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STATEMENT BY

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UNITED STATES SENATE

ON "LEAP AHEAD" TECHNOLOGIES AND TRANSFORMATION INITIATIVES WITHIN THE ARMY SCIENCE AND TECHNOLOGY PROGRAM

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ON ARMY SCIENCE AND TECHNOLOGY PROGRAM
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INTRODUCTION

Mr. Chairman and Members of the Committee, thank you for the opportunity to appear before you to discuss the Fiscal Year 2002 (FY2002) Army Science and Technology (S&T) Program and the significant role S&T has in The Army Transformation. It is my privilege to represent The Army leadership, the members of The Army S&T community, and America's soldiers who rely on us to provide them with the capabilities they need to execute our National Military Strategy throughout the world.

I thank the Members of this Committee for your important role in making today's Army the world's preeminent land combat force. I also thank you for your assistance in our Transformation efforts. Your continued advice and support are vital to our success.

TRANSFORMATION

The Army is changing and Army S&T has accepted the challenge of enabling this change. We are transforming today's Army from a Cold War Legacy Force to an Objective Force. This force will provide early entry capabilities that can operate jointly, without access to fixed forward bases, and still have the power to win campaigns decisively. The Army's Transformation will initially augment, and eventually replace, today's Legacy Forces which are too heavy or lack staying power.

We are an Army between wars, and we are challenging all the assumptions about what conflict may be like in the future. We are doing this to

ensure that our future soldiers have the capabilities necessary to accomplish the full spectrum of operations they will face in the 21st Century. Our future force, the Objective Force, will be more responsive, more deployable, more agile, more versatile, more lethal, more survivable, and more sustainable than our present force. The Objective Force will be strategically dominant, capable of placing a combat capable brigade on the ground anywhere in the world within 96 hours, a division on the ground within 120 hours, and five divisions in theater within 30 days. These are ambitious, but achievable, goals.

THE ROLE OF ARMY S&T

The Army S&T program is central to enabling the new vision and is on the critical path of the transformation leading to the Objective Force. We are committed to providing the technology to accelerate this transformation. The Army has challenged us to answer some very tough questions about achieving the Objective Force-desired capabilities. As General Shinseki has stated at a recent Association of the United States Army meeting, "We are asking the science and technology community and industry to deliver capabilities that will help break the Cold War mindset we all carry with us." He made specific challenges in that same speech:

- I would like to know whether we can design (combat) systems that can't be hit.
- I want range overmatch: I want to see farther than the other guy and engage well outside his lethal envelope.
- I want early, discrete targeting.
- I want to pull the trigger first every time and kill a target each and every time I pull the trigger, and I want to do it at smaller calibers.

To meet these challenges, the Army's S&T community has focused and sharpened its efforts. The Army has also partnered with the Defense Advanced Research Projects Agency (DARPA) to demonstrate an entirely new land combat capability called the Future Combat Systems (FCS). FCS is not "a platform." It is a system of battlefield capabilities in which the whole exceeds the sum of its parts.

FCS represents a true paradigm shift in how we fight – perhaps as significant as the introduction of the tank or the helicopter. Fielding FCS will be equivalent to making heavy forces lighter and lighter forces more lethal, in addition to reducing logistics demands. Some of the key challenges include:

?? **Survivability:** Survivability is the primary technology challenge because our combat systems must weigh less than 20 tons to be rapidly deployable. This forces us to find new ways to protect our soldiers. To survive a first round engagement with 21st Century threats, individual FCS platforms will require advances in Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) and platform protection systems. Overall force survivability will require unprecedented battlespace situational understanding, stand-off threat detection, and neutralization capability. Options under development include advanced communications and sensor systems that will increase situational awareness and allow us to "see first" and farther than the enemy; active protection systems which are designed to degrade, deflect or defeat incoming threats before they can hit our vehicles; signature reduction techniques that will make us harder to see and therefore harder to hit; and lightweight armor that weighs ¼ of the current armor, but provides the same protection.

?? **Lethality:** Although our systems will be lighter weight, they must maintain the lethality overmatch of current systems while supporting the shortened timelines associated with future threat environments. Required capabilities include lethal and non-lethal, line-of-sight and non-line-of-sight, gun, missile and directed energy weapons that will provide for the destruction or

incapacitation of multiple targets. Options under development include the precision and loiter attack missile systems that will allow us to conduct precision engagements against the enemy at much greater ranges than he can; lightweight, lower caliber guns and ammunition capable of precision direct and indirect fire at long ranges, potentially enabling us to combine capabilities of the traditional tank and artillery piece into one system; extremely lethal compact kinetic energy missiles that ensure overmatch against advanced protection systems, and directed energy systems like lasers and high-power microwaves for lethal and non-lethal applications.

