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BY THE ARMED SERVICES COMMITTEE
SUBCOMMITTEE ON EMERGING THREATS AND CAPABILITES
UNITED STATES HOUSE OF REPRESENTATIVES

DEPARTMENT OF THE AIR FORCE

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UNITED STATES HOUSE OF REPRESENTATIVES

SUBJECT: Fiscal Year 2012 Air Force Science and Technology

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INTRODUCTION

Mr. Chairman, Members of the Subcommittee, and Staff, I am pleased to have the opportunity to provide testimony on the Fiscal Year 2012 Air Force Science and Technology (S&T) Program.

The United States continues to face a vast array of diverse and complex security challenges. From the current conflicts in Iraq and Afghanistan to unknown threats of the future, the United States Air Force must balance its investments to be prepared to defeat adversaries and succeed in a wide range of contingencies. Since testifying before this Subcommittee last year, the Air Force has developed and published an S&T Strategy, the first of its kind since 2004, and created a collaborative S&T Planning Process. The S&T Strategy, signed by our Secretary and Chief of Staff, provides a framework for the S&T community to develop a balanced portfolio that ensures we are technologically prepared for an uncertain future while developing the necessary technology for our warfighters operating around the world today. This balance is often referred to as technology push from the laboratory versus technology pull from the warfighter. We sought to strengthen the technology pull piece of our portfolio by creating an S&T planning process that is built on engagements between the Air Force Research Laboratory (AFRL), Product Centers, and warfighters. These engagements are centered on the twelve Air Force Service Core Functions and result in technology solutions to warfighter capability needs that are vetted and approved by an Air Force Headquarters-led S&T governance process.

AIR FORCE S&T FISCAL YEAR 2012 PRESIDENT'S BUDGET REQUEST

The Air Force Fiscal Year 2012 President's Budget request for S&T is approximately $2.3 billion, which includes approximately $200 million in support of devolved programs consisting of High Energy Laser efforts and the University Research Initiative. These investments support a robust 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 $95 million or 2.8 percent real growth from the Fiscal Year 2011 President's Budget request. This increase reflects Air Force leadership's steadfast support for its S&T Program, even in the face of a very challenging fiscal environment.

Within the S&T portfolio, significant adjustments were made to address our warfighters' most pressing needs for technological solutions. These included advanced technology development increases of $38 million in our munitions portfolio, $14 million in the air vehicles portfolio, and $11 million in the directed energy budget. At the same time, we increased the budget for basic research by $18 million to maintain a balance between the known challenges of today and the uncertainty of the future.

AIR FORCE S&T SUPPORTS AIR FORCE STRATEGIC PRIORITIES

The Air Force S&T Program creates compelling air, space, and cyberspace capabilities for precise and reliable Global Vigilance, Reach, and Power for our Nation. It provides the foundation for the majority of the Air Force's following five Strategic Priorities:

- Continue to Strengthen the Nuclear Enterprise
- Partner with the Joint and Coalition Team to Win Today's Fight
- Develop and Care for Airmen and Their Families
- Modernize Our Air, Space, and Cyber Inventories, Organizations, and Training
- Recapture Acquisition Excellence

These strategic priorities, along with input from the Capabilities Review and Risk Assessment, warfighter capability needs, S&T Vision as articulated in *Technology Horizons*, and our S&T Strategy, inform our new S&T planning process to help shape our S&T investments. The S&T planning process was created over the past year with extensive participation from across all levels of the Air Force. This process provides a framework for the Major Commands, Product Centers, and

AFRL to work collaboratively to identify and understand both technology needs and potential solutions. A collaborative Needs and Solutions Process is essential to ensure the laboratory is aware of warfighter capability needs and acquisition technology needs, and that the laboratory's technology solutions meet both these needs. Embedded within the S&T planning process is the Air Force S&T Governance Structure, co-chaired by the AFRL Commander and me as the Deputy Assistant Secretary (Science, Technology and Engineering), with responsibility for prioritizing and commissioning proposed S&T demonstrations for which the Air Force makes a corporate commitment to transition. In addition to commissioning specific S&T demonstrations, the Governance Structure improves the cross-flow of information between warfighters and provides Air Force-level awareness of the S&T portfolio. The results of the S&T Governance Structure culminate with a review and endorsement by the Air Force Requirements Oversight Council (AFROC). Findings of the AFROC are then signed out by the Vice Chief of Staff.

