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INTRODUCTION

Mr. Chairman, Members of the Subcommittee, and Staff, I very much appreciate the opportunity to provide written testimony on the Fiscal Year 2003 Air Force Science and Technology (S&T) Program. The United States Air Force is committed to a robust S&T Program that enables us to achieve our vision of continuing our transformation to an integrated air and space force capable of rapid and decisive global engagement. By continuing our investment in transformational technologies that support a reduced cycle-time, spiral development acquisition process, the Air Force will retain its dominance of air and space in future conflicts against both traditional and asymmetrical threats.

Innovation is a vital part of our heritage and is key to ensuring the Air Force will meet the challenges of tomorrow. Transforming our warfighting capabilities towards this end will involve continued innovations in how we think about employing our forces to defend our nation, as well as quantum leaps in our technology. We must be prepared to counter the worldwide availability of advanced weapons, regional instabilities, and other emerging and less predictable asymmetrical threats. We are developing transformational technologies that permit flexible forces capable of operating far from home, on short notice, for extended time periods. We must also be able to afford these innovations once we develop them in order to re-capitalize the Air Force to fulfill our vision. To meet these objectives, we search out the most promising and affordable technologies in order to win decisively, protect our forces, and minimize collateral damage.

S&T BUDGET

We have been faced with the reality of a fiscally constrained, but operationally-demanding budget environment. The high operations tempo the Air Force has sustained in

support of peacekeeping operations and conflicts, such as Afghanistan, has placed a great burden on our people and resources and has strained our ability to maintain a balanced investment between current readiness, short-term objectives, and the long-term challenges that are enabled by our S&T Program.

In spite of these tight budgets, the Air Force is working hard to increase S&T funding, while maintaining a balanced S&T portfolio. The Air Force Fiscal Year 2003 President's Budget (PB) request was $1,659 million, an increase of approximately $280 million over the Fiscal Year 2002 PB. In conjunction with the PB increase, there has been a significant increase in the involvement of the warfighting commands and senior Air Force leadership in S&T planning, programming, and budgeting. For example, we have established semi-annual S&T Summits where the Secretary of the Air Force, the Air Force Chief of Staff, and the Air Force four-stars and other senior leaders review the S&T portfolio. The latest S&T Summit focused on transformational technologies that can be developed to assist in combating terrorism and homeland defense.

The Air Force has increased its space technology investment by initiating an advanced development program, Transformational Wideband MILSATCOM, to develop and demonstrate laser communications technologies. Laser communications could provide higher data throughput, and higher frequencies that could transform our military satellite communications infrastructure. Laser communications technology promises to increase the data transfer rates at least tenfold compared to current radio frequency communications systems. Additionally, laser communications uses a narrow beam, which decreases the likelihood of intercept and increases resistance to jamming. While laser communications has a high potential to revolutionize satellite communications, there are technical challenges to overcome such as precision pointing and

tracking, weather constraints, and adapting the equipment for use in space. While we continue to work on the challenges, we are conducting a study to determine the best architecture for implementing laser communications technologies to complement radio frequency-based systems. Transformational Wideband MILSATCOM is the only project in Program Element 0603436F, and will be executed at the Air Force Space and Missile Systems Center because of the desire to rapidly transition this technology into operational use, and the significant amount of manpower required to manage the effort.

S&T PLANNING PROCESS

I am pleased to report that the S&T Planning Review we undertook and completed in response to Section 252 of the National Defense Authorization Act for Fiscal Year 2001, Public Law 106-398, was an overwhelming success. We approached this review enthusiastically and received the wholehearted support and participation of not only the Air Force S&T community, but also the requirements, planning, logistics, and user communities. Approximately 300 people were involved in this review: 160 from the S&T community; 90 from the requirements, plans, and logistics communities; and 50 from the user community. As required, the Air Force identified short-term objectives and long-term challenges. The short-term objectives identified include: Target Location, Identification, and Tracking; Command, Control, Communications, Computers, and Intelligence; Precision Attack; Space Control; Access to Space; Aircraft Survivability and Countermeasures; Sustaining Aging Systems; and Air Expeditionary Force Support. The long-term challenges identified include: Finding and Tracking; Command and Control; Controlled Effects; Sanctuary; Rapid Aerospace Response; and Effective Aerospace Persistence. In addition, we defined technology development roadmaps for each of these objectives and challenges.

