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**BEFORE THE  
SUBCOMMITTEE ON TERRORISM,  
UNCONVENTIONAL THREATS AND CAPABILITIES  
COMMITTEE ON ARMED SERVICES  
UNITED STATES HOUSE OF REPRESENTATIVES**

**ON  
THE UNITED STATES ARMY'S SCIENCE AND TECHNOLOGY (S&T)  
PROGRAM FOR FISCAL YEAR 2010**

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**UNITED STATES HOUSE OF REPRESENTATIVES**

Mr. Chairman and Members of the Subcommittee, thank you for having me here today to discuss the fiscal year (FY) 2010 Army Science and Technology (S&T) Program and the significant role we play in supporting the Warfighter today, while developing the technologies that drive the Army's transformation. We appreciate the members of this Committee for your sustained support of our Soldiers currently at war, and for funding the 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 and accelerate/mature technology to enable Future Force capabilities while exploiting 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 these needs. Our Fiscal 2010 budget priorities are in line with Secretary Gates' recently announced objective to "reshape the priorities of America's defense establishment." I would like to take the opportunity today to focus on some important areas of investment for our program: Force Protection, Lightening the Soldier's Load, Force Health Protection, Power and Energy, Battle Command and Basic Research.

### **Force Protection**

Army S&T transitions to Operation Iraqi Freedom and Operation Enduring Freedom have significantly reduced Soldier and vehicle weight burdens while increasing protective capability. Vehicle armor upgrades for advanced IED defeat, fuel tank hardening, and crew protective opaque and transparent armors have all stemmed from Army S&T investments that have been accelerated and deployed on the Mine Resistant Ambush Protected (MRAP) armored vehicle. In FY08, for example, Army S&T responded an OSD/DDR&E request to develop near-term options for armor enhancements at reduced weight for MRAP vehicles. A number of solutions were quickly developed that increased protection against the largest threat and reduced

package weight by one-third. This effort resulted in over 50% (8000) of MRAP vehicles outfitted with enhanced, reduced weight armor by December 2008, using Army S&T designs and engineering.

Additional vehicle transition successes in reactive armors, ceramic armors, and transparent armors (both in materials and manufacturing efficiencies) have been notable and have transitioned to several military-use vehicle prime contractors.

To further individual soldier protection systems, Army S&T is pursuing improvements in body armor component fabrics and materials through two technical design paths. The first path will provide increased levels of protection at equal weight and/or in better, flexible configurations. The second path will provide the same level of protection at significantly reduced weights. For both designs, performance enhancements will be achieved through advances in high performance ballistic fiber and textile technologies, transparent polymers, composites, and materials systems integration. For example, Army S&T efforts are currently focused on improving the high performance ballistic fiber technology needed to obtain a 50% increase in textile material strength to reduce soft body armor weight by 40-50%. In addition, new ceramics technology and manufacturing techniques are being investigated, to include silicon carbide materials and the ability to form ceramic materials into complex shapes.

### **Lightening the Soldier's Load**

Army S&T is seeking to optimize our future investments to mature both vehicle and soldier protection and efficiently reduce weight burdens as collective systems. In the area of enhanced soldier protection and lighter-weight loads, we are continuing efforts to lighten soldier helmets and body armor through manufacturing technology and advanced material solutions. We are developing new protection enhancements and weight reduction for body armor applications with efforts to address protection for the head, face, torso and extremities, focusing on fragmentation protection, protection from small arms threats, and blast protection for the thorax area of the body. For example,

improved transparent armor materials that provide enhanced fragmentation protection have been demonstrated with a weight savings of 20%.

S&T investments contributing to soldier weight reduction above and beyond helmet and body armor are approached in a holistic method to address personnel load issues. Exploitation of advanced materials and manufacturing processes allow for 10-20% weight reduction of individual components with an overall weight savings estimated at 20 lbs, while increasing the capability in the areas of advanced fibers for carrying equipment (rucksack and utility systems), powered equipment and battery weight reduction (efficient batteries, night vision, communications and sight augmentation systems), combat ration packaging efficiency, and weapon/ammunition modernization. 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.

### **Force Health Protection**

Our investment in medical S&T provides the basis for maintaining the physical and mental health of Soldiers as well as enhancing their performance. We are currently researching novel methods for screening and treating for Traumatic Brain Injury, by identifying physical and functional changes in the injured brain, and countering the post-injury inflammation. Battlemind, the U.S. Army's psychological resiliency building program, prepares Soldiers for the psychological rigors faced during deployment and improves the Service Members' ability to transition home. The Army is currently developing and validating advanced group-level Battlemind Training to further reduce deployment-related psychological problems, including symptoms from combat-related Post-Traumatic Stress Disorder (PTSD). For Battlefield Trauma Management, a primary focus is to address the single greatest potentially preventable cause of combat – internal hemorrhage. This requires an integrated approach which includes controlling bleeding, replacement of lost fluid volume, cells, and clotting capability, and providing fluids and adjuncts to maintain adequate delivery of oxygen to critical tissues.

Army S&T is also a core partner in the Joint Trauma Analysis and Prevention of Injury in Combat (JTAPIC ) program, a component of the DoD Blast Injury Research Program Coordinating Office. JTAPIC links the DoD medical, intelligence, operational, and materiel communities to facilitate the collection and integration of data and information to improve our understanding of vulnerabilities to threats. This enables the development of improved Tactics, Techniques, and Procedures (TTPs), requirements and materiel solutions to prevent/mitigate combat injuries. The JTAPIC program routinely integrates data from combat incidents and analyzes this data in to actionable information.

