in terms of technology areas. The following paragraphs highlight our investments within five of these key areas:

Force Protection Technologies

The Army's S&T community is developing both active and passive protection technologies that increase the survivability of Soldiers, platforms and facilities/bases. This includes the ability to track, engage, and defeat rockets, artillery rounds, and mortars; detect and neutralize Improvised Explosive Devices (IEDs)/mines; and protect against traditional threats to tactical and combat vehicles. Major investments in Force Protection include the development of new materials, physics-based models, and armor formulations for increased ballistic protection at reduced weights for both Soldier and platform applications; the development and demonstration of a suite of active and

passive protection technologies to maximize the survivability of lightweight vehicles and rotorcraft; active protection countermeasures against Kinetic and long-range Chemical Energy munitions for combat vehicles; and protection for installations against rockets, artillery, and mortars.

In keeping with the practices of counter-insurgency operations such as those applied in Afghanistan and Iraq, military forces are frequently located in close proximity to the locals (or people) whom we are endeavoring to secure. Force protection at smaller, remote bases and those integrated within or nearby local communities offers particular challenges that can differ from those force protection challenges posed at the larger bases. The Army S&T community is leading a Deployable Force Protection initiative on behalf of the Department of Defense to address these challenges, with an additional investment of nearly $170 million over FY11-15. This effort is focused on providing integrated, interoperable and scalable base protection capabilities, including standoff detection, ballistic protection and fire/defensive solutions. The objectives of the initiative are threefold - identify promising technologies for near-term solutions that meet identified needs; inform future S&T investments; and establish a Red Teaming capability to generate insights into technology robustness and product improvements. With this additional investment, Army S&T is spending approximately $250 million from FY11-15 on technologies to protect our troops as they deploy in Iraq, Afghanistan and other areas around the world.

C4ISR Technologies

Investments in this area enable networked surveillance and decision aids for collaborative, real-time, mission planning, on-the-move operations, and networked lethality particularly in complex urban environments. These investments also pursue technologies to enable secure, mobile, ad-hoc networks for sustained high op-tempo, full spectrum operations; infrared (IR) sensor technologies for extended range detection and identification; and airborne imaging/moving target identification radars. Specific technology investments include software and protocols for secure, mobile, ad-hoc networks; third generation infrared imaging sensors; and tactical decisions aids that incorporate geo-spatial and cultural information into the Army's Battle Command systems to enable better predictive analysis capability. These technologies are essential for maintaining comprehensive situational awareness, effective allocation of resources, and supporting rapid decision making in the challenging environments we face in irregular warfare.

For FY11, the Army is making significant new investments in Infrared Focal Plane Array (IR FPA) technology. With efforts in both cooled and uncooled FPA technology, these

investments will reduce costs through new detector materials and designs and improve overall performance by enabling the development of high-definition (HD) sensors critical for targeting, persistence surveillance, 360 degree day/night situational awareness, and HD night vision. Again, the Army's S&T community has been asked to lead this FPA initiative on behalf of the Department of Defense. In FY11-15, the Army's FPA investment is increased by $94 million to result in an overall investment of over $160 million in the next five years to develop applications that will be used throughout the Department of Defense. This focused investment ensures the United States' pre-eminence in this technology area and dominance on the battlefield.

Medical Technologies

Our investment in medical S&T provides the basis for maintaining the physical and mental health of Soldiers as well as enhancing their performance. Investments in this area improve health protection, treatment, and life-saving interventions for Soldiers. This program has three components: combat casualty care (inclusive of blast trauma from explosive devices); military operational medicine (to enable effective performance under environmentally extreme conditions worldwide); and infectious disease (diagnosis, treatment, and preventatives).

Of particular note is the Army's S&T investment in regenerative medicine that has achieved great success through the regeneration of human tissues and organs. The Army, with the help of the Navy, Air Force, Veterans Health Administration, and the National Institutes of Health, has established the Armed Forces Institute of Regenerative Medicine (AFIRM). The AFIRM consists of over 200 scientists in 27 Universities and the US Army Institute of Surgical Research. AFIRM was established primarily to discover better ways to prevent and treat damage due to burns and to develop methods that allow the regeneration of nerve, bone, and muscle tissue in those warriors who have serious tissue loss. This capability has great potential for treating military personnel with disfiguring and disabling injuries. Regenerative medicine uses tissue engineering to prompt the body to regenerate cells and tissues, often using the patient's own cells combined with degradable biomaterials. The ultimate goal of this effort is to regenerate entire limbs.

Approximately 900 Soldiers, Sailors, Airmen and Marines have lost limbs in Operation Iraqi Freedom and Operation Enduring Freedom, the preponderance of these losses being to members of the Army. While Soldiers usually adapt well to leg prostheses, upper extremity prostheses are not accepted as well. Approximately 40% of upper extremity amputees choose not to wear prosthesis, describing the apparatus as "too much of a bother."

