Statement Testimony

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Mr. Chairman, Ranking Member Smith, members of the committee, I am pleased to be here today on behalf of the dedicated men and women of the Department of Defense who discover, develop, engineer, and field the critical technologies that are the foundation for a secure future. I would like to thank the members of Congress for your continued support of the Department's science and technology (S&T) program and our broader research and engineering (R&E) enterprise[1]. Your steadfast support has allowed the Department to field technologically-based military capabilities that provide the capability edge upon which our Soldiers, Sailors, Airmen, Marines and civilians rely.

I am honored to be joined today by leaders of the Department's Science and Technology (S&T) organizations who will provide testimony in support of their individual programs - Dr. Marilyn Freeman from the Army, Rear Admiral Matthew Klunder from the Navy, Dr. Steven Walker from the Air Force, and Dr. Ken Gabriel from the Defense Advanced Research Projects Agency (DARPA). Their leadership has proven instrumental in ensuring our S&T investments provide compelling technology options and unmatched operational capabilities for the Department.

We testify today in support of the Fiscal Year 2013 President's budget request for DoD S&T; a request that has been thoughtfully prepared within context of challenging national fiscal environment. I can assure this committee we are all mindful of the budget pressures facing our Nation. We have made a collective commitment to ensure that the taxpayers' dollars provided to the Department's S&T enterprise are invested wisely with a laser-like focus on needed capabilities for our national security.

New Strategic Guidance

On January 5, 2012, the President released new strategic guidance for the Department of Defense[2]. The strategy builds upon developing partnerships and global alliances. It rebalances our global posture and presence to emphasize Asia-Pacific and the Middle East. The Guidance sets a new path for the Joint Force of the future[3]- a force will be smaller, leaner, agile, and flexible, and rely upon advanced technical capabilities for mission success. The guidance outlines ten primary missions for a 21st century defense, which the Joint Force must be prepared to execute. The Department's S&T budget request was structured in scope and content to support these missions.

[1] Science and Technology (S&T) is defined as the sum of basic research (6.1), applied research (6.2) and advanced technology development (6.3). Research and Engineering is S&T plus Advanced Component Development and Prototyping (6.4). Both S&T and R&E are activities that occur before initiation of formal acquisition programs.

[2] Sustaining U.S. Global Leadership: Priorities for 21st Century Defense, January 2012 http://www.defense.gov/news/Defense_Strategic_Guidance.pdf

[3] Sustaining U.S. Global Leadership: Priorities for 21st Century Defense, January 2012 - cover letter from Secretary of Defense Leon Panetta, http://www.defense.gov/news/Defense_Strategic_Guidance.pdf

FY 2013 President's Budget Request (PBR)

The FY 2013 Department-wide S&T budget request of $11.9 billion ($62 billion from FY 2013 - FY 2017) maintains a strong S&T posture. The FY 2013 PBR is above the FY 2011 enacted budget of $11.7 billion, and down modestly from the FY 2012 enacted budget of $12.2 billion. The FY 2013 S&T budget request:

- Maintains Basic Research at $2.1 billion - an investment that largely supports university based research;
- Funds the Defense Advanced Research Projects Agency at $2.8 billion to develop strategic concepts for the Department;
- Funds Counter Weapons of Mass Destruction S&T at $1.0 billion; and
- Maintains S&T funding in each of the Military Departments at approximately $2.0 billion.

In preparing the FY2013 S&T Budget for the PBR request, I led a comprehensive review of the Department's Research and Engineering program elements and projects. This review, coupled with the Department's Strategic Guidance, shape the scope and content of the S&T budget request.