Upon completion of the review, the Comptroller General of the General Accounting Office (GAO) assessed the review's compliance with the law. The recently released GAO report not only found the Air Force in compliance with the requirements of the legislation, but was also very favorable of Air Force efforts. The results of the S&T Planning Review are now providing both a short-term and long-term focus to the S&T Program. They are being incorporated into the Air Force S&T Plan, the Air Force Strategic Plan, and are laying the foundation for future Air Force S&T budget planning.

Subsequently, Section 253 of the National Defense Authorization Act for Fiscal Year 2002, Public Law 107-107, has directed the Air Force, in cooperation with the National Research Council of the National Academy of Sciences, to carry out a study to determine the effect of S&T program changes of the past two years. We expect to submit the results of this study to Congress not later than the May 1, 2003, deadline.

MAXIMIZING OUR S&T DOLLARS

The Air Force continues to leverage technology to transform combat effectiveness. Our strategy is to pursue integrated technology solutions that support our warfighter's highest priority needs. We must also pursue the fundamental enabling technologies that will transform tomorrow's Air Force. As technological superiority is a perishable commodity, we work hard to maximize the payoff of our S&T funding, by not only developing transformational technologies, but also by speeding the introduction of these new technologies into new capabilities for our warfighters using spiral development and reduced acquisition cycle times.

Aiding in the transition of technology to the warfighter is the Air Force's newly established Acquisition Center of Excellence, which will develop new acquisition processes and concepts for accelerating development programs into operational use. This new initiative could

more highly focus the S&T Program on technologies that have a clear and well-defined technology transition path into developmental and fielded systems. The spiral development concept will be an important foundation of this new Air Force acquisition initiative. In addition to the Air Force's Acquisition Center of Excellence, another avenue that could provide for transition of maturing S&T technologies is the Congressionally-directed Challenge Program. This program as described in Section 244, "Program to Accelerate the Introduction of Innovative Technology in Defense Acquisition Programs," of H.R. 2586, directs the Office of the Secretary of Defense to increase the introduction of innovative and cost-saving technology in acquisition programs.

Since deployed technology may remain in use for decades, the Air Force S&T Program not only focuses on enhancing performance, but also on increasing our emphasis on the reliability, maintainability, and affordability of weapon systems. Emphasizing affordability from the very beginning through training of our management and engineering staff, as well as through careful review of technology transition pilot projects, increases our potential to reduce the costs of technology early in the process and throughout a product's life cycle.

We are very selective about investing in high payoff technological opportunities. We constantly seek opportunities to integrate Air Force planning and leverage our S&T funds by cooperating with other Services, Agencies, the private sector, and international partners. For example, we rely on the Army as the lead Service for defensive chemical-biological technology development. The Air Force also has strong inter-Agency efforts, such as our program in aging aircraft, which is focused on detection and management of corrosion and fatigue in aging structures. It is closely coordinated with the civilian aging aircraft research programs at the National Aeronautics and Space Administration (NASA) and the Federal Aviation

Administration (FAA). Finally, the Air Force is involved in international technology cooperative efforts for S&T, such as the software defined radio development, insensitive high explosives, and aircraft battle damage repair efforts conducted with France, Germany, and the United Kingdom. Another example of international cooperation is the bi-lateral work we are doing with Australia on testing small ordnance release and separation on aircraft with internal weapon bays at subsonic and supersonic speeds.

COMBATING TERRORISM

Since the September 11th attack on the United States, the Air Force has responded to civil and military requests for assistance providing both technology and scientists and engineers. For example, continental United States air defense systems are positioned along our borders to cover the air space from the shoreline to 250 miles outward. However, September 11th brought with it a sudden military need to cover the airspace over the United States as well. We sent scientists and engineers, equipment, and radar fusion software to the Northeast Air Defense Sector operations center, and integrated military and FAA radar data for real-time situational awareness of all air traffic in the Northeast United States.

In partnership with the MITRE Corporation, we mounted sensors on a New York Police Department helicopter and on a Drug Enforcement Agency aircraft. The helicopter and aircraft over flew "ground zero," using the video mosaic tool kit the Air Force developed to process Predator data, to produce a current aerial map of New York City. The police and fire departments used this map in their search and rescue efforts.