AIR FORCE S&T TENETS

The Air Force S&T Program is directed by senior Air Force leadership and is based on the following enduring tenets, documented in the Air Force S&T Strategy. First, we must prepare for an uncertain future and investigate game-changing technologies to affordably transition the art-of-the-possible into military capabilities. We will create technology options that address urgent warfighter needs and provide new capabilities in support of the Air Force Service Core Functions. In this time of constrained fiscal realities, advanced technologies must be demonstrated that address affordability by promoting efficiencies, enhancing the effectiveness, readiness, and availability of today's systems, and addressing life cycle costs of future systems. In keeping with our Service heritage, we will foster an appreciation for the value of technology as a force-multiplier throughout the Air Force. We will maintain in-house expertise to support the acquisition and operational communities and modernize and improve the sustainability of unique research facilities and

infrastructure. Finally, we will remain vigilant over and leverage global S&T developments and emerging capabilities to avoid technological surprise and exploit art-of-the-possible technologies for our military advantage.

AIR FORCE S&T PROGRAM PRIORITIES

The Air Force S&T Fiscal Year 2012 President's Budget request supports the following overarching priorities that are detailed in the Air Force S&T Strategy. While the S&T Priorities reflect the S&T Tenets, they are not intended to be as enduring because we must have the flexibility to adjust priorities in response to various environmental influences.

Priority 1: Support the Current Fight While Advancing Breakthrough S&T for Tomorrow's Dominant Warfighting Capabilities

We must invest in S&T that will enable the Air Force to operate effectively and achieve desired results in all domains and operations, both today and in the future. The Air Force Rapid Reaction and Innovation Process addresses near-term warfighter needs through the rapid infusion, integration, and innovation of S&T-based solutions that capitalize on the breadth and depth of the S&T Program. This process is designed to tightly integrate S&T knowledge with operator knowledge to deliver solutions to the warfighter in 12 months or less.

In the past year, we've developed several quick reaction solutions to provide near-term support to our warfighters. In response to an Air Force Special Operations Command request to rapidly determine ground bearing strength for landing aircraft in remote sites, we developed a man-portable motorized dynamic cone penetrometer. Air Mobility Command requested weather sensing technology to enable single pass airdrop for C-17 and C-130 aircraft. In response to this request, we developed a pod for a tactical remotely piloted aircraft to pre-deploy a wind measuring dropsonde.

Recently, munitions scientists from AFRL teamed with the Lawrence Livermore National Laboratory to design and test an advanced composite-case warhead to provide a precision lethality

munition with low collateral damage capability. The composite warhead case disintegrates during the explosion and minimizes fragmentation, thus decreasing damage and injury to nearby structures and personnel, including friendly forces and innocent civilians. This effort is a showcase for close cooperation between the munitions research, development, and production communities to rapidly provide a valuable new munition capability for the warfighter.

Basic research in numerous emerging scientific areas may enable dramatic technological advances over current capabilities that will be essential for the future Air Force. We are conducting research in Information Assurance to develop a unified science of security that incorporates the human user, software, hardware, and methods for achieving substantially improved intrusion resistance and intrusion-tolerance in Air Force cyber systems. Research in Network Sciences is analyzing different classes of interacting networks, identifying methods of separation of superimposed networks, identifying the mechanisms of how these networks interact, and characterizing their integrated properties. There is significant research being done to enable Transformational Computing. We are developing autonomous electronic neuromorphic devices and systems, along with enabling science, that scale to biological levels of performance. This research aims to achieve high computational performance, adaptation, flexibility, self-repair, and other forms of intelligent behavior in complex, uncertain, and highly dynamic environments.

