DEPARTMENT OF THE AIR FORCE

PRESENTATION TO THE HOUSE ARMED SERVICES COMMITTEE

SUBCOMMITTEE ON TERRORISM, UNCONVENTIONAL THREATS AND CAPABILITIES

UNITED STATES HOUSE OF REPRESENTATIVES

SUBJECT: Fiscal Year 2009 Air Force Science and Technology

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March 13, 2007

NOT FOR PUBLICATION UNTIL RELEASED
BY THE ARMED SERVICES COMMITTEE,
UNITED STATES HOUSE OF REPRESENTATIVES

INTRODUCTION

Mr. Chairman, Members of the Subcommittee, and Staff, I am pleased to have the opportunity to provide testimony on the Fiscal Year 2009 Air Force Science and Technology (S&T) Program. Last year, I spoke extensively about adapting Air Force S&T to the new security environment identified in the Quadrennial Defense Review. Recall, I presented our new AF S&T vision – to Anticipate…Find, Fix, Track, Target, Engage, and Assess…Anything, Anytime, Anywhere – as our guide for shifting investment emphasis from traditional conventional threats to address new threats, such as terrorism. I am proud to say that this budget continues to reflect a shift towards this new security environment.

The Air Force Fiscal Year 2009 President's Budget request for S&T is approximately $2.1 billion, which includes $1.9 billion in "core" S&T efforts with the remaining funds supporting devolved programs to include High Energy Laser efforts and the University Research Initiative. These investments sustain a strong and balanced foundation of basic research, applied research, and advanced technology development to provide demonstrated transition options to support future warfighting capabilities. This year's budget request includes an increase of $157 million or 6.7 percent real growth over the Fiscal Year 2008 "core" request. Even taking the $40 million of Manufacturing Technology (ManTech) funding that was moved into S&T out of the equation, this still represents a very healthy 4.5 percent real growth and reflects the continued strong support of Air Force leadership for its S&T Program.

AIR FORCE GUIDING PRINCIPLES FOR S&T

In 2005, I established five guiding principles for the Air Force S&T Investment Program: Value Our People; Balance the Portfolio; Focus Investments; Honor Commitments; and Transition Technology. These principles have provided a valuable framework for oversight of the S&T program and align well with Air Force and Department of Defense strategic priorities.

The following provides some highlights of our recent accomplishments and initiatives for the coming budget year.

VALUE PEOPLE

Developing, recognizing, and ensuring competent technical intellectual capital exists in the laboratory and elsewhere across the Air Force is my number one guiding principle. As Functional Manager for the 15,000 Scientists and Engineers (S&Es) across the Air Force, my commitment to develop and care for the 3,300 S&E Airmen in our laboratory is paramount to maintaining our competitive advantage. This commitment is reflected in our use of the various flexibi1ities afforded the Air Force under the Laboratory Personnel Demonstration program or Lab Demo. Additionally, my S&E development teams are creating new leadership development tools and initiatives to vector laboratory S&Es into appropriate career paths necessary to ensure future Air Force technical leaders for years to come. In fact, I had the great honor of formally recognizing 33 of our top S&Es (22 of which came from the laboratory) at a recent ceremony as true leaders and pioneers of science, technology, and engineering advancements in the Air Force. Critical to building our nation's intellectual capital and supporting the growth of future Air Force technical leaders, we continue to leverage the National Defense Science and Engineering Graduate Scholarship and the National Defense Education Programs. We also leverage the Science Mathematics and Research for Transformation program to educate and recruit undergraduate and graduate students. We have selected 48 individuals for this scholarship program since 2005 – all are still in the program with the exception of five who have graduated and were placed in Air Force positions. Additionally, I recently initiated a study with the National Research Council (NRC) to address our science, technology, engineering and mathematics (STEM) requirements in the Air Force, to ensure we are adequately positioned to

meet the three priorities identified in our Air Force Strategic Plan. We expect this study to finish later this year and, in concert with the NRC, look forward to presenting the results to you.

Finally, we continue to incorporate good ideas from our people into our processes through the Secretary's Air Force Smart Operations for the 21st Century Initiative. This initiative is a relentless pursuit of process excellence and our S&E workforce is heavily involved from the laboratory, to product centers, to test and sustainment centers. Mindful of the future, the Air Force will continue to make our tech workforce a top priority and will strengthen our efforts to recruit and retain the best technical talent the Nation has to offer.