The Air Force Joint Defensive Planner program, an automated tool recently developed to allow joint collaborative planning of theater air defense, was modified for use by the North American Air Defense Command. Air Force scientists and engineers modified the Joint

Defensive Planner databases to include a high-resolution topographical map of the United States, plus the location and capabilities of all military and FAA radars in the continental United States. This modified planner was installed in the 1ST Air Force CONUS Regional Operations Center at Tyndall Air Force Base, Florida, and gave us the first ever, complete picture of radar coverage of the continental United States.

Another technology that has been deployed to support Operation Enduring Freedom is the Interactive Data Wall. Think of it as a very large computer screen. The data wall starts at waist level, goes up three feet, and is twelve feet wide. It has very high resolution, with over four million pixels in the display, and can overlay multiple sets of information and show several different displays simultaneously. Anything that can be displayed on a computer or television can be displayed on the data wall. You control the displays through voice recognition software and laser pens. The Air Force has been experimenting with data walls in joint exercises over the past two years and has met with much success in learning how best to use them. In December, the Commander of the Army 10th Mountain Division requested a data wall for immediate deployment in support of Operation Enduring Freedom with a second data wall to follow 90 days later. We delivered the first data wall the next day and the second one in less than 90 days.

The Air Force technology has also been directly supporting warfighters involved in Operation Enduring Freedom by providing fatigue countermeasures to B-2 bomber crews at Whiteman Air Force Base, Missouri, who are flying 44-hour missions to Afghanistan. The Warfighter Fatigue Countermeasures technology program is focused on optimizing warfighter survivability and combat capability during sustained and continuous (24/7) operations. Our primary S&T objective is to identify, develop, and transition tools and procedures that prevent and delay cognitive performance deterioration caused by acute and cumulative fatigue resulting

from extended duty periods, disrupted or irregular rest periods, and circadian dysrhythmia typical of military operations today. Warfighter Fatigue Countermeasures research products primarily impact the warfighter through improved procedures, guidelines, and policy changes. These "knowledge products" derive from a thorough scientific assessment of the human system and the particular environment within which the human system must operate and are most frequently delivered through operational consultations. We also have software products in development that provide quick access to our expert knowledge on fatigue and cognitive performance.

TRANSFORMATIONAL TECHNOLOGIES

There are many other Air Force technology areas that deserve special mention. Let me highlight just a few additional examples. The Unmanned Combat Air Vehicle (UCAV), designated the X-45A, is an area that is generating increased excitement and could enhance warfighting capabilities. The Air Force/Defense Advanced Research Projects Agency (DARPA) X-45A joint advanced technology demonstration program has entered its fifth year. Flight vehicle checkout, ground testing, and high-speed taxi tests of the first demonstrator are underway, with projected first flight in the spring of 2002. Test results to date have been very good, and we fully expect continued success. We plan to complete Phase II of the X-45A program by the fall of 2003 and the Air Force is planning for a follow-on acquisition program.

To increase aircraft survivability and operational efficiencies, the Air Force is developing both manned (F-22 and Joint Strike Fighter) and unmanned (UCAV) flight vehicles that can carry and employ weapons from both external and internal weapons bays. To increase the number of weapons the flight vehicle can fit into their internal weapons bays, part of our investment strategy focuses S&T funding on developing and demonstrating smaller precision weapons.

One of the small munitions currently being flight demonstrated is the Low Cost Autonomous Attack System (LOCAAS). The LOCAAS is a 100-pound class powered munition whose primary target set is moving and relocatable targets. It will demonstrate the effectiveness and military utility of this type of munition for the Lethal Suppression of Enemy Air Defenses, Theater Missile Defense Attack Operations, and Armor/Interdiction mission areas. LOCAAS will integrate a ladar precision terminal seeker with autonomous target recognition algorithms, a multi-modal warhead, Global Positioning System/Inertial Navigation System midcourse guidance, and a miniature turbine engine with a fly-out range of 100 miles. This advanced technology demonstration program has five flight tests scheduled in Fiscal Year 2002 and Fiscal Year 2003, culminating in an autonomous flight with active seeker and warhead against a real target in Fiscal Year 2003. The first flight test was recently held and demonstrated the LOCAAS ability to fly a programmed flight path and perform high bank turns, while maintaining aerodynamic stability.

To continue the trend of miniaturization of space platforms, DARPA and the Air Force have provided funding to ten universities to explore the military utility of innovative, low-cost nanosatellites. These nanosatellites, weighing two to ten kilograms, will demonstrate such experiments as formation flying, differential Global Positioning System navigation, miniaturized sensors, and micropropulsion technologies.