In the area of Socio-Cultural Modeling we are developing computational and modeling approaches to study factors and causes of the emergence of terrorist organizations, the recruitment and retention of members of terrorist organizations, terrorist ideologies, and formulate hypotheses about adversaries' intentions.

Research in the area of Physics and Chemistry of Surfaces in Highly Stressed Environments includes the design of techniques and experimental measurement of surface phenomena from the atomic scale up through the macro scale. Additional topics include nanofabrication of complex

surfaces, study of physical and chemical processes by which such surfaces might be modified, and an emphasis on the interaction of electromagnetic radiation with complex surfaces.

Exploiting the revolutionary advances in nonequilibrium chemistry, nanotechnology, high power laser in situ diagnostics, and multi-scale computational tools will transform the field of traditional optical materials and lead to the creation of "extreme" optics – optics for extreme environments.

We are also investing in technologies to improve the agility, mobility, affordability, and survivability of Air Force assets. To support mobility, we are developing technologies and planning tools for synchronized distributed operations in order to increase the quality of air refueling asset solutions, involving both tanker aircraft and aircrews, to satisfy operational air refueling requirements. These efforts are instrumental to enabling the Global Reach that our Joint and coalition partners have come to rely on from the Air Force. To help improve the affordability of Air Force assets, we are developing technologies that will increase efficiency and effectiveness in learning and training through the use of Distributed Mission and Live, Virtual, Constructive training. To support affordability and agility, we are developing supervisory control interface technologies that will enable a single operator to simultaneously and safely control multiple remotely piloted aircraft.

Focused efforts on producibility, aerodynamic and propulsive efficiency, and weight reduction will translate to improved affordability of future systems. Investments in advanced materials, such as radio frequency and electronic materials, optical and infrared materials, high temperature metals and ceramics, and hybrid materials will help reduce life cycle costs, improve performance, affordability, supportability, reliability, and survivability of current and future Air Force systems and operations.

In addition, efforts are underway in our Robust Scramjet program to develop scramjets that process ten times the airflow of our current scramjet technology demonstrator. These engines will support long-range strike and operationally responsive space access, and will enable the Air Force to achieve desired effects in all domains and operations. The high speeds achievable by scramjet engines will greatly increase the survivability of long-range strike weapons or air platforms penetrating anti-access/area denial environments. Further, when combined with conventional rocket- or turbine-based propulsion systems to form combined cycle engines, scramjets will be able to achieve aircraft-like operation for spacelift vehicles enabling more operationally responsive space access than current expendable launch systems. This will allow for the possibility of operating from runways and will significantly increase launch flexibility to achieve desired orbits.

Priority 2: Execute a Balanced, Integrated S&T Program that is Responsive to Air Force Service Core Functions

While it is important to develop and execute an S&T portfolio that balances today's warfighter needs with the uncertainty of tomorrow's security environment, it is equally important to identify those emphasis areas where we would invest our next S&T dollar. Priority 2 from our S&T Strategy provides those emphasis areas.

The reality of today's Air Force is that we're fighting today's wars with many of our grandfathers' aircraft and we will continue to live within this reality for the foreseeable future. Therefore, we must improve the sustainment, affordability, and availability of the legacy weapon systems on which we depend. Within the S&T Program, we have a Program Element for sustainment that is dedicated to developing and demonstrating technologies to address operational sustainment issues in existing systems, as well as supporting new systems. While this effort focuses on a small number of topics, it has already yielded results as demonstrated in the area of vehicle health monitoring, where S&T efforts aided in identification of potential system failures.

Under the Technology for the Sustainment of Strategic Systems effort, we are developing advanced aging and surveillance tools that will enable the user to identify individual rocket motor stages that are not expected to meet their projected life goals. Current tools would result in the replacement of an entire production lot of motors. The new tools will help save billions in motor replacement costs.

