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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 2001 (FY2001) 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 help with The Army's FY2000 budget, the FY2000 Supplemental for Kosovo, and the \$100 million to assist in our initial transformation efforts. Your continued advice and support are vital to our success.

## **TRANSFORMATION**

The Army today must meet diverse and complex demands for land forces in joint and multinational formations. We believe the future will require missions ranging from humanitarian assistance and disaster relief to peacekeeping to major theater wars that may involve the use of weapons of mass destruction. To better meet these demands, The Army in October 1999 announced a bold and comprehensive new vision to transform itself into a full spectrum force capable of dominating at every point on the spectrum of military operations.

Implementing the new vision requires comprehensive transformation. The Army's Transformation Strategy pursues capabilities for full spectrum dominance in the future force that we call the Objective Force. This Objective Force is more responsive, deployable, agile, versatile, lethal, survivable, and sustainable than our present force. Three major phases are planned for the transformation: the Initial phase when we acquire off-the-shelf vehicles; the Interim Capability phase when we seek capabilities within the constraints of available technology; and the Objective Force phase when we apply new technologies to realize a force by FY2012 capable of placing a combat brigade on the ground within 96 hours after liftoff, a division within 120 hours, and five divisions within 30 days. These are ambitious but achievable goals: to transform the entire force as soon as the technology permits and we are resourced to buy and sustain this force.

### **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's Chief of Staff, General Eric K. Shinseki, has asked us to answer very tough questions about achieving the Objective Force-desired capabilities by FY2012 — we are challenged to provide a comprehensive set of answers in FY2003. Perhaps the best way to view our focus on the Objective Force is to understand The Army's and its technical community's emphasis on developing

and fielding an entirely new land combat capability that we call the Future Combat Systems (FCS).

FCS is not just "A" platform. We are not developing "A Tank" or "An Artillery System" or "An Infantry Carrier." FCS is a system of battlefield capabilities in which the whole exceeds the sum of its parts. Its major attributes are: network centric architecture; robotics integrated into the force for unmanned ground combat vehicles; increased reliance on extended range engagement; capable of air-mobile operations. FCS enables a true paradigm shift – perhaps as significant as the development of the tank and the helicopter. Fielding FCS technologies will make heavy forces lighter, lighter forces more lethal, and reduce logistics demands. We have a diverse portfolio of technology investments to maintain land force dominance today, and we have committed to investing about \$500 million each year over the next five years to achieve FCS capability. The Army leadership's decision to accelerate fielding of FCS to FY2012 presented a difficult challenge to the S&T program. To accelerate FCS, funds were both added into and reprogrammed within S&T - shifting the emphasis of the S&T program from an evolutionary path to a revolutionary path that leads to transformation of The Army. This resulted in redirection of our funding from near-term advanced technology upgrade efforts to resource the FCS major demonstration in FY2006 – leading to a direct transition from S&T to Engineering and Manufacturing Development (EMD). The Army has had to make some tough decisions to get to the funding level submitted to you in the President's budget. We need your help in the FY2001 budget to establish the S&T effort for the Objective Force. The following table provides a breakout of the FCS funded program for FY2001 through the Future Years Defense Plan (\$million).

<b>Future Combat System Technologies</b>	<b>FY2001</b>	<b>FY2002</b>	<b>FY2003</b>	<b>FY2004</b>	<b>FY2005</b>
C4ISR	148	74	52	51	25
Lethality	117	103	105	133	162
Survivability	83	88	81	79	73
Army Contribution to DARPA-led Functions	44	107	122	114	111
Mobility	33	31	32	29	27

Robotics	16	20	28	26	24
Human Engineering	12	13	14	10	5
Technology Demos-Army-led Functions	3	3	25	48	42
	457	440	458	491	469

An additional \$46 million in FY2001 would reduce program risk by funding additional industry concepts and designs for FCS. This funding would support additional industry solution sets to help us identify the best technical approaches to meet the challenges inherent in the complex system of systems capabilities required for FCS.

To assure success in overcoming the technology barriers for FCS, The Army has partnered with the Defense Advanced Research Projects Agency (DARPA) in a collaborative program for the evaluation and competitive demonstration of FCS. This program will: 1) define and validate FCS design/operational concepts using modeling and simulation, and surrogate exercises; 2) fabricate and test a FCS Demonstrator with three or more of its desired functionalities (direct fire, indirect fire, air defense, nonlethal, reconnaissance, command and control on the move, ability to transport troops) suitable for EMD and production; and 3) develop selected enabling technologies for use in the Demonstrator. We are enthusiastic about our collaboration because of DARPA's reputation for pushing the technology envelope and for the opportunity to combine our resources to focus together on this important Army initiative.