BALANCE THE PORTFOLIO

My second guiding principle is to ensure a balanced portfolio investment between near-, mid-, and far-term needs. The proportion of 6.1 to 6.2 to 6.3 in the S&T portfolio is largely driven by history and has served us well; however, we are currently aligning the portfolio to the Air Force Strategic Plan to assess this balance. At present, to ensure our far-term needs are met, we allocate no less than 15 percent of our core portfolio to our 6.1, basic research efforts to make certain we bring to bear the most innovative thoughts and push technology in areas to which we have not even defined the problem or concept of operation. This research is targeted toward the Air Force's most challenging technical problems through the support of universities, industry, and the Air Force Research Laboratory (AFRL). To meet near-term needs, our goal is to allocate no less than 30 percent of the portfolio to 6.3, advanced technology development efforts to facilitate mature technology transition opportunities for modernization and support to the warfighter in ongoing conflicts. Keeping the right balance is always a challenge, and we continually assess these goals to ensure the right investment is in place to respond quickly to the threats of today and anticipate those of tomorrow.

FOCUS INVESTMENTS

My third guiding principle is to focus our resources on things that matter most – winning the global war on terror, providing modernized capabilities to warfighters, and providing technologies to ensure enduring aerospace power for the Nation. This budget focuses investments to demonstrate and deliver technologies to address all three. We continue to build on our new planning framework called Focused Long-Term Challenges, which is linked through our S&T vision to Air Force strategic priorities.

First, we shifted investments in traditional areas to support the global war on terror, as defined by our Air Force tech vision to anticipate enemy actions, and to tag, track and locate them anywhere on the globe, 24 x 7…a universal situational awareness. Our goal is to develop a layered and flexible sensing architecture that responds to the Commander's intent by anticipating, detecting, continuously tracking, identifying, and precisely locating high value difficult targets. As you may know, we rapidly developed the Angel Fire electro-optical staring array, which deployed with the Marine Corps to theater to support ongoing operations. Angel Fire is an airborne wide-area (city-sized), image gathering, persistent electro-optical sensor array that distributes real-time imagery straight to the warfighter. To improve on Angel Fire capabilities, we increased investment in an all-weather, day-night persistent intelligence, surveillance, and reconnaissance (ISR) technology called the GOTCHA Synthetic Aperture Radar. And, for those times when overhead surveillance is ill-suited or requires augmentation, we also increased investment in bio-taggants. The use of these new bio-taggants could revolutionize our ability to track weapons of mass destruction around the globe. Bio-taggants attach either a passive identifying material (or taggant) to a biological warfare agent that can then be read by line-of-sight spectroscopy, or an active taggant that is activated by radio frequency energy so it can be read through walls.

Next, we shifted investments to increase focus on game changing technologies to guarantee modernized systems have technological superiority on the battlefield, while ensuring preeminent national aerospace power in the areas of cyberspace, defensive counterspace, directed energy, alternative fuels, revolutionary propulsion, and composites. For instance, we have a Cyber Situational Awareness display effort under development that will alert operators to anomalies or intrusions into a network and will anticipate an adversary's next cyber move. The goal is not to wait until after a cyber attack occurs and then analyze what happened, but to examine what is happening in real-time and provide feedback to adaptive defense measures to permit us to "fight through" any attack. The technologies we are developing will provide our new Cyber Command with similar capabilities as those developed for conventional Air Force employment, such as strike or reconnaissance systems.