Finally, in FY09 the Army initiated a research program on suicide, working with the National Institute of Mental Health. The Army suicide prevention efforts are focused on prevention, early intervention, screening, treatment, and quality of life for all Service Members and their Families. This important work will continue in FY10.

## **Power and Energy**

The Army continues to focus on developing and demonstrating technologies to reduce power consumption and increase energy efficiency. The Army Science and Technology power and energy strategic goals are to reduce platform energy consumption, develop more efficient power sources, enable smart energy management, develop proactive thermal management, and develop and evaluate alternative fuels.

The Army was a significant contributor in manpower and knowhow to the operation and success of the recently completed DoD Wearable Power Competition (WPC). The WPC's two primary goals were to bring in non-traditional DoD performers with their innovative power source ideas, and the successful completion of a 96 hour test of a wearable power source weighing less than 8.8 pounds. To the Army's credit, the three winning Wearable Power entrants have had previous Army S&T investment.

The Army is executing \$75 million in research, development, test, and evaluation from the American Recovery and Reinvestment Act for near term energy efficient technologies. Power generation efforts include research in portable and flexible solar

arrays for Soldier and tent powering applications and research in generating power from the waste heat of generators. Efforts to reduce energy consumption include research and demonstration of advanced silicon carbide components that require less cooling to operate and research in an intelligent power distribution system that is reasonable to tactical applications.

### **Battle Command**

Army S&T is working on advancements in information transport and on enabling improved collaboration for the Warfighter. For information transport at the tactical level, Army S&T is investing in lower cost, more capable satellite communications antennas for current and planned satellite constellations. Additionally, S&T is developing the software application for existing radios to better utilize the limited RF spectrum in military operations. Research and development is underway to more seamlessly share information across functional domains. This will allow more timely interaction and sharing of information across intelligence, planning and battle operations.

### **Basic Research**

Fundamental 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 we have increased our focus on seven areas that are likely to yield extraordinary capabilities for our Soldiers – autonomous systems, network science, immersive environments, neuroscience, biotechnology, nanotechnology, and quantum information science.

In fiscal year 2009, Secretary Gates set the vision for the Minerva Research Initiative (MRI), a new university-based social science research program for all the services. MRI focuses on areas in the social sciences of strategic importance to U.S. national security policy which have not received substantial Department investment in the past. MRI research will pursue understanding of the internal military-political dynamics of repressive regimes, the vulnerabilities of regimes and institutions to various kinds of influence and instability, the nature of crowd dynamics, the potential to influence public

opinions and attitudes in diverse cultures, cultural effects on network security and military operations, the influence of technology on military capabilities of potential adversaries and allies, and other intersections of social-cultural issues with military activities. The Army science and technology community is fully supportive of the MRI objectives and is actively soliciting proposals focused on social science and cultural issues affecting US military warfighting capabilities and we are increasing our investment in this area.

Within basic research, we are making major progress in many areas. One particular example is power and energy-related science with the ability to “grow” batteries through genetically engineered organisms. Dr. Angela Belcher at MIT, whose work is supported by the Army and through the Army-sponsored Institute for Collaborative Biotechnologies at the University of California, Santa Barbara, is at the forefront of research enabling biologically inspired, virus-based assembly of battery components. For the first time, MIT researchers led by Dr. Belcher have shown they can genetically engineer viruses to build both the positively and negatively charged electrodes of a lithium-ion battery. This technology will lead to future batteries that are far more compact and powerful than anything available today and at much lower cost. This is one of many exciting new discoveries that will reap major benefits for our Soldiers well into this century.

### **Science and Engineering Workforce**

To maintain technological superiority now and in the future, the Army needs to hire top quality scientists and engineers into the Army Laboratories and Research, Development, and Engineering Centers. This is especially daunting given that 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 reshaping of the workforce. These initiatives are unique to each laboratory allowing the maximum management flexibility for the laboratory directors as well as allowing them to be competitive with the private sector. The Army is also instituting direct hire authority at our labs, and we would like to

thank the Committee for their strong support on this issue. Finally, we have long recognized that a scientifically and technologically literate citizenry is our nation's best hope for a diverse, talented, and productive workforce. To pursue this goal, we leverage the numerous resources across our programs and the Department of Defense (DoD) to engage America's youth in science, technology, engineering, and mathematics.

### **Defense Acquisition Reform**

Army Science and Technology supports current efforts in Congress and within the Department to reform the acquisition system. Because of our position so early in the material development process, the Army S&T program is well positioned to leverage our flexibility in support of any major weapons system acquisition reforms undertaken through consultation between Department of Defense senior leadership and our Congressional stakeholders.

### **Conclusion**

The S&T portfolio contributes to addressing the Army's critical challenges and restoring balance in our forces through the four imperatives: Transform, Sustain, Prepare, and Reset. It has and will continue to enable the success of our force modernization efforts and to exploit technology opportunities through spin outs (Transform). Emerging medical technologies enable improved care for our wounded Soldiers and will enhance their future quality of life (Sustain). Advanced training technologies will accelerate the preparation of our Soldiers and leaders to operate in complex 21st century security environments (Prepare). Technology insertion opportunities and advanced training can contribute to resetting the force to prepare for future deployments and other contingencies (Reset).

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.