?? **C4ISR:** Network centric operation is the linchpin for FCS and the Objective Force, providing the foundation for comprehensive situational awareness and the capability for instantaneous prioritization, distribution and engagement of multiple threats. On-the-move, distributed command and control, multi-function sensors and sensor fusion algorithms, and development of a seamless Tactical Internet among leaders, soldiers, platforms, and sensors are critical to achieving these goals. Options under development include digital, secure on-the-move communications for collaborative planning and execution, positive command and control, and shared situational awareness; enhanced radar and sensor systems for longer range detection, accurate identification and precise localization; information assurance to counter information attack and avoid deception, denial and disruption; and aided target recognition to reduce reliance on the human-in-the-loop and increase likelihood of engagement against high-value targets.

?? **Power Generation & Management/Electric Propulsion:** The Objective Force will require efficient power generation and management systems to remain lightweight, but still function at a fraction of the logistics burden of the current force. Fortunately, the Army can leverage commercial investments, and is engaging with industry to achieve mutual development benefit. Options under development include hybrid electric drive for high acceleration, silent operation, design flexibility and increased fuel efficiency; fuel cells for efficiency, quiet operation, reduced environmental impact and potential water

generation; advanced diesel engines scaled for FCS-class vehicles with higher power density and greater fuel efficiency; low power demand electronics to increase energy efficiency; and efficient power management designs.

?? **Human Engineering:** Future soldiers will face increased challenges because of the variety of missions and complexity of tasks that they must accomplish. We must minimize this complexity and ensure our soldiers are trained and ready to function on the battlefields of the future. Options under development include human/machine interface designs that decrease task complexity and execution times, improve performance levels, and minimize physical, cognitive, and sensory demands; associate systems to complement human operators, offload routine tasks and enhance high priority task performance; and embedded/deployable training and mission rehearsal environments to maximize warfighter readiness for the full spectrum of operations in rapid deployments.

UNMANNED SYSTEMS

The Army supports the Congress' desire for fielding substantial unmanned capability among future operational ground combat vehicles and is aggressively addressing the technology, costs, risks and operational issues. To achieve that end, the Army has implemented a bold robotics technology investment strategy to provide the critical options needed to create opportunities for insertion of unmanned capabilities into the Objective Force. The Army has structured the FCS program with phased upgrades to support the introduction of progressively more robust unmanned ground combat capabilities.

As part of its on-going partnership with DARPA, the Army is sponsoring the development of FCS concepts that involve significant unmanned capabilities. The Army strategy is to initiate the incorporation of substantial unmanned capabilities through the FCS program. The synergistic integration of manned and unmanned systems envisioned for the Objective Force will expand the

envelope of capabilities at the leader's command and reduce the threat to our soldiers, taking them out of harms' way. The Army vision for the FCS and the Objective Force incorporates unmanned systems as a key element for both ground and air operations. The Army is currently developing the fundamental technology to enable these systems, both on its own and in collaboration with the DARPA.

The collaborative Army/DARPA FCS program will define and validate FCS design and operational concepts, including the role of unmanned ground vehicles (UGVs) and unmanned air vehicles (UAVs). Potential unmanned functions include:

- Remote sensing (UGV scouts, UAVs)
- Communications relay (UAVs)
- Unmanned weapons carriers for line-of-sight and non-line-of-sight fires (UAVs and UGVs), and
- Unmanned logistic support vehicles (follower UGVs).

As part of the Army/DARPA program, DARPA is pursuing advanced technology for UGVs to increase mobility and support enhanced perception capabilities. While promising, these technologies may not be sufficiently mature to be inserted for the initial fielding of FCS. The Army is, therefore, pursuing a complementary lower risk UGV approach for FCS. Building on past successes, the Army is pursuing a dual-track approach for development of UGV technology, consisting of a Robotic Follower Advanced Technology Demonstration (ATD) and a Semi-Autonomous Robotics for FCS Science and Technology Objective (STO).

The Robotic Follower ATD will develop and demonstrate near-term technology that permits unmanned systems to follow a path “proofed” by a manned vehicle. The unmanned system may follow by as much as a minutes, hours or a day later. The potential for new obstacles, such as other vehicles, civilian traffic, or battle damage will still require substantial development of perceptual capabilities. Follower technology will enable the use of unmanned

vehicles for logistics missions, as non-line of sight weapons carriers, and to provide rear security for troop formations, among other capabilities.