We continue to conduct research and develop technologies for responsive access and operation in space. Defensive counterspace activities have received increased investment in this year's budget and the Air Force is working to provide technologies to detect, understand, and mitigate the threats in the space environment across the full-range of natural and man-made sources. Such technologies could include real-time proximity sensing, threat warning, nuclear detonation remediation, and survivable space electronics. These technologies enable protection of high value assets from space- and ground-based threats, and create capabilities to retain U.S. freedom of action in space. The ability to detect, track, and identify, as well as provide on-demand, highly detailed characterization of individual space objects and near-real-time, high-fidelity forecasts of space environmental effects are all prevalent space situational awareness concerns. One such nanosatellite project currently underway is investigating methods to provide a responsive space situational awareness capability to characterize objects at geostationary orbits. We are also investigating smaller, plug-and-play types of satellites that offer more responsive construction and launch options, such as conventional air-launched missiles. Our microsatellite

activities have led to new satellite acquisition concepts, leveraging small satellites to deliver essential capability to the warfighter faster. An example of such capabilities is the Tactical Satellite-2 (TacSat-2) that launched on December 16, 2006. TacSat-2 successfully demonstrated rapid space launch procurement and employment, rapid reaction tactical operation, and autonomous mission operations, planning, and data distribution – capabilities that will link the ultimate high-ground closer to the tactical warfighter.

As with space situational awareness, directed energy is seen as a game changer. Our directed energy activities plan to deliver precision effects for the warfighter, and include various technologies, both near- and far-term, that will create new Air Force applications and missions. Increased investment in directed energy technologies include solid state lasers paving the way for high energy lasers in small- to medium-sized platforms for offensive and defensive applications, and high power microwave devices and antennas for non-lethal covert electronic attack. The Air Force is currently developing and demonstrating the enabling component technologies required for an airborne non-lethal directed energy weapon. Efforts will continue to refine existing beam control and antenna concepts to meet airborne requirements. Supporting technologies, such as new materials for power and millimeter wave sources, and multi-megawatt, lightweight power generation for these potential directed energy devices, are also being developed. Development and transition of these innovative directed energy technologies provide our warfighters with the best capabilities to defeat the enemy in this new era of irregular warfare.

Rapid global engagement is critical to delivering precision effects, and the Air Force has increased investment in alternative fuels and revolutionary propulsion technologies in response. The Air Force spends more than $10 million per day on aviation fuel and this is the main reason we are evaluating different fuel sources to reduce the Department of Defense's (DoD's) dependence on foreign oil. We are currently leading the evaluation of alternative fuels and engine technologies that may lead to greater fuel efficiency and significantly reduce our

dependence on oil. The Air Force is qualifying synthetic fuel based on a domestic source to ensure a stable energy supply regardless of political uncertainties in oil-producing countries or supply disruptions. As a result, we continue to certify Fischer-Tropsch (F-T) fuel for military aviation use. The Air Force successfully certified the B-52 to use a blend of JP-5 and a synthetic fuel derived from natural gas using this F-T process. The Air Force is also looking at other ways to increase aircraft fuel efficiency, including advanced computational fluid dynamics tools to improve aircraft design optimization and reduce drag, as well as exploring lighter aircraft structures. In addition, the Highly Efficient Embedded Turbine Engine project is developing fuel efficient engine technologies that support future ISR, tanker, mobility, manned, and unmanned combat air vehicle missions with extreme endurance and range requirements.

Influenced by an NRC aerospace propulsion study, we increased investments in revolutionary propulsion projects promoting engine efficiency and performance such as the Adaptive Versatile Engine Technology (ADVENT) project. ADVENT is a variable-bypass ratio turbofan engine technology concept that allows efficient engine operation at both subsonic and supersonic speeds. It provides supercruise thrust without after-burner, all using a fixed inlet and/or fixed exhaust configuration. Revolutionary propulsion activities also include technologies in hypersonics and long-range strike platforms. Our X-51 Scramjet Engine Demonstration project plans to provide the hypersonic propulsion needed for an affordable, fast reaction, stand off weapon. This technology could allow rapid response to time-sensitive or deeply buried targets at long range, while reducing vulnerability to enemy air defenses.

In response to a Scientific Advisory Board study, we increased investment in critical thermal management technologies. Thermal loads are growing in our increasingly complex weapon systems, while available heat sinks remain the same. Seeing this manifest itself in existing weapon systems, we have increased investments to find technology solutions in high

heat sink fuels, advanced materials, and other heat rejection/reduction/energy extraction systems to avoid this problem in future systems.