In the AFIRM's first clinical trial on limb replacement, a Marine received the first hand transplant in the world where bone marrow-induced immune tolerance was instituted. Through the use of a novel immunosuppressant regime, donor bone marrow was transplanted at the same time as the hand. The donor bone marrow, coupled with novel immunosuppressant drugs, induced a tolerance of the transplanted hand that exceeds any previously attained. As a result, the patient has been weaned to only one immunosuppressant drug instead of the customary three. AFIRM has also performed a double hand transplant with similar results. A transplanted limb allows wounded warriors to regain function of their limb over time.

Soldier System Technologies

Our investments in Soldier technologies seek to provide individual Soldiers with “platform-level” capabilities. The goal is to seamlessly link Soldiers to sensors and platform-based lethality capabilities in real time -- to accurately identify and engage targets with greater precision lethality. All enhanced Soldier capabilities are developed with the load each Soldier must carry in mind. Key Soldier technology investments are approached in a holistic method to address personnel load issues. Efforts focus on both materiel and non-materiel solutions by evaluating the critical aspects of physical, biomechanical, psychomotor and cognitive aspects of the Soldier load. Tradeoffs acknowledge the Soldier’s need to balance the limits of human performance with his need for situational awareness, agility and mobility in complex terrain. Investments include: the development and integration of advanced lightweight materials into Soldier-borne equipment; modular protection components allowing for "in the field" Soldier-load tailoring based on threat analysis; and energy efficient electronic equipment designs powered by high density power sources with the capability to exploit battlefield generation of power for recharging. As the emphasis on deployed forces is placed more on light infantry-type operations, continued investment and maturation of materials and processes to lighten the load on individual Soldiers is paramount to a target goal of achieving true fighting load weights for all Soldiers regardless of specialized weapons or communications.

Human Dimension

The Army S&T community continues to investigate technologies that can assist and support the physical and cognitive capabilities of the Soldiers to perform in full spectrum operations. To this end, we invest in areas such as the social sciences to help better understand the environments and cultures within which we operate. We develop training tools that provide the Soldiers with more effective ways to prepare for interactions within the complex environments and situations within which he will fight

and/or provide stability. In addition we develop methods to more effectively select Soldiers and leaders within the Army and better, more effects methods of training. This effort leverages much of the work that is done within the Social Sciences as a way to underpin our training tools. We assess the effectiveness of immersive training, embedded training and live, virtual and constructive training events. In FY11-15, you will see an increase in the Army's investments to leverage on-going DoD-wide activity in the social/cultural venues, as well as increases to develop, evaluate and validate training methods and tools such as those used in large scale distributed training and Post-Traumatic Stress Disorder (PTSD) treatment.

Basic Research

Essential to realizing superior land warfighting capabilities is the discovery of new fundamental knowledge through high-risk/high-payoff basic research in areas highly relevant to the Army mission. To accomplish these goals the Army maintains a robust basic research program that extends across a variety of disciplines, leveraging some of the best minds in the country.

I will highlight of few of the disciplines in which we have elected to increase our efforts. In FY11, the Army will increase its focus on developing the scientific foundations leading to the discovery of novel materials with extraordinary performance characteristics of particular interest to the Army, such as ballistic protection. The robust research approach will emphasize multi-scale modeling and simulation for performance prediction and design of materials under extreme conditions (high strain rate, temperature, pressure, etc.). This modeling effort, supported by in-house and extramural experimental studies, will study a range of material classes (such as structural, electronic, energetic) and coupled disciplines (e.g., mechanics and electromagnetics) enabling two-way information transfer across the length scales from the molecular level up to the material system level.

In a parallel effort, we will initiate new research into the characterization of chemical and biochemical phenomena occurring at or near solid surfaces and interfaces. This research will include studies of the interplay between chemical reactions and transport processes on surfaces, developing theory and models leading to the understanding and prediction of fundamental physical and chemical processes at complex surfaces and interfaces. This materials and surface/interface research will lead to new methods and materials for a broad range of potential applications across the Army including force protection for Soldiers, platforms and facilities.

In order to meet the ever increasing power needs of the future force, and in particular the dismounted soldier, we have increased FY11 research funding to pursue new compact power and energy sources. This research will explore new materials and processes leading to more efficient energy sources, energy storage, energy harvesting, and energy conversion capabilities. The approach will leverage the high-performance computing capabilities within the Army laboratories in combination with extensive experimental efforts to predict characteristics and performance *a priori* for energy generation, storage and conversion materials. This multidisciplinary approach will also investigate emerging nanostructured materials such as carbon nanotubes, graphene, silicon carbide, diamond, as well as bio-inspired approaches to harvesting or generating electrical power.

