

**STATEMENT BY  
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FOR RESEARCH AND TECHNOLOGY  
AND CHIEF SCIENTIST**

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

**ON  
RESPONDING TO THE CHANGES AND  
CHALLENGES IN THE TWENTY-FIRST CENTURY  
IRREGULAR WARFARE THREAT ENVIRONMENT**

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**INTRODUCTION**

Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to describe the fiscal year (FY) 2009 Army Science and Technology (S&T) Program and the significant role of S&T in supporting the warfighter today and in achieving the Army's Transformation.

We want to thank the Members of this Subcommittee for your sustained support of our Soldiers who are at war and for funding the investments that will provide future Soldiers with the dominant capabilities they need to defend America's interests and those of our allies throughout the world. Your continued advice and support are vital to exploiting the potential of technology for victories on the battlefields of today and tomorrow.

**S&T INVESTMENT STRATEGY**

The Army's S&T investment strategy is shaped to pursue technologies that create unmatched and unprecedented capabilities for the future land combat forces while leveraging early instantiations of these capabilities for the warfighter of today.

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. I would like to highlight several of the areas that are applicable to the irregular warfare environment as illustrations of the Army S&T community's contributions to enhancing the current warfighting capabilities. The Army S&T community has developed and assisted in the fielding of passive armor solutions that provide tactical wheeled vehicles with ballistic protection that rivals combat vehicle protection. We have created improved Soldier body armor that protects extremities, shelters that withstand mortar attacks, and detection and neutralization systems for use against improvised explosive devices (IEDs). We have made advances in command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) providing the warfighter in theater with improvements in advanced imagery and signal sensors and network-centric battle management tools. We have enabled our Soldiers to attain decisive results with reduced collateral effects by providing precision capability for the guided multiple launch rocket system and the Excalibur 155mm artillery munition. But we recognize that the warfight is not just about the technologies that provide overmatch capability but about the men and women who conduct this warfare. In keeping with our commitment to the Soldier health and well-being, we have developed medical technologies such as Battlemind Training, a tool used to prepare the warfighter for the rigors of combat and to help them reintegrate into non-combat environments on their return home.

Our major investments in the core S&T program are best understood in terms of Future Force technology areas. The following paragraphs describe the types of investments within five key Future Force technology areas:

- 1) Force Protection technologies. We are developing active and passive protection technologies to increase the survivability of Soldiers, rotorcraft, and ground vehicles. This includes the ability to track, engage, and defeat rockets, artillery rounds, and mortars; detect and neutralize IEDs/mines; and protect against traditional threats to tactical and combat vehicles. Major investments in Force Protection include the development of new materials, models, and armor formulations for increased ballistic protection at reduced weights for Soldier, tactical, and combat vehicles; 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. This budget requests an increase in funding for new initiatives in active armors, such as electromagnetic armor and improved energetic materials for reactive armor, both designed to defeat emerging and future threats at reduced weight.
  
- 2) 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 multi-functional radars for extended range detection and identification in foliage, in urban areas, through walls, as well as individual targeting and tracking. 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.

- 3) Lethality technologies. Investments leverage development of next generation explosives and reactive materials to enable controlled lethality warheads that enable scaleable effects in a single munition – yields that can be selected based on the intended target, thereby minimizing unintended collateral effects; low-cost seeker and guidance technologies that enable greater precision at an affordable cost; technologies that increase munition safety without degrading performance (insensitive

munitions); and electromagnetic gun technology to achieve unprecedented lethality with a lower logistics burden.

- 4) 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 protection, treatment, and life-saving interventions for Soldiers. This program has three components: combat casualty care (inclusive of blast trauma from explosive devices); infectious disease (diagnosis, treatment, and preventatives); and military operational medicine (to enable effective performance under environmentally extreme conditions worldwide). The Army is leading a joint medical program focusing on the prevention, mitigation, and treatment of medical blast casualties sustained from IEDs and other sources of blast-related wounds. In addition, we have begun an investment in tissue regeneration research with the ultimate goal of developing technologies that will lessen the impact of severe and debilitating wounds by regenerating skin, nerves, muscle, and eventually bone.
  
- 5) Soldier System technologies. Our investments in Soldier technologies seek to provide individual Soldiers with “platform-level” capabilities. These include greater protection, networked communications for shared local and extended situational awareness, as well as connectivity that allows

the Soldier to exploit joint lethal fires. 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. Key Soldier technology investments include: advanced body armor; lightweight novel power sources including fuel cells; and sensors and network links that put the Soldier on the "net" In the challenging "urban canyons" that are and will continue to be the focus of operations, particularly in irregular warfare.