Sustainment is the primary cost driver for turbine engine investments within the Department. As these costs continue to rise, it has a direct impact on fleet modernization. Our approach to address this is to focus technologies toward the goal of increasing fighter engine average time on wing by two times and reducing propulsion-related Class A Mishaps by 75 percent. The turbine engine community is proactively working with the Air Force on technologies for improved robustness and increased reliability to support fielded engine issues, as well as potential unforeseen issues with future engines.

Development in advanced materials and processes has significantly reduced low observable aircraft repair times, resulting in reduced aircraft downtime. These advanced materials provide a 30 percent reduction in cure times and can be applied over a larger window of environmental conditions. In addition to supporting legacy aircraft, this technology directly supports the F-22 and F-35 platforms.

While we continue to address issues associated with maintaining our legacy systems, we must also invest considerable resources toward emerging warfighting concepts. Cyberspace superiority enables the precise application of forces in all domains, generates effects across the full spectrum of operations, and preserves an agile and resilient cyberspace infrastructure for assured mission execution. Air Force networks face a continuous barrage of assaults from state-sponsored actors, terror networks, international criminal organizations, individual hackers, and all level of threats in between. Therefore, we must reduce cyber vulnerabilities while emphasizing mission

assurance. We have multiple research efforts addressing this challenge, including cyber situational awareness, host-based defenses, botnet detection and mitigation, and self-healing networks to allow us to fight through cyber attacks. Additionally, our efforts in digital forensics will identify the adversary and source of the attack, enabling active responses as appropriate.

The Air Force has the key responsibility of maintaining the airborne and land-based elements of the nuclear triad. Accordingly, we must support the needs of the nuclear enterprise in the Air Force S&T Program. We have two major S&T objectives in support of the nuclear enterprise – to develop and transition the key S&T required to support current nuclear-capable air and missile systems, command and control, as well as other ground and support systems, and to develop the key S&T to increase the trade space and lower acquisition risks for future development of nuclear-capable systems to replace the present capabilities. S&T investments must address critical aging systems, infrastructure, and future systems holistically. Current technology investments are planned for Advanced Ballistic Missile Guidance Technology, Advanced Rocket Propulsion Technology, Advanced Thermal Protection Materials, and Missile Site Security.

We must invest in technologies to maximize the effective use of both human and machine in warfighting systems through advanced autonomy, human-machine interaction, human performance augmentation, and verification and validation technologies. We have three overall goals for research in these areas. First, we will develop effective, flexible, fault-tolerant, trusted autonomous systems and associated human-machine interaction technologies to increase mission effectiveness of unmanned assets while reducing manning requirements and training times. Second, we must develop advanced software verification and validation technologies to ensure autonomous system technologies can be certified for operation in a timely and efficient manner and to facilitate rapid building of trust in those systems. Finally, we seek to develop human performance augmentation technologies to increase vigilance, optimize situational awareness, enhance individual and group

performance, reduce learning curves, increase mission effectiveness, and provide lethal combat scenario training and combat simulations in safe environments, while saving money, time, and lives.

As the demand for Intelligence, Surveillance, and Reconnaissance (ISR) continues to grow, the Air Force is aggressively evolving our ISR capability to support combat operations and meet mid-term and evolving threats through enhancements of fielded systems and investing in the future. In order to maintain Global Vigilance, we need to develop technologies that will provide robust situational awareness to enhance decision-makers' understanding and knowledge by improving ISR capabilities and data processing, exploitation, and dissemination. To accomplish this, we are conducting research and development programs to provide persistent ISR, including integrated wide area surveillance sensors in the electro-optic, infrared, and radiofrequency domains. We are developing higher-level fusion and the enabling text information and knowledge base technologies to achieve situational awareness and understanding at all command levels for dynamic planning, assessment, and execution processes. We are developing digital information exploitation technologies for electronic communications and special signals intelligence, imagery, and measurement signatures to increase accuracy, correlation, and timeliness of the information. This information will feed the next generation of monitoring, planning, and assessment technologies that will predict the most probable adversarial courses of action and corresponding blue courses of action, enabling aerospace commanders to develop effects-based campaigns.