The FY 13 PBR S&T investment rebalances and aligns content to support the Department's strategic guidance. For example, $700M was added across the Future Years Defense Program (FYDP) to enhance the Joint Forces' ability to operate across all domains. This funding is targeted to initiate an Air Force hypersonic cruise missile capability demonstration, accelerate the development of advanced electronic warfare (EW) concepts, accelerate technology development for the Long Range Anti-Ship Missile program, and launch technology development efforts in anti-jam precision guided munitions. Additional adjustments were made to increase funding in the Department's S&T priority areas of Cyber S&T, Electronic Warfare, Autonomy (Robotics), and Advanced Manufacturing by realigning funding in lower priority areas. The Department also increased investments in a next generation, high-efficiency turbine engine, the Adaptive Versatile Engine Technology (ADVENT), for an engineering and manufacturing decision in FY 2014.

The table below summarizes the Fiscal Year 2013 budget request.

Program ($Billions)	FY 2011 Enacted	FY 2012 Enacted	FY 2013 Request	FY12 – 13 Change
Basic Research (6.1)	**1.9**	**2.1**	**2.1**	**0.0**
Applied Research (6.2)	**4.4**	**4.7**	**4.5**	**-0.2**
Advanced Technical Development (6.3)	**5.4**	**5.4**	**5.3**	**-0.1**
S&T Total	**11.7**	**12.2**	**11.9**	**-0.3**

Today's testimony by the Department's S&T leadership provides additional detail on key strategic initiatives in the FY 2013 budget request. The testimony will also describe initiatives

underway to accelerate the transition of concepts into technologies that will be part of future acquisition programs.

S&T Priorities

In FY2010, we gathered over 200 scientists, engineers, operators and subject matter experts from across the Department and launched a comprehensive analysis of operational architectures, critical capabilities, and enabling technologies to support the Department's current and future missions. We took a broad look at cross-cutting areas that would have the greatest impact to the Department, even as the Department's New Strategic Guidance was being outlined.

That review resulted in the April 2011 announcement by Secretary Gates that the Department will consider seven science and technology areas as key priority areas. These priority areas are supported in the FY 2013 PBR 2013; these investments provide the technical foundation for important future capability options:

- **Cyber Science and Technology –** The focus of cyber S&T is on the development of technologies that enable system resiliency, agility, and mission effectiveness across the spectrum of joint operations. The research also addresses foundations of trust and development of new frameworks to more thoroughly assess cyber-security techniques.

- **Electronic Warfare / Electronic Protection (EW/EP) –** Pervasive advances in commercial and consumer electronics, challenge conventional U.S. electronic warfare capabilities. Investments in this area focus on new concepts and technology to protect systems and extend capabilities across the electro-magnetic spectrum.

- **Data-to-Decisions –** The Department relies upon the ability to analyze enormous data sets very quickly. Data-to-Decisions investments focus on investments in automated analysis techniques, text analytics, and user interface techniques to reduce the cycle-time and manpower requirements required for analysis of large data sets.

- **Engineered Resilient Systems** – The technically advanced systems our Joint Forces will need in the future must be adaptable to operate in dynamic, and sometimes unpredictable, environments. Research in Engineered Resilient Systems focuses on agile and cost-effective design, development, testing, manufacturing, and fielding of trusted, assured, easily- modified systems.

- **Counter Weapons of Mass Destruction (WMD)** – The Department is focused on crosscutting research in countering weapons of mass destruction, specifically directed at finding and tracking unsecured fissile material. Research focuses on the development of novel detectors and processing algorithms for increased detection capabilities.

- **Autonomy** – The Department's investments in this area are focused on developing systems that can operate in complex real-world environments. Such systems will augment or substitute for human operators, particularly in hazardous environments, and to conduct missions that are impractical or impossible for humans.

- **Human Systems –** This goal of Human Systems is to advance the Department's technology capabilities for development of system interfaces and for training of personnel to increase productivity and effectiveness. Training research focuses on realistic, adaptive, and interactive scenarios, and persistent, affordable integrated training. Personnel training research concentrates on human-machine teaming; intelligent, adaptive human aiding; and intuitive interaction.

The seven DoD S&T priorities represent an integrated effort by the Department to focus technical staff and budgetary resources on a set of primary topics important to the Joint Forces. For each priority S&T development roadmaps are being developed to focus near-term project investment portfolios and experimentation campaigns.