The Air Force is also conducting the Experimental Satellite System series to demonstrate increasing levels of microsatellite technology maturity. The XSS-10, the first microsatellite in the series, is scheduled to launch in Fiscal Year 2002. It will demonstrate semi-autonomous operations and visual inspection in close proximity of an object in space -- in this case a Delta II upper stage. In Fiscal Year 2004, we will launch XSS-11, which will demonstrate autonomous

operations and provide experience with command and control in proximity operations to another space object.

Hypersonics is another transformational technology of high interest to Air Force S&T. Our HyTech program achieved major successes in Fiscal Year 2001 with the first ever ground test demonstration of a scramjet producing positive net thrust over the Mach 4.5 to Mach 6.5 flight range. The engine was developed by Pratt & Whitney, in collaboration with Air Force scientists and engineers, and was recently recognized by *Aviation Week and Space Technology* magazine as a 2001 Laureate in Aeronautics/Propulsion.

One of the most transformational and quickly deployable technologies available today is command, control, and communications technology, also known as information technology. This technology is at the heart of our Moving Target Indicator Exploitation program, which is developing web-enabled automated tools to exploit data from current and future sensor systems such as the Joint Surface Target Attack Radar System. The effort is focused on four technology areas: ground moving target tracking; motion pattern analysis; behavioral pattern analysis; and sensor resource allocation and scheduling.

WORKFORCE

The Air Force civilian and military S&T workforce is highly motivated and productive. The Air Force is unique in that 20 percent of its laboratory scientist and engineer (S&E) government workforce is active duty military. This gives us a direct link to the warfighter. Some of these military S&Es come directly from operational commands, while others will serve in operational commands later in their careers.

The Air Force is committed to shaping its S&E workforce with the vision to enhance excellence and relevance of S&T into the 21st Century and appreciates the support Congress has

provided. This challenge requires the Air Force to maintain a dominant edge in technology and also requires us to provide clear direction and growth for our S&E workforce. However, we as do others, find it is difficult to recruit and retain S&Es. The Air Force has several initiatives that address recruitment and retention issues.

The Air Force published a "Concept of Operations for Scientists and Engineers in the United States Air Force" and baselined the requirement for the Air Force S&E workforce. Upon analyzing the baseline requirement, we found our military and civilian authorizations to be about right, but our actual demographics are seriously short in some key areas. We are, therefore, shifting our focus to retaining the workforce we have and infusing it with the vitality of new S&Es to meet tomorrow's need. During the next seven years, we are investing nearly a third of a billion dollars to support the containment and growth of our technological workforce. We are encouraging this growth through critical skills accession bonuses, critical skills retention bonuses, recruiting, and re-recruiting efforts. As we grow our S&E workforce, we are providing career guidance and mentoring that will enable us to meet our 21st Century challenge. Initiatives, such as the special hiring legislation authorized by Congress, which provides "DARPA-like" hiring authority to the military departments, should also provide positive results in shaping our S&E workforce. This authority has only recently been delegated to the Air Force, but we are very optimistic about its potential.

CONCLUSION

The Air Force is in the midst of a technological and organizational transformation that is radically changing air and space contributions to the nature of war. Stealth and precision strike, in particular, have injected leap ahead improvements into combat power unlike any we have known since the introduction of the jet engine. We are also making important strides in

command and control, long-range power projection, and mobility in support of an integrated Expeditionary Aerospace Force.

In conclusion, the Air Force is fully committed to providing this nation with the advanced air and space technologies required to meet America's national security interests around the world and to ensure we remain on the cutting edge of system performance, flexibility, and affordability. The technological advantage we enjoy today is a legacy of decades of investment in S&T. Likewise, our future warfighting capabilities will be substantially determined by today's investment in S&T. As we face the new Millennium, our challenge is to advance technologies for an Expeditionary Aerospace Force as we continue to move aggressively into the realm of space activities. The Air Force is confident that we can lead the discovery, development, and timely transition of affordable, transformational technologies that keep our Air Force the best in the world. As an integral part of the Department of Defense's S&T team, we look forward to working with Congress to ensure a strong Air Force S&T Program tailored to achieve our vision of an integrated air and space force.

Mr. Chairman, thank you again, for the opportunity to present written testimony, and thank you for your continuing support of the Air Force S&T Program.