For the Air Force to continue to provide the critical capability of Global Power, we must sustain our ability to hold virtually any target on the planet at risk. This will require the development of a long-range precision strike capability to create desired effects across the full range of military operations and ensure appropriate redundancies. Our S&T investments are enabling the development of this capability. The X-51A Scramjet Engine Demonstration had a successful first flight on May 26, 2010, demonstrating release, boost, separation, scramjet ignition, and initial

acceleration. Two additional flights in Fiscal Year 2011 and one in Fiscal Year 2012 will expand the flight envelope to Mach 6. In Fiscal Year 2012, we will begin weaponizing the X-51 research vehicle. Development activities will focus on miniaturization of subsystems to allow for a payload and the ability to cold start the weapon after release from an aircraft.

The Air Force views energy efficiency as a mission enabler that can increase combat effectiveness, expand reach, and minimize operational risks. We are integrating energy considerations across the Air Force enterprise by reducing demand, increasing supply, and creating a culture that makes energy a consideration in everything we do. Air Force S&T invests significant resources in a diverse energy technology portfolio. With efforts in improved turbine engine fuel efficiency, alternative fuels, aerodynamic improvements, lightweight materials, and a host of other efforts, Air Force S&T is developing numerous technologies from which future energy-efficient weapon systems will be built.

We are continuing to push the envelope in propulsion technology to increase engine performance while improving fuel efficiency. The Integrated Vehicle Energy Technology (INVENT) program is developing energy-optimized aircraft subsystems and tip-to-tail energy optimization simulation capabilities that will enable enhanced capabilities for future Air Force platforms, including next-generation tactical and ISR platforms.

The Air Force invests heavily in developing new technologies for aircraft turbine engines. In particular, there are three ongoing research efforts developing the next generation of advanced turbine engines. The Adaptive Versatile Engine Technology (ADVENT) program is developing multi-design-point engine technologies that will provide optimized fuel efficiency of up to 25 percent and performance capabilities over a wide range of flight regimes. The follow-on Highly Efficient Embedded Turbine Engine (HEETE) program is developing low-observable-compatible, subsonic propulsion technologies that will provide up to a 35 percent improvement in specific fuel

consumption. The Efficient Small Scale Propulsion (ESSP) program develops advanced small scale propulsion technologies that will provide up to a 30 percent improvement in specific consumption, production cost, and development cost.

Progress in the development of alternative fuel sources for Air Force and other Department of Defense (DoD) platforms will be significantly aided by the recently commissioned Assured Aerospace Fuels Research Facility at Wright-Patterson Air Force Base, Ohio. The ability to develop research quantities of alternative fuels will help enable the development of domestically-produced, environmentally-friendly, cost-effective fuels for future air platforms. Additionally, the Advanced Power Technology Office (APTO) became part of AFRL in October 2010 and is developing advanced alternative energy and fuel technologies to reduce the dependency on foreign energy sources.

Priority 3: Retain and Shape the Critical Competencies Needed to Address the Full Range of S&T Product and Support Capabilities

In order to deliver capabilities from across the breadth of investments I've just discussed, we must have a dedicated, educated, and highly-skilled workforce of Scientists and Engineers (S&E). One avenue we can use to hone these needed skills is to increase the level of in-house basic research to allow our researchers to do hands-on laboratory work. This work will go through a rigorous merit peer review process similar to that for university proposals. We are actively seeking to improve our intramural basic research program. Recent efforts include emphasizing increased participation of early career researchers performing in-house basic research to ensure the development of a skilled S&E workforce. We are growing our National Research Council Resident Research Associates (Post-Doctoral) program and Summer Faculty Fellowship program which bring academic and industry expertise to Air Force research sites.

While all of our S&Es need the opportunity to enhance their critical competencies, we are particularly mindful of the needs of our relatively new organic cyber workforce. Our Fiscal Year 2012 budget request continues to emphasize research, as well as technology development and demonstration, in the cyber domain to allow us to grow our cadre of cyber S&E experts to protect and defend information networks. The Air Force Institute of Technology recently began offering a Cyber Security Boot Camp Course that was originally developed by AFRL at Rome, New York. The course is a summer program for Reserve Officer Training Corps (ROTC) cadets studying computer science, computer engineering, and electrical engineering. The program consists of an instructional component and cyber war games, hands-on internships, and cyber officer development days that focus on the study of cyber as a revolution in military affairs.