Basic Research

The Department's basic research program paves the way for our technological future – today's scientific discoveries provide the foundation for tomorrow's capabilities. Given the rise in global investments in research and development the U.S. cannot assume assured technological superiority - we must remain on the scientific cutting edge through adequate investment. The FY 2013 PBR of $2.1 billion maintains a strong basic research program. In fact, the PBR represents a 17.8 percent real growth in basic research funds since FY 2009. The President's long standing commitment to a strong DoD basic research program has yielded a number of world-class scientific breakthroughs. Among the remarkable achievements this past year,

- Air Force-sponsored researchers at Harvard University have succeeded in coaxing ultracold atoms trapped in an optical lattice to self-organize into a magnet, using only the minute perturbations resulting from quantum mechanics. The research, published in the journal Nature[4], is the first demonstration of such a "quantum magnet" in an optical lattice, opening new possibilities for quantum engineering of novel materials like high-temperature superconductors.

- In the area of novel engineered materials, Army funded scientists at the University of Maryland and the Joint Quantum Institute, working with scientists at the Army Research Laboratory, discovered and demonstrated methods for creating the first functional atom-based circuit[5]. This achievement is a crucial milestone in atom-based physics, or "atomtronics," that has the potential to go well beyond 20th century electronics, enabling breakthroughs in ultra-accurate gyroscopes and ultra-secure quantum encryption.

- The Navy's synthetic biology program has succeeded in developing multicellular computation using genetically programmed logic gates and chemical 'wiring'[6]. Ultimately it should be possible to encode more complex circuits in individual cells which, once linked by cell–cell communication 'wiring' may resemble logic blocks used in field-programmable gate arrays. This methodology can be used in the engineering of

[4] Nature **462**, 74-77 (5 November 2009) | doi:10.1038/nature08482; Received 20 July 2009; Accepted 3 September 2009 "A quantum gas microscope for detecting single atoms in a Hubbard-regime optical lattice" http://www.nature.com/nature/journal/v462/n7269/abs/nature08482.html

[5] "First functional atomic circuit will enable revolutionary sensors" http://www.arl.army.mil/www/pages/172/docs/ARL_Annual_Review_2011.pdf

[6] *Nature* **469**, 212–215 (13 January 2011) doi:10.1038/nature09565 "Robust multicellular computing using genetically encoded NOR gates and chemical 'wires'" http://www.nature.com/nature/journal/v469/n7329/full/nature09565.html

biological systems to perform increasingly complex functions, e.g., manufacture of fuels, pharmaceuticals, or as sense-and-respond devices.

- The Navy in collaboration with DARPA has co-funded work in Nitrogen-Polar Aluminum Gallium Nitride (AlGaN) High Electron Mobility Transistors (HEMT) which demonstrated for the highest frequency performance on record, at 272 GHz (fT) and 350 GHz (fmax)[7]. The research, conducted at UC Santa Barbara, is significant as this is emerging as the leading technology for solid state millimeter-wave RF amplifiers for Navy sensors, communication systems and electronic warfare.

The Defense Science Board (DSB) recently completed an assessment of the Department's basic research program[8] and found that the current DoD basic research program is very good, comparable to other basic research programs in the government and well-suited to DoD needs. The assessment characterized our basic research program managers as highly qualified, the program reviews plentiful, and coordination among researchers as excellent. The DSB recommendations focus primarily on the development of new business processes to ensure our future research talent pool and methods to meet the challenges of operating in an increasingly globalized research and development environment.

We have used the results of this assessment, the ASD(R&E) comprehensive review and extensive meetings with academia to identify emerging technologies that could form a basis for the next generation of dominant military capabilities in the next decade. Some examples are:

- ***Synthetic Biology*** involves modifying living cells (typically bacteria) to produce novel substances, such as bio-fuels, bio-sensors, improved vaccines, and high strength materials.