### **S&T INVESTMENT STRATEGY**

In the FY2001 President's budget request, the S&T program is key to the long-term transformation of The Army. Our S&T request for FY2001 is \$1.29 billion - \$201 million for Basic Research (Budget Activity 6.1); \$603 million for Applied Research (Budget Activity 6.2); and \$491 million for Advanced

Technology Development (Budget Activity 6.3). When compared to the FY2000 President's budget request, this represents an 8 percent increase for 6.1 and 6.2 to mature high risk/high payoff technologies for the Objective Force. This includes a \$43 million transfer from the Office of the Secretary of Defense (OSD) to The Army to assume the role of lead Service for unmanned ground vehicles S&T and joint Service Center of Excellence for battlefield robotics research. The budget request includes a 6.5 percent decrease in 6.3 due to transfer of Anti-Personnel Landmines-Alternatives from S&T to development and completion of several Advanced Technology Demonstrations (ATDs) and Advanced Concept Technology Demonstrations (ACTDs). Overall, these changes represent a 2.1 percent increase in the S&T top line from FY2000 to FY2001 (0.6 percent real growth to this top line). All priorities in S&T, however, are not equal in the funded program – enabling the Objective Force is the number one priority.

### **ENABLING THE VISION – NEAR- AND MID-TERM FY2001-2010(6.2/6.3)**

There are several key S&T programs in the FY2001 budget request that I would like to highlight as near- and mid-term enablers to The Army vision. For the most important effort, FCS, we are requesting \$44 million for the collaborative program with DARPA and \$413 million for FCS Army enabling technologies. Of these enabling technologies, such as wireless communications and sensors, active protection, advanced armor, fuel cells, kinetic energy missiles and direct fire munitions, I would like to specifically address unmanned ground combat systems (UGCS) technology. Our approach with UGCS will be to put “robotics out front...in harm's way” to reduce risks to our soldiers. The application of robotics to FCS will provide unmanned shooter platforms and robotic seekers and sensors. These unmanned systems will be easily transportable, function at tactical speeds/operations, modular and multi-mission with reduced logistics footprint and reduced soldier vulnerability.

Technologies demonstrated in the Future Scout and Cavalry System (FSCS) ATD will help to accelerate FCS by further developing FCS technologies. The scout function from the TRACER/FSCS program will be integrated into the FCS concept as will results from FSCS trade-off studies. Our request for FSCS in FY2001 is \$69 million.

Another important S&T program for the Objective Force is the Line-of-Sight Anti-Tank (LOSAT) ACTD. This program demonstrates a hypervelocity (one mile/second), kinetic energy missile with overwhelming lethality – “one shot, one kill” – that provides a volume of extremely lethal, accurate direct fire. Our light forces need a long-range, high rate of fire weapon system with the overwhelming lethality required to produce the shock effect to quickly destroy threat armor. LOSAT is the only system that can provide this capability and not be countered by explosive reactive armor, applique, or active protection systems. The system will be deployable on all airlift assets, such as C-130 and C-5 aircraft and sling load carried by UH-60L Black Hawk and CH-47 Chinook helicopters. Our request in FY2001 for LOSAT is \$51 million. We continue to investigate the concept for a smaller, lighter, compact kinetic energy missile in our Applied Research program for application to the direct fire role in FCS. Our request in FY2001 for this Compact Kinetic Energy Missile is \$19 million.

We are formulating a joint Army/Navy Applied Research program in FY2001 to develop an affordable high-g microelectro-mechanical systems inertial measurement unit (MEMS IMU). Our goal is a 15 cubic inch MEMS IMU at less than \$1.2 thousand/unit cost with an accuracy of one degree/hour bias stability, withstanding an operating environment over 10,000g's. This effort includes manufacturing technologies to reduce cost by improving processes and testing, resulting in a 75 percent MEMS IMU cost reduction from current ring laser gyros. Our request in FY2001 for MEMS IMU is \$7 million.