All of the military capabilities that might be brought to bear in conflict are of little value if forces cannot gain access to or survive in the battlespace, whether it is air, space, or cyberspace. Operating manned aircraft safely in the same air space with increasing numbers of unmanned aerial vehicles (UAVs) of all sizes has become a greater concern. To address this issue, we are currently developing advanced flight control automation and adaptive algorithms for UAVs, photonic sensing and flight control, and joint air space management and deconfliction software. Breakthroughs in these "sense and avoid" technologies for UAVs have a multiplier effect, in that sense and avoid technologies certified for use by the Federal Aviation Administration in domestic airspace could have positive impacts on the military UAV industrial base leading to increases in innovation and costs through a market that includes both military and commercial customers.

Of course, our strong commitment to composite aircraft structures, materials, and manufacturing techniques continues. We have increased emphasis in composites for the use and sustainment of aircraft, specifically in the area of hybrid composites. Hybrids provide the best of both worlds combining the strength of metals with the lighter weight of composites. We continue to identify and allocate a portion of the portfolio to the development of tools, training, and advanced composites knowledge transfer to enable the government product and logistics center workforce to work with composites in the future. In addition to composites, we feel there are many advances to make in the sustainment area and we are pursuing technologies to embed health monitoring capabilities into our systems to increase readiness, reliability, and maintainability, while reducing costs. We are also developing, characterizing, and demonstrating structural hybrid materials and strategies to protect against enemy radar detection

and enable low-observable, integrated antenna, and lightweight radar applications. These technologies enable protection from threats, while maintaining full mission capability.

Guided by our S&T vision, we have focused our investments to support the Air Force strategic priorities to win the global war on terror, provide modernized capabilities to warfighters, and provide technologies that ensure enduring aerospace power for the Nation.

HONOR COMMITMENTS

Honoring commitments is my fourth guiding principle. We are committed to leveraging and synergizing our S&T investment through Memoranda of Agreements (MOA) and similar commitments with our sister Services and Defense Agency partners, such as an MOA with the Defense Advanced Research Projects Agency for embedded engine health monitoring and prognosis. Our commitment to the Office of the Secretary of Defense's new Reliance 21 process provides an improved avenue for the Services and Defense Agencies to benefit from each other's S&T investments and we welcome this collaboration. This year, under the new Reliance 21 process, we have opened our previously internal Air Force S&T reviews to the entire DoD S&T enterprise and are setting the standard for collaboration across the Department. We are also committed to the new Reliance 21 Technology Focus Team concept. These teams closely examine select technology areas and are charged with identifying S&T gaps or opportunities in delivering technologies to meet DoD capability needs.

We value and protect our commitments to our international allies and the North Atlantic Treaty Organization as well. One example is our collaboration with the Australians on the Hypersonics International Flight Research and Experimentation project in which Flight 1 is scheduled to take place later this year at the Woomera Test Range in Australia.

Industry partnerships for mutual DoD-commercial interests, such as the Versatile, Affordable Advanced Turbine Engine (VAATE) program, provide innovative cost-share

relationships with industry and other agencies, such as the Department of Energy. We have also strengthened our commitment to, and communications with, industry with regards to independent research and development by creating a new Air Force/industry interchange process. We are conducting industry days and technical interchange meetings to align and coordinate our technology development and needs with industry's research and development activities. Whether our commitments are with others in the Air Force, our sister Services and Defense Agencies, the Office of the Secretary of Defense, industry, our allies, or Congress…you have my word that we will deliver on our commitments.

TRANSITION TECHNOLOGY

Last, but not least of my guiding principles is to find new and improved ways of transitioning technologies directly to the warfighter in the field, or into our weapon system acquisitions. I am proud to say that this year; we are establishing a new Technology Transition Office within Headquarters Air Force to spear-head and focus this effort for the Air Force Acquisition Executive. The focus of this office is on developing and implementing policies to overcome transition obstacles and facilitate the transition of technology in support of new concepts, programs of record, and fielded systems. It serves as a central focal point for addressing inquiries and proposals in this important area, creating synergy in technology transition efforts that will more efficiently match solutions to needs, and revitalizing requirements planning and technology maturation. This office is also responsible for investigating activities to reduce risk to acquisition programs through improved requirements evaluation, increased prototyping, and focused technology maturation for timely insertion into programs of record.