Even as we support and develop the S&Es working in our laboratory today, we must also support Air Force Science, Technology, Engineering, and Mathematics (STEM) initiatives to develop and optimally manage the S&E workforce of the future. *Bright Horizons*, an Air Force STEM strategic roadmap for shaping the way the Air Force manages its mission-critical STEM capabilities, is currently in coordination and is expected to be signed this spring. We are establishing an Air Force STEM Office to create policy and processes and to coordinate outreach activities. STEM initiatives will be aligned with the following major goals:

- Develop accurate and timely STEM-related manpower requirements across the Air Force
- Establish adequate and predictable funding levels in terms of funded military billets, civilian pay, and career field management
- Aggressively use force management practices to build and maintain a highly competent, diversified, and agile force at the right grade levels, at the right time, and appropriate locations

- Support and build lasting relationships with the best university undergraduate and graduate students working in fields important to the Air Force – educate students on Air Force S&T needs and Air Force career opportunities
- Aggressively pursue strategic partnerships and outreach activities with our schools, universities, sister Services, professional associations, and other Federal agencies – the Air Force has outreach initiatives that connect with over 30,000 students and 1,000 teachers
- Develop and apply measurements that drive business behaviors across the Air Force to be consistent with the vision and goals of the pending *Bright Horizons*.

Priority 4: Ensure the Air Force S&T Program Addresses the Highest Priority Capability Needs of the Air Force

It is critical to Air Force modernization efforts that the S&T Program be a trusted partner of the acquisition and sustainment community to assess technology maturity and accelerate technology transition. We are working with Air Force warfighters to develop the technologies to address their most pressing needs and we must do everything possible to facilitate transition of this technology. As part of the S&T Planning Process, we created Flagship Capability Concepts – these are Air Force-level integrated Advanced Technology Demonstrations with well-defined scope and specific objectives that are desired by a Major Command and will be matured by AFRL with the intent for transition to the acquisition community to be deployed to an end user. These Flagships are sponsored by the using command and are vetted through the S&T Governance Structure to ensure they align with Air Force strategic priorities. The results of the S&T Governance Structure are briefed to the AFROC and are ultimately endorsed by the Vice Chief of Staff, indicating that these are the highest priority S&T efforts for transition. After approval, Flagships are managed like acquisition programs with regular reviews of cost, schedule, and performance. Additionally, the

Flagships are linked with the Air Force Development Planning process to ensure adequate systems engineering and pre-acquisition planning is accomplished for transition to an acquisition program.

The Vice Chief of Staff recently endorsed the first three Air Force Flagship Capability Concepts. The High Velocity Penetrating Weapon was established to demonstrate critical technologies to reduce the technical risk for a new generation of penetrating weapons to defeat difficult hard targets. These weapons will use a higher velocity impact to increase warhead penetration capability required for emerging high-strength targets in difficult environments. Advanced technologies will enhance weapon kinematics, ensure precision guidance in contested environments, and dramatically reduce the size of the overall weapon. The ultimate goal is to demonstrate 5,000-pound-class weapon penetration capability in a 2,000-pound-class weapon. As a result, future fighter aircraft will be able to deliver bunker-busting capabilities currently associated only with the bomber fleet.

The second Flagship addresses the high cost of space access. The Responsive Reusable Boost for Space Access concept will develop and demonstrate technologies to reduce the cost of space access by 50 percent and also provide Air Force Space Command with the capability for responsive, almost aircraft-like access to space. The technologies include autonomous guidance, navigation, and control enabling unmanned operation; advanced structures and subsystems; and a reusable hydrocarbon-fueled engine technology demonstrator. If successful, this technology concept would compete as a replacement for the current fleet of expendable rockets.