## **BASIC RESEARCH PROGRAM**

In the 2009 budget request we have increased basic research funding by 24 percent over the 2008 request, making basic research our largest single investment area within the S&T portfolio. This increase in Army basic research will leverage the substantial investments in research throughout our economy to produce unprecedented increases in capability for the Army. The basic research investments create the potential to maintain and increase the nation's superior land warfighting capabilities and reduce our risk for an uncertain future. The fundamental underpinnings of technology that we are pursuing with this investment will make it possible to conduct ever more complex military operations, with greater speed and precision, and to devastate any adversary on any battlefield. Army basic research continues to explore breakthrough opportunities in network science, neuroscience, biotechnology, immersive technology, quantum information science, nanotechnology, and autonomous

systems. The Army has also increased funding to establish research initiatives in human, social, cultural, and behavioral modeling; modeling and analysis of complex, multi-scale networks; and neuroergonomics—leveraging our emerging understanding of how the brain works to create more effective system interfaces and training tools and techniques.

## **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 and direct hire authority 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. 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.



## **TECHNOLOGY TRANSITION**

Successful transition of Army S&T products to programs such as Future Combat Systems (FCS) is central to enabling the Army's transformation. With the Army's focus on support to current operations, the Army S&T strategy has expanded to include the pursuit of enhanced capabilities for the Current Force while continuing to develop and mature transformational capabilities for the Future Force. Within the Army S&T community, we conduct program reviews to assure ourselves that technology development efforts are on track to deliver products to the program manager (PM) that perform as required, have the appropriate maturity level, are on schedule, and are still supported by the Army. DoD policy requires that all technology in a program preparing for a Milestone (MS) B decision must be demonstrated at a technology readiness level of six or better, lessening the occurrence of "immature" technologies that account for cost and schedule overruns in major acquisition programs. When a program is preparing for its MS B decision, the Deputy Assistant Secretary of the Army for Research and Technology conducts decision reviews that assess and certify that the technologies to be used in the program are sufficiently mature. This teamwork between the S&T and acquisition communities improves overall long-term success of Army technology transition processes and programs.

## **SCIENCE & TECHNOLOGY SUCCESS STORIES**

I would like to describe a few recent examples of successful S&T efforts that have transitioned to programs of record:

- Mounted Combat System (MCS) and Abrams Armament Systems Technologies. This effort developed technologies to enhance capabilities of the Abrams Main Battle Tank and the FCS Mounted Combat System (MCS) ammunition suite. It demonstrated an integrated dual mode (autonomous and designated) Mid-Range Munition (MRM) for the 120mm gun. The MRM provides a precision, beyond line of sight capability of up to 12km. The MRM transitioned to Program Manager Maneuver Ammunition Systems (PM MAS) in FY 2007 for an FY 2008 Systems Development and Demonstration (SDD) start. The effort also demonstrated the Line of Sight Multi-Purpose Munition which provides overwhelming lethality from a single munition against multiple target types. This effort also transitioned to PM MAS for an anticipated SDD in FY 2010.
- Hybrid Electric Drive Components for Future Combat Systems. We developed, characterized, and validated the performance of advanced hybrid electric power system component technologies for improved mobility, survivability, lethality, and fuel efficiency for FCS. This energy and power technology for FCS ground vehicles will enable silent watch, silent mobility, enhanced dash speed, and reduce signatures (acoustic, thermal, visual, electromagnetic interference).
- Future Force Warrior (FFW) Technology. The FFW technology effort demonstrated an integrated, modular combat ensemble with reduced

fighting load, improved individual mobility, fight-ability and human performance. FFW developed a system-of-systems capability, successfully demonstrating technologies for a fully integrated dismounted combat system, including weapon, head-to-toe protection, netted communications, and Soldier-worn power sources enabling enhanced human performance. The technologies enable revolutionary warfighting capabilities including network interconnectivity with existing and emerging networks at the Soldier and small combat unit level while reducing fighting load and power requirements, and improving Soldier protection, lethality, and situational awareness. This program transitioned the FFW concept and data to PEO Soldier.

- Novel Energetic Materials. The novel energetic materials effort focused on creating a new family of revolutionary low cost insensitive explosive formulations with better performance, enhanced weapon lethality, and increased safety. The effort demonstrated new high-nitrogen gun propellants for 120mm tank cannon and 105mm light artillery that provided a 20 percent increase in muzzle energy and a 40 percent reduction in gun tube wear.

## **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 the Future Combat Systems program as well as exploiting technology opportunities through the FCS 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.

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 war on terrorism to ensure that the Army remains a victorious, relevant, and ready land component of the Joint Force. The Army S&T community is the "engine" of change for the Army's transformation.