The Air Force recently transitioned responsibility for the Joint Capability Technology Demonstrations (JCTD) management into this office, which provides us with huge opportunities

for tech transition synergy. One success story involves transition of weapon technologies into a JCTD project called Focused Lethality Munition (FLM). Conventional bombs pose risks for civilian casualties and infrastructure damage in urban environments. The FLM project provides a highly localized lethal footprint to support military operations in urban terrain. This is truly an example of synergizing S&T and JCTD investments to make a difference.

The Technology Transition Office is also responsible for monitoring the transition of the Laboratory's Advanced Technology Demonstrations (ATDs). And, while the ATD process involves a more evolutionary transition of technologies in conjunction with the budget timelines, we are in the process of codifying a new process for the Air Force to rapidly deliver S&T capability to warfighters within months rather than years. A recent success with this process involves an operational prototype Space Situational Awareness system that was developed and delivered to the Joint Space Operations Center (JSpOC). This system called JSpOC Situation Awareness and Response System utilizes existing space weather data, satellite telemetry, ephemeris data, and engineering information about satellites to provide a rapid visual indication of the space situation and an assessment of abnormal activities or events.

In addition, our efforts in the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) and ManTech programs are further examples of programs where we are seeking to improve technology transition. The Air Force appreciates the opportunity provided by Congressional direction authorizing the SBIR Commercialization Pilot Program and we are well on our way to making this program a huge success. We have developed a more strategic topic generation process aligned with customer technology challenges to increase the likelihood of transitioning SBIR technologies and products. We have collocated SBIR representatives with our customers to assist in this process, thanks to the Commercialization Pilot Program.

Lastly, the strength and effectiveness of Air Force warfighting capability depends on our ability to ensure the industrial base is poised to be responsive to our warfighting needs. We recently addressed an industrial base issue that involves Lithium Ion cells, which are increasingly used as a preferred source for batteries in many U.S. Government defense, intelligence, and civil aerospace applications. Lithium Ion technology is particularly advantageous to space applications, since it offers to reduce battery mass by as much as one-half and volume by two-thirds, when compared to state-of-the-art nickel hydrogen technology. In an effort to address growing concerns over the future supply of Lithium Ion cells in the national technology and industrial base, we are partnering with other government agencies to jointly fund and manage a collaborative effort for the development of a space Lithium Ion battery capability. The goal of the effort will be to establish an assured source for space quality Li-Ion battery cells and associated critical materials for space applications as part of the national technology and industrial base.

Coupling these activities with a focus on more disciplined Systems Engineering in the pre-acquisition planning phases is strengthening the Air Force transition process, resulting in acquisition programs with the latest technology and more mature technical planning.

CONCLUSION

The Air Force S&T Program has a rich legacy of developing technologies that support warfighting capabilities. History clearly demonstrates the broad benefits to the Air Force of our S&T efforts in terms of military power, industrial capability, economic growth, educational richness, cultural wealth, and national prestige. The Air Force continues to maintain a diverse and ambitious S&T portfolio. The Air Force S&T Program researches, develops, and demonstrates technologies that could be used in a number of different warfighter applications. Our technology vision – to Anticipate…Find, Fix, Track, Target, Engage, and

Assess…Anything, Anytime, Anywhere – guides us in our efforts to address the spectrum of threats the 21st Century brings with it.

The Air Force S&T Program is in direct support of the Air Force strategic priorities to win the war on terror, while preparing for the next war; develop and care for Airmen to maintain our competitive advantage; and recapitalize and modernize our aircraft, satellites, and equipment to optimize the military utility of our systems and better meet 21st Century challenges. Our Fiscal Year 2009 budget builds on past S&T successes and a future technical vision with a clear focus on the new security environment. Today's Air Force leaders have shown their commitment in supporting an Air Force S&T Program that has served the Air Force well for over sixty years. This commitment is clearly shown through the Air Force Fiscal Year 2009 President's Budget request of over $2 billion. The Air Force S&T Program is in a time of great change as we reshape our S&E workforce, address the new security environment through a capability-based planning construct, retool our processes under the Secretary's Air Force Smart Operations for the 21st Century Initiative, understand the S&T needed in support of the new Cyber Command, and tackle technology transition and manufacturing issues. Despite the challenges facing us in Air Force S&T, we will continue to focus and protect our S&T investments to advance the state-of-the-art in areas critical to our continued dominance of air, space, and cyberspace.

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