**ENABLING THE VISION – FAR-TERM – BEYOND FY2010 (6.1)**

In FY2001, The Army Basic Research budget totals \$201 million. This investment is the minimum required to sustain the vision for The Army Beyond FY2010 and maintain U.S. technological superiority in land warfighting capability in the 21<sup>st</sup> Century. Basic Research (6.1) is the foundation of The Army S&T investment strategy in an era of scientific and engineering innovation. Partnering with academia and industry is the critical enabler in this strategy. The goals of The Army strategy are: to sustain technological superiority in land warfighting capability; to identify and mature emerging S&T in support of force modernization; and to insure against technological surprise. Army Basic Research investments, structured to leverage research expertise across academia, industry and government, include: University Affiliated Research Centers, Centers of Excellence, and the University Single Investigator Program, which are focused primarily in academia; The Army Federated Laboratories, which involve consortia of industry, academic, and government partners; in-house, government research in Army niche areas such as energetic molecules for propellants and explosives, infectious diseases, and cognitive readiness; and Strategic Research Objectives that synergistically focus related research activities on potential high payoff areas such as Compact Power Sources and Mobile Wireless Communications.

**Army Federated Laboratories:** The Army Federated Laboratory (Fed Lab) is a fundamental reinvention of how The Army partners with the private sector to exploit commercial innovation in the basic research arena. Fed Lab does not have permanent infrastructure, but can be thought of as a collection of geographically distributed “virtual” laboratories building the scientific and technological foundation in areas where the center-of-mass lies outside Army laboratories. A Fed Lab consortium consists of at least one industry partner as the lead, one major university partner, and one Historically Black College or University or Minority Institution. The three current Fed Labs are focused on technologies for the digital battlefield. The Army plans to extend the Fed Lab concept into the Applied

Research (6.2) arena in FY 2001 through the creation of a new industry/academia consortia focusing on robotics for future unmanned ground combat systems.

**University Affiliated Research Centers and Centers of Excellence:** University Affiliated Research Centers (UARCs) and Centers of Excellence (COEs) are the centerpiece academic linkage to Army Research and Development (R&D) organizations. Established in high-interest technical areas, COEs have proven to be effective in many application-oriented projects in areas such as rotary wing technology and electronics. Center programs often couple with graduate education programs to increase the supply of scientists and engineers in areas of importance to The Army. In FY1999, The Army created a new university affiliated research center, The Institute for Creative Technologies (ICT) at the University of Southern California, to take advantage of the expertise of the entertainment and computer game industries. The ICT is focusing on technologies common to both defense and the entertainment industry, bringing together specialists from industry, academia as well as The Army, to produce a unique synergy. The products of the ICT will be used to enhance military capabilities in the areas of training, soldier and leader development, and combat mission rehearsal. In FY2001, we are requesting \$16 million for the ICT.

**University Single Investigator Program:** This program provides approximately 600 university research grants to nearly 120 institutions in 48 states, with a major outreach program to Historically Black Colleges and Universities and Minority Institutions. Focusing investments in academia enables The Army with the ability to exploit unique research opportunities, leverage world-class academic expertise and facilities, and focus academic basic research on Army-related problems.

**Army In-house Basic Research:** In-house Basic Research is primarily focused in Army unique business areas where there is no academic research interest or commercial research investment (e.g. armor/anti-armor, energetic materials, gun

propulsion, and infectious diseases that are endemic to underdeveloped countries). It has been the source of many fundamental accomplishments in physics, mechanics, fluid dynamics, electronics, and medicine that have been instrumental in the development of current Army capabilities, such as advanced armors and armor piercing ammunition for the M1 Abrams family of tanks, the Hepatitis A vaccine, and Fibrin bandages. It also allows The Army to maintain its core competencies so The Army can be a smart buyer.

**Strategic Research Objectives:** To meet future technology requirements integral to The Army beyond FY2010, nine Strategic Research Objectives (SROs) have been defined to synergistically focus related research activities on potential high payoff goals. SROs are multidisciplinary areas considered to have significant potential for leap-ahead or revolutionary improvements in capabilities. Examples of SROs include: Enhancing Soldier Performance, Armor Materials by Design, Mobile Wireless Communication, Intelligent Systems, and Nanoscience. Army SROs are coordinated with the other Services through OSD managed Strategic Research Areas. The Army currently focuses approximately 25 percent of its basic research resources on SROs, and has established a goal of increasing this focus to approximately 50 percent of the basic research program by FY2003.

## **CONCLUSION**

This year's proposed budget is a critical first step. It carefully balances near-term readiness and long-term modernization. This budget will allow us to make an initial S&T investment in FCS as the weapon platforms for the Objective Force. It will allow for the continued integration of information technologies into our weapon systems through digitization. It will continue our investment in new platforms that are essential to force modernization. General Shinseki has thrown down the gauntlet – challenging The Army to transform. The Army S&T

community has accepted this challenge for the Objective Force and has energized all resources to meet it. We are accelerating the pace of transformation of The Army!