The last Flagship Capability Concept, Selective Cyber Operations Technology Integration, provides cyber technologies capable of affecting multiple nodes for the purposes of achieving a military objective. This will provide a non-kinetic means to deny, degrade, deceive, disrupt, or destroy an adversary's operations.

In order to be successful with our Flagship Capability Concepts or any other efforts in our S&T Program, we must leverage research and development within industry, including small businesses. The Air Force Independent Research and Development (IR&D) program executes a three-step process to transmit Air Force technology needs to industry, gather information on relevant industry IR&D efforts, and align industry and Air Force investment plans to address technology gaps and eliminate redundancies. AFRL and Air Force Product Centers also host a wide variety of forums, such as Industry Days and Dialogue with Industry, to inform industry of plans regarding current and future acquisition programs. The Air Force Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) program executes an annual budget of over $350 million to develop innovative new technologies from small businesses. SBIR also administers a Commercialization Pilot Program that partners promising SBIR companies with prime contractors to assist the transition of SBIR-developed technologies into industry projects supporting Air Force needs. The Air Force Technology Transfer program offers industry partners tailored opportunities for access to advanced technology, the unique chance to work directly with top Air Force S&Es, and the invitation to take advantage of specialized facilities and equipment.

Another area critical to the successful transition of technologies is to develop and demonstrate technology solutions that decrease manufacturing risks. The Air Force Manufacturing Technology (ManTech) program continues to reduce acquisition and sustainment costs, time, and risk while increasing the availability of advanced technologies for the warfighter. In 2010, the ManTech program completed transition of a "Manufacturing Readiness Level" assessment tool that enables acquisition programs to quantitatively assess the manufacturability of new technologies. This tool will reduce the programmatic risk in acquisition, as well as accelerate the transition of breakthrough technology. Capitalizing upon digital information is a key tenet in ManTech's future and will decrease future manufacturing risks. Computational techniques to model and predict the

behavior of manufacturing processes and supply chains will enable tomorrow's systems designers to simulate production strategies for far less time and money than conventional "build and bust" approaches. This Advanced Manufacturing Enterprise ability to "war-game" a manufacturing scenario based upon supply chain disruptions will allow the Air Force to forecast part shortages based upon pending socioeconomic factors and avoid production delays. Direct Digital Manufacturing (DDM) techniques utilize digital computer-aided design data and produce net shape metallic and polymer components using the latest laser and profilometry technologies. Last year, ManTech demonstrated DDM to manufacture a small remotely piloted aircraft. The time from computer-aided design data development to part production and assembly was less than one week as compared to conventional design and manufacturing approaches that took over three months for similar components. The Air Force ManTech program also continues to lead the nation in developing advanced manufacturing technologies for high temperature ceramic composite and super alloy turbine engine components, aircraft structural materials, radars for Actively Scanned Electronic Arrays, precision-guided weapons, satellite communication links, and solar cells. We also develop and transition new technologies to the depot systems as part of the High Velocity Maintenance program.

CONCLUSION

The Air Force S&T Program is balanced to address warfighting needs – both near-term and far-term. Science and knowledge provide the foundation of the S&T Program, laying the cornerstone of the future force. It is here that leading-edge scientific discoveries are transformed into new technologies turning the art-of-the-possible into the state-of-the-art. Through regular interaction with the warfighter, we are better able to understand their capability needs and address these needs by leading and harnessing innovation across Service laboratories, government agencies,

industry, and academia. These efforts mitigate risk and form the basis for new capability concepts – the highest priority of which are designated as Flagship Capability Concepts.

The Air Force investment in S&T ensures the infusion of revolutionary and evolutionary S&T-enabled capabilities that are needed to maintain air, space, and cyberspace dominance across all twelve Air Force Service Core Functions. By embodying the S&T Tenets documented in the recently released Air Force S&T Strategy, focusing on the S&T Priorities, and utilizing the process of turning science into capabilities, the Air Force S&T Program will provide the technological edge needed to win today's fight and prepare for tomorrow's challenges.

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