- ***Quantum Information Science*** uses quantum mechanics to perform otherwise intractable numerical calculations, provide ultra-secure communications and solution possibilities to certain important problems, and enable an ability to simulate exotic materials.

- ***Cognitive Neuroscience***, the study of how the brain functions, provides a deeper understanding of human learning and decision-making, which can lead to improvements of performance under stress and to cures to the effects of war trauma.

- ***Novel Engineered Materials*** encompasses superconductors, metamaterials, plasmonics, and spintronics, among other materials, that can provide fluid-repellant coatings, yield self-healing composites, improve energy efficiency, improve antennas and detectors, and greatly increase computational capabilities.

- ***Human Behavior Modeling*** of individuals, groups, and nations is intended to enhance strategic and tactical decision making, improve immersive training and mission rehearsal, and facilitate cross-cultural coalition building.

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[7] Device Letters, IEEE, Volume: 32 Issue: 12. "N-Polar GaN/AlN MIS-HEMT With of 204 GHz for Ka-Band Applications", http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=6059473

[8] Report of the Defense Science Board Task Force on Basic Research, January 2012, http://www.acq.osd.mil/dsb/reports/BasicResearch.pdf

- ***Nanoscience***, the study and manipulation of the radically different material properties that emerge at the nano-scale, makes possible new classes of electronics and sensors, chemical catalysts, high strength materials, and energetic materials.

Cyber

The Department has a comprehensive strategy for cyber operations, as conveyed in the recently published *DoD Strategy for Operating in Cyberspace*[9]. The strategy sets a framework for cyber research across a wide range of technical areas that result in system and network resiliency, enables agile operations, and assures effective missions. Examples of research programs to support the strategy includes basic research in the science of cyber security; development of trust services that can assess, compose and deploy cyber elements with known and predictable confidence in their identity, functionality and content; research that provides techniques and capabilities to better integrate cyber operations with traditional kinetic capabilities; and research into cyber range infrastructures that can aid in analyzing the impact of new cyber technology within the context of joint force mission scenarios.

New cyber analytic tools are key to technology development and accelerated transition of successful technology development into acquisition programs. To this end, we've started a Cyber Measurement Campaign to measure progress of new cyber capabilities toward program goals. The campaign will include the development of new experimental architectures to enable evaluation of alternative cyber solution approaches. The framework will be used in our cyber ranges, such as the Joint Information Operations Range, to enable a more data-driven evaluation of S&T investments.

Irregular Warfare (IW)

S&T investments in IW address a broad range of operational challenges in battlespace awareness, communications support, building partnership capacity, mission rehearsal and exercise, pursuit and denial, and knowledge management. While all important areas, our experiences in irregular warfare over the past ten years have taught us the tremendous value of battlespace awareness tools. Warfighters have said they need an integrated set of capabilities to sense, localize, and track perceptions, attitudes, beliefs and behaviors of adversaries engaged in irregular warfare. The capabilities would inform analysts about rapidly emerging situations, such as triggers that indicate an impending irregular warfare action, along with tools to provide relevant courses of action. S&T investments to develop battlespace awareness capabilities are primarily aimed at creating new concepts in the social, computational, and information sciences.

Developing an overall integrated set of capabilities for irregular warfare battlespace awareness require new methods for exploitation of multiple heterogeneous sources of information and new methods to overcome noise, clutter, weak signals, and active denial. More capable tag, track and locate capabilities will also aid in successfully differentiating important signals from background clutter. Additionally, improvements to biometrics and forensics capabilities are also needed. The Department's S&T enterprise has investments in all of the above areas.

As new and novel sensors are developed and deployed as irregular warfare capabilities we can expect a significant increase in the amount of structured and unstructured data collected. This

[9] Department of Defense Strategy for Operating in Cyberspace, July 2011, http://www.defense.gov/news/d20110714cyber.pdf

trend is already evident but the current capabilities to organize and analyze the data are not keeping pace. Commanders at both the strategic and operational levels need new capabilities that rapidly access and organize key information necessary to inform decision making. The data-to-decisions priority area will ensure the Department's investments in this area meet the need.

