RECORD VERSION

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SUBCOMMITTEE ON TERRORISM,
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INTRODUCTION

Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to describe the Fiscal Year 2007 Army Science and Technology (S&T) Program and the significant role Army S&T has in creating, adapting, and maturing technologies to enhance the current force and enable the future force.

We want to thank the Members of this Committee for your support of our Soldiers who are now at war and for sustaining the investments that will provide Soldiers with the dominant capabilities they will need to defend America's interests and those of our allies throughout the world. Your continued advice and support are vital to our success.

S&T CONTRIBUTIONS TO THE GLOBAL WAR ON TERRORISM

Army S&T supports our Soldiers deployed to fight the Global War on Terrorism (GWOT) by rapidly responding to a broad set of needs by leveraging past investments, by exploiting transition opportunities from on-going S&T efforts and by applying new technology to create novel solutions to improve the performance and/or utility of currently fielded equipment, while retaining the flexibility to develop solutions for unforeseen problems. The following are examples of the three approaches:

- Creating new capabilities from past investments: Army S&T is continuing to improve fielded technology to shorten the timeline between target identification and engagement against threats to our Soldiers. Examples include integrating a low-cost acoustic gunfire detection & cueing system into the Crew Remotely Operated Weapon System (CROWS) Lightning (lighter weight with high-speed drives) for Uparmored HMMWV applications as well as another S&T product to

provide medium resolution low-power thermal imager for rapid target detection on-the-move as a potential improvement in HMMWV capabilities.

- Exploiting technologies from current investments: Army S&T is improving current counter rocket/artillery/mortar (CRAM) component technologies already fielded in theater. The Lightweight Counter-Mortar Radar (LCMR), Unattended Transient Acoustic MASINT System (UTAMS), and the Acoustic Mortar Detection System (AMDS) are being improved and integrated to reduce false alarms, and increase the accuracy and range of target interception.
- Applying new novel technology solutions to solve current problems: The PackBot robot has been modified to detect explosives. The system integrates a hand-held explosive trace detector on a robotic platform to remotely detect TNT in improvised explosive devices (IEDs). The enabling technology employs *Amplifying Fluorescent Polymer* (AFP) that changes color when TNT is present.

These examples characterize three different ways that the Army's S&T investments have been exploited to enhance the capabilities of Soldiers in today's fight.

FORCE PROTECTION

Foremost in all of our minds is the need to provide the best available technologies to protect our Soldiers. Specifically, to counter the threat of improvised explosive devices (IEDs) we have matured key technologies that have already been fielded to Soldiers, such as Interceptor Body Armor, electronic countermeasures, and lightweight armor kits for our tactical vehicles.

The major focus of our force protection work is to counter IEDs. We are focusing

counter IED investments in three areas: detection, neutralization, and protection. Detection technologies include: a ground-based sensor suite integrating magnetic, video, and infrared sensors; airborne, high resolution electro-optical/infrared sensors and change detection algorithms; trace explosive detection sensors and hardware; and techniques and algorithms to detect radio frequency IED command links.

Neutralization technologies include high power electro-optical pulses and high power microwaves to pre-detonate IED and/or to defeat IED command links. Protection technologies include lightweight passive armors. Other force protection technologies funded in the FY2007 request include:

- "Backstop" for overhead protection of personnel and buildings as well as compartmentalized interior designs using indigenous materials
- Acoustic and radar sensors for detecting and locating the source of rocket, artillery and mortar fire
- Infrared technology for counter-sniper operations, providing warning and locations for counter fire
- Medical technology to protect Soldiers from endemic diseases and provide rapid treatment to save lives, such as the Chitosan Bandage and the one-handed tourniquet

Beyond those technologies already contributing to the current force, we continue to make significant progress in maturing the sensor and kill mechanism technologies to enable active protection systems (APS). APS will significantly increase the survivability of lightweight platforms. We are funding both close-in and standoff protection systems to defeat chemical energy and kinetic energy munitions. This past year we have successfully demonstrated the ability to defeat rocket-propelled grenades fired from very close ranges. The technologies successfully defeated rocket-propelled grenade (RPG) threats in two different

scenarios: a single RPG fired against a moving vehicle and defeating two RPGs fired nearly simultaneously at a stationary vehicle. We are sustaining investments in these technologies as well as advanced lightweight armors to provide an integrated survivability suite for FCS and other lighter-weight combat systems, approaching protection levels available today only with heavy armor.

We continue to pursue multiple technology solutions to identify and defeat IEDs from standoff ranges. Our work is synchronized across the Department of Defense through close coordination with the Joint IED Defeat Office.

FUTURE COMBAT SYSTEM (FCS)

The single largest S&T investment remains the pursuit of enabling technologies for the Future Combat System (FCS). For 2007, we have over $300M of our budget in technologies planned for the FCS program and simultaneously pursuing opportunities to spin out technologies into the current modular force. FCS is in the system development and demonstration (SDD) phase of acquisition, for experimentation, demonstration and fielding that leads to the first full FCS Brigade Combat Team (BCT) in 2014. The FCS has been designed so that each part of the system is networked within the whole to achieve an unprecedented synergy. Key FCS and spin out technology investments include:

- Networked battle command systems to enable shared situational awareness and improved decision-making
- Networked lethality through standoff precision missiles and gun launched munitions
- Enhanced survivability through networked lethality, improved sensors to locate and identify threats, signature management, active and passive protection systems

- Semiautonomous and autonomous unmanned air and ground systems
- Low-cost, multispectral sensors to find the enemy

UNMANNED SYSTEMS

The Army S&T program is pursuing unmanned and robotic capabilities that include: unmanned aerial systems (UASs), unmanned ground vehicles and unattended sensors. These systems' capabilities will be modular in design for spiral technology insertion and rapid adaptation to changes in mission needs. The unmanned systems and technology applications provide capabilities that are not available today, reducing risks to our Soldiers while simultaneously reducing logistics demands generated by human needs. Specific capabilities include:

- Persistent surveillance and communications on the move enabled by multi-sensor and communications mission equipment packages for UASs
- Unmanned air and ground systems with lethal capabilities for decisive operations against threats as they are forming

As an example, the A-160 Hummingbird UAS is being developed as an option to satisfy medium altitude long endurance requirements for communications relay. The A-160 technology development has been pursued in partnership with DARPA and is currently undergoing flight-testing.

SOLDIER SYSTEMS TECHNOLOGY

Our investments in individual Soldier technologies seek to provide Soldiers with greater protection, communications and network connectivity to maintain situational dominance. 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 speed and lethality. We are also pursuing technologies to enable an integrated and modular lightweight, low observable, chemical and biological protective warfighting ensemble with enhanced ballistic protection. Other key Soldier technology investments include lightweight, high-efficiency power sources; personal climate control; embedded physiological monitoring and limited medical treatments; multi-functional lightweight materials; and embedded training. Advanced high performance fiber technology for body armor continues to be a primary focus for enhancing Soldier protection. These technology developments are being pursued to ensure affordability so we can field critical capabilities within the resources provided.

NETWORK-CENTRIC TECHNOLOGIES

The S&T investments to enable network-centric operations cover the domains of communications, command and control, and sensors. These efforts mature the algorithms, protocols, high data rate processor technologies, and antennas to enable mobile, wireless, tactical networks. The S&T program will develop and demonstrate real-time, continuous situational understanding by integrating data from manned and unmanned air- and ground-based sensors. Technologies include: high performance multispectral sensors (electro-optic, infrared, radio frequency, acoustic, seismic, chemical); fusion algorithms and intelligent agents to integrate data from a wide variety of networked sensors (airborne and ground). Our two toughest challenges to enable network-centric operations are to overcome the technical barriers in 1) collaborative decision aids and information displays to speed decision processes 2) transporting essential data across mobile networks with quality of service that supports distributed operations. Technologies to overcome these barriers include: automated decision tools, algorithms, network protocols, and affordable directional antennas. We are developing decision aids to manage cognitive load and

uncertainty resulting from partial and missing information to improve the quality and speed of decisions. One approach that shows great promise to overcome the data transport barrier applies distributed multi-element antenna array technology to enable steerable beams. Embedded cultural awareness tools to provide leaders and Soldiers with understanding of manmade, topographic, and environmentally significant features to mitigate against undesired outcomes, while facilitating strategic, tactical, and sustainment operations.

BASIC RESEARCH PROGRAM

The Army Basic Research program seeks and produces new understandings to enable revolutionary advances and paradigm shifts in operational capabilities. This program invests in world-class researchers (government, academia and industry) and state of the art equipment and laboratories to explore fundamental phenomena and exploit scientific discovery. These investments are key to the Army's ability to win the race for speed and precision. Today's force has dominant capabilities enabled by Army sponsored research for technology developments such as global positioning systems, night vision devices, precision-guided munitions and communications. These capabilities can be traced to sustained basic research investments in decades past. Basic research is the driving force that "creates" the future and expands human imagination to provide unprecedented capabilities for our Soldiers.

The Army's basic research program has five components: World class university-led single investigator research; focused centers to enable paradigm shifting capabilities such as nanotechnology for the Soldier; research centers of excellence that advance solutions to enduring needs in the areas such as micro electronics and materials; industry-led collaborative technology alliances focused on robotics, power and energy, communications and networks, advanced sensors, and decision aids; and Army unique, in-house research in behavioral

science, infectious diseases and combat casualty care, environmental science, ballistics protection among others.

Some examples of recent progress in Army research are: "liquid armor"—applying nanotechnology to create flexible materials for the Soldier's uniforms and improved composite armors for vehicles and insensitive propellants and remote detection of high explosive materials using ultra-sensitive polymers. For the future we are seeking to create technology to enable interactive computer based virtual humans for Soldier training; Soldier simulation and training aids for unique cultural environments; biotechnology for improved sensors, energy generation and networks; flexible displays for Soldier applications; ultra-small and inexpensive power supplies using dime-sized microengines; and the science for development of hand-sized micro-autonomous systems and technologies with sensors for communication and navigation.

SCIENCE AND ENGINEERING WORKFORCE

To maintain technological superiority now and into the future, we need top-quality engineers and scientists in Army Laboratories and Research, Development and Engineering Centers. We recognize this challenge— the DoD and Army must compete to obtain its future workforce from a declining number of highly qualified candidates from our colleges and universities. We have taken important steps to attract and retain the best science and engineering talent. Our laboratory personnel demonstrations have instituted initiatives to enhance recruiting and reshaping the workforce such as: recruiting bonuses, pay banding flexibilities, pay-for-performance, incentive awards, and enhanced employee education and development programs. To help increase the number of science and engineering graduates, we have established 14 outreach programs to attract more students to math, science, and engineering careers and to sustain their interests in these fields as professionals. We have also provided

recommendations for the emerging National Security Personnel System (NSPS) to incorporate what we have learned from our laboratory personnel demonstrations. In addition, we are renewing our research laboratories to maintain state of the art capabilities that are essential to attract and to equip talented scientists and engineers with tools to pursue the frontiers of science and engineering.

TECHNOLOGY TRANSITION

Successful transition of Army S&T products is central to enabling the Army's Transformation and accelerating new technologies into the current force. We use Technology Readiness Level metrics to assess and communicate the estimated maturity of a technology to the acquisition Program Managers, who buy the systems that are provided to our Soldiers. The S&T community's outcome-oriented approach to technology development has yielded significant progress over the past few years. Examples of successful S&T efforts that have transitioned to programs of record include:

- FCS to System Development and Demonstration (SDD)
- Objective Crew Served Weapon to SDD
- Precision Guided Mortar Munition to SDD
- Lightweight 120mm cannon for FCS
- Compact, High Power Engine for FCS
- Tactical C2 protection algorithms to PM Warfighter Information Network-Tactical (WIN-T)
- Network Fires (Cooperative program with DARPA) to SDD as Non-Line-of-Sight Launch System

CONCLUSION

The Army must have a diverse S&T portfolio to be responsive to current and future warfighter needs. The S&T community seeks technological solutions that can be demonstrated in the near-term, explores the feasibility of new concepts for the mid-term, and explores the imaginable for an uncertain far-term future. The Army S&T community has committed our intellectual resources—our people—and our facilities and funding to maintain the momentum of the Army's Transformation!