Recently, President Obama has stressed the need for increased national attention to building our capabilities in the fundamental sciences to ensure our nation remains a global leader in technology. In response to this call, the Army has expanded its support for university research and research education of students through its competitive single investigator program. This increased investment will lead to fundamental discoveries in areas such as electronics, quantum imaging, mechanical chemistry, brain-electronics interfaces, bio-forensics, and harnessing bacteria for micro-scale manipulation of materials, while educating the next generation of scientists, engineers and mathematicians and familiarizing them with the Army's research community. This expanded university investment will engage the best and brightest professors and graduate students across the U.S. academic community. The increased funding could support as many as 45 additional graduate students per year, helping the U.S to maintain its lead in cutting-edge research and ensuring that the Army and the nation has the talent needed to not only maintain but rather grow our future workforce of scientists, engineers and mathematicians.

Laboratory Infrastructure and Science and Engineering Workforce

To maintain technological superiority now and in the future, the Army must continue to hire top quality scientists and engineers into the Army Laboratories and Research, Development, and Engineering Centers. This is challenging because the Army must compete with the other Services as well as the private sector to obtain its future workforce. We have taken important steps to attract and retain the best science and engineering talent. Our laboratory personnel demonstrations have instituted initiatives such as pay banding to enhance recruiting and afford the opportunity to reshape our workforce. 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 December 2009, final Federal Register Notices

were published for laboratory demonstrations at the Natick Soldier Research, Development and Engineer Center (RDEC) and the Edgewood Chemical Biological Center; this is the last step in the approval of their lab demo plans. The Armament RDEC and Tank Automotive RDEC are preparing plans for their laboratory personnel demonstrations.

The Army has also instituted direct hire authority for scientists and engineers (S&Es) with advanced degrees at our demo laboratories, and we would like to thank the Committee for their strong support on this issue. The Army laboratories have hired 34 talented S&Es using this authority since June 2009, and the laboratory directors intend to use this authority to the fullest extent possible this year. The Research, Development and Engineering Centers are also taking advantage of the enhanced hiring authority for acquisition personnel.

To maintain technological superiority now and in the future, the Army needs to maintain state-of-the-art laboratory facilities and attract top quality scientists and engineers. With the support of the Committee, our labs and centers are now able to spend a portion of their funding on minor military construction projects, providing new facilities and capabilities**.** This authority has enabled the Army to fund 13 minor milcon projects in FY08 and to initiate 15 projects in FY09. Of the total, twelve of the efforts were for revitalization of the Army laboratories; the remainder will provide improved test and evaluation facilities. Additionally, we are continuing to work on the implementation of the Section 219 authority provided by Congress. This authority will give the labs additional flexibility to use funds in innovative ways, both for conducting research and for upgrading facilities. We fully support this authority, and look forward to working with the Committee to further develop it going forward.

Finally, we believe that strong science, engineering and mathematics education at all grade levels is critical to both the ongoing success of the Army S&T enterprise and the nation as a whole. Army S&T contributes to this future success through the Army Educational Outreach Program (AEOP) which comprises 21 outreach efforts, either through direct oversight or through active participation. In the 2008-2009 academic year, AEOP received over 76,000 student applications, engaged nearly 7,000 teachers, involved 430 universities and utilized the experience and personal commitment of over 1,200 Army scientists and engineers. For FY10, efforts are concentrated on ways to expand the reach and influence of successful existing programs by leveraging partnerships and resources with other services, agencies, industry and academia. An instrumental initiative that is expected to have the single biggest impact on how the programs run is the Army's Education Cooperative Outreach Agreement (COA) which is currently out for solicitation. The Army envisions the Educational COA will bring

together government and a consortium of organizations working collaboratively to further Science, Technology, Engineering, Mathematics (STEM) education and outreach efforts nationwide.

Conclusion

The S&T portfolio continues to contribute to addressing the Army's critical challenges and restoring balance in our forces. Given the current demands on Army resources from ongoing overseas operations, and our desire to be good stewards of taxpayer dollars, the Army S&T community addresses the issue of affordability wherever possible. Increasingly sophisticated capabilities come at a price. The S&T community is seeking to drive down system costs for the Army through deliberate technology initiatives that focus on replacing high-cost components in existing systems, merging multiple capabilities into single systems and developing manufacturing processes that reduce overall production and assembly costs. We will continue to look at issues of affordability as the Army modernizes.

With the continued support of Congress, the Army will be able to maintain funding for a diverse S&T portfolio that is adaptive and responsive to unanticipated needs of the current fight while still achieving the desired capabilities for the Future Force.

The Army's scientists and engineers are expanding the limits of our understanding to provide our Soldiers, as well as our Joint and coalition partners, with technologies that enable transformational capabilities in the ongoing Overseas Contingency Operations to ensure that the Army remains a relevant, ready and victorious land component of the Joint Force. The Army S&T community is the "engine" of change for the Army's transformation.