The Semi-Autonomous Robotics for FCS program focuses on the development of more capable mid-term technology systems that are able to maneuver without substantial human intervention. The development of perceptual capabilities will permit unmanned vehicles to "understand" the environment, not only in terms of trafficability, but also tactically. The creation of the algorithms required for unmanned systems to employ tactical behaviors, analogous to the tactical judgment employed by soldiers, are a key part of this STO. The substantial, though still somewhat fragile, autonomous mobility capabilities recently demonstrated during troop-led experiments in relatively rugged terrain at Fort Knox, KY, underscore both the attainability and promise of the technology.

Additional Army technology investments that have direct relevance for FCS and the Objective Force are being made with DARPA. They include the Organic Air Vehicle (OAV) and a UAV rotorcraft with a large payload, long endurance and a vertical take off and landing capability (the A-160 Hummingbird), advanced command, control and communication technologies, and novel sensor systems. These technologies hold the potential to permit the FCS, and its associated dismounted forces, to operate in complex terrain by exploiting organic, non-line-of-sight fire capabilities through remote sensing and communications relays.

OTHER S&T PRIORITIES

Beyond the FCS, our S&T program must continue to support the full range of capabilities required for the remainder of the Objective Force. Some key areas of investment include:

- Objective Force Warrior: Integrated soldier system of systems to provide leap-ahead capabilities for the dismounted soldier with dramatic weight and power reduction. The system of systems will provide seamless connectivity with other personnel, weapon systems, FCS, and robotic air/ground platforms to achieve overmatch for the full spectrum of future operations.

- Medical Technology: Individual health monitoring, new medical and dental preventive and treatment modalities, including, vaccines and drugs against malaria, hemorrhagic fever, and scrub thyphus, will significantly reduce Disease and Non Battle Injury (DNBI) casualties and increase return to duty, thereby reducing the medical footprint and the attendant logistical requirements. Innovative products for far-forward stabilization and resuscitation, hemorrhage control, and minimizing neural injury will push advance care forward to the point of injury, decrease the mortality rate, reduce return-to-duty delay rate, and make extended evacuation times possible.

- Advanced Simulation: Modeling and simulation technology, such as an innovative partnership with the entertainment and game industries through the University of Southern California (the Institute for Creative Technologies or ICT) to accelerate the development of compelling immersive environments for training, mission rehearsal, and concept development. Another project, the Joint Virtual Battlespace (JVB) program, is an enabling technology for evaluating how FCS contributes to the total capability of the Objective Force, and how the Objective Force plays in a joint force. JVB, combined with virtual prototyping, also could provide an effective means for performing Operational Test and Evaluation without the need for numerous hardware test articles. This could result in significant time and financial savings in the Army Acquisition Process.

?? Rotorcraft Technology: As the DoD lead for Rotorcraft Science and Technology, the Army is investing in the critical technologies that could provide heavy (up to 20 Tons) and semi-heavy (12 Tons), intra-theater lift to the Services, and armed unmanned platforms for combat reconnaissance. These technologies also could upgrade the current Army Aviation Fleet for heavier loads and reduced logistical burden.

?? Basic Research: Investment in knowledge and understanding of fundamental phenomena to enable future technological development; includes support for academic research through the Single Investigator Program, University Centers of Excellence, University Affiliated Research Centers (UARCs, such as ICT), and the Collaborative Technology Alliances (CTAs, formerly known as Federated Laboratories). A specific new thrust in this area is the establishment of a Nanoscience UARC focusing on the application of emerging nanotechnologies to enhance future warrior survivability.

?? Micro electro-mechanical System Inertial Measurement Unit (MEMS IMU): The Army has recently solicited 50%-cost share proposals to develop a low-cost, gun hardened and high accuracy MEMS IMU for gun-launched guided munitions, tactical missile and other military applications. The focus is to produce a MEMS IMU that will be bought by the DoD in bulk, thereby giving the economy of scale necessary to yield an inexpensive unit price. The goal is a military tactical-grade IMU that meets 90% of DoD munition and missile needs at a low-performance unit price, available from two, or more, commercial contractors.

?? High Energy Lasers: The Army S&T program continues to investigate high energy solid state laser technology options for potential application on the tactical battlefield. In this effort, we are seeking to identify the most promising solutions to ensure speed of light engagement and laser weapon lethality throughout the spectrum of battlefield environments of weather, dust and obscurants.

CONCLUSION

Since the Army Vision was announced in October 1999, the Army S&T program has been re-shaped and focused to speed the development of those critical technologies essential to Transform the Army into the Objective Force. The Army S&T community has accepted the challenges and has energized all of its resources to meet them. We are accelerating the pace of transformation of The Army!