The Minerva basic research program seeks to develop expertise in the science of human systems and key to future irregular warfare capabilities. The researchers funded by the Minerva program produce insights that lead to a deeper understanding of important social issues affecting global populations. The payoffs from the funded research are improved strategic and operational concepts to thwart terrorism; new concepts to succeed in irregular warfare operations; and new concepts that facilitate the building of new coalitions and strengthening existing coalitions needed to implement the new strategic guidance. As examples, Minerva efforts studied the relationship between violence and the provision of developmental aid in Afghanistan. Minerva program funds will be used to sponsor basic research at universities and faculty chairs at defense education institutions.

Integrated Laboratory Enterprise

The Department operates 67 laboratories across 22 states with a total workforce of 60,000 employees. Over 35,000 of these are degreed scientists and engineers, who conduct DoD-relevant research leading to key technology demonstrations and publish thousands of reports and peer-reviewed technical papers. In many cases, this community defines a technical field with seminal work and leads the industrial base in their respective areas.

The Department also operates 10 Federally Funded Research and Development Centers (FFRDCs), 13 University Affiliated Research Centers (UARCs) and 10 Information Analysis Centers (IACs) across critical disciplines for the Department. These institutions enable the Department to connect with top technical talent across the Nation in fields ranging from cyber security to ballistic missile defense to advanced microelectronics and more. They provide objective systems engineering, objective red team assessments, gold standard test and evaluation, deep dive technical talent and innovative paths for rapid prototyping.

This enterprise is a unique environment for advanced technology development and concept incubation. The Department's laboratories are uniquely suited to couple basic research concepts to early-use military applications. For example, based on work started by the Air Force Research Laboratory, the Air Force Adaptive Versatile Engine Technologies program, "ADVENT," is developing a new jet engine with far greater fuel efficiency, and a much broader range of optimal operating conditions. It is a good example of where a Department laboratory has led the development of new capabilities well beyond the bounds of commercial technology. The ADVENT engine combines the very best performance characteristics of large aircraft engines, like those in tankers and transports, with those of fighters through the use of complex electronic control of air bypass systems and advanced materials to permit higher operating temperatures. Based on successful component tests at the Air Force Research Laboratory, the project is now ready to mature into the Adaptive Engine Technology Development (AETD) project, and the funding request for FY13 will support completion of engine testing to demonstrate the critical technologies leading to preliminary design for full-scale development, including risk reduction of new engine components, integration technologies, engine core maturation, full-scale ground

testing, and analysis of performance. With this phase, the Air Force should be ready for Engineering Manufacturing Development (EMD) within three years.

There are many success stories from each of the labs that the witnesses here today can offer. However, it is important to ensure the Department's laboratories are positioned for success and I will work with each of the Services to determine the resources and processes necessary for their continued success as concept incubators.

Enterprise Initiatives

Across the Department, we continue to improve the S&T enterprise' business process to focus efforts, identify new and emerging research opportunities as well as gaps, and outline investment strategies to accelerate the transition of advanced concepts from research into fielded capabilities.

Over the past year, the Department's S&T Executive Committee comprised of leaders of our S&T organization and leaders from the Joint Staff; OSD Policy, and OSD Manufacturing and Industrial Base have provided key leadership to ensure progress is made within each of the Department's S&T priorities discussed earlier in this testimony. We've established priority steering councils, comprised of S&T experts from across the enterprise, for each of the priority areas. The steering councils develop investment roadmaps, measure progress, and most importantly, coordinate the research investments to ensure maximum efficiency and effectiveness. For Service-specific areas, such as materials or propulsion, we have established communities of interest to coordinate research for maximum effectiveness and efficiency among Department organizations. The priority steering councils and the communities of interest work across the Department and across the Federal research enterprise to calibrate ideas and drive transition of research concepts to industry. These new business processes have empowered the Department's researchers to better communicate the Department's S&T investment strategy to academia and industry leading to much higher quality research proposals.

Technology Transition

We remain committed to technology transition to ensure new technologies have an impact on system procurements when they've reached a sufficient level of maturity. The Department continues to see progress in its technology transition efforts, and the witnesses here today can discuss their individual technology transition processes.

The Department continues to enjoy a strong relationship with industry and academia through a variety of programs designed to foster collaboration, including the Small Business Innovation Research (SBIR) program and Cooperative Research and Development Agreements (CRADA). In fact, in FY 2011, the Department issued approximately 2,000 SBIR Phase 1 awards (as a result of 12,000 proposals), and approximately 900 Phase 2 awards and engaged in approximately 2,500 CRADAs across a broad industrial base. Each of these is an avenue of innovation and a transition path to bring ideas into the Department and transition concepts developed in DoD Laboratories to commercial use.

The Department's Multidisciplinary University Research Initiative (MURI) program has provided additional avenue of technology transition and supports multi-university projects that

bring together prominent scientists focused on pushing the frontiers in emerging areas of science. The MURI program has a demonstrated track record of major accomplishments and has proven to be an excellent source as the seed corn for future capabilities. Over the past year we have invited defense industrial base associations and their member firms to participate in the Department's annual MURI reviews with the goal of cementing partnerships early between the universities' researchers that create the new concepts with the industry developers who have the capacity to mature these concepts into future capabilities for the Department. We are currently engaged in a study to discover new business processes that will accelerate technology developed in our service labs to industry.

Increasing leverage of Industry Independent Research and Development Projects

We have also established new processes to increase the transition of defense industrial base independent research and development (IR&D) investments. Industry's IR&D projects are important source of innovation because they represent an independent and different perspective on the technology solutions needed to solve Department requirements. Importantly, IR&D provides the Department with technology options not available from our labs or contracted research.

Communication is key to maximizing the payoff from IR&D. Industry wants the Department to communicate its capability needs and its plans for future acquisition programs. Government researchers want to know about industry IR&D projects to plan research investments and to plan technology strategies for future acquisition programs. We have taken steps to strengthen this important communication link.

Beginning this year, industry will make available data on their IR&D projects to Government scientists, researchers and acquisition personnel through a new website, the Defense Innovation Marketplace, (www.defenseinnovationmarketplace.mil). The website will also contain current information on Department research priorities and program solicitations - information valuable to industry technology officers as they plan their future IR&D investments. We believe the Marketplace will become a prominent medium connecting industry and government personnel in new and innovative ways leading to more efficient and effective research investments and result in increased transition of innovative technology into future acquisition programs.

Small Business Outreach - Rapid Innovation Program

The Department established a program to implement the FY 2011 National Defense Authorization Act, Section 1073 - the Defense Rapid Innovation Program (RIP). The Department's goals for the RIP is the discovery and transition of innovative technology, primarily from small business, that solve the types of challenges characterized by joint urgent operational needs (JUONs), other critical national security needs, and technology to improve acquisition program success.

Beginning in September 2011, the Services and the Office of Small Business Programs (OSBP) issued broad agency announcements to solicit proposals for RIP funds[10]. The four solicitations

[10] Office of Small Business Programs Solicitation Number HQ0034-11-BAA-RIF-0001
Army Solicitation Number W911NF11R0017
Navy Solicitation Number ONRBAA11-032
Air Force Solicitation Number AFRL-PK-11-0001

addressed a broad range of needs and we received over 3,500 responses, and the majority of the responses were from small businesses. Contract awards are imminent and will continue through the remainder of FY12. The Department is examining options to effectively use the FY 2012 RIP appropriation of $200 million.

Rapid Fielding - Lessons to be retained

Over the past decade, the Department has greatly expanded its ability to rapidly field warfighter capabilities, based on urgent needs, using streamlined response processes. While these efforts have been correctly focused on theater contingency operations, we now seek to institutionalize rapid fielding as a core competency to affect the cost savings and the acquisition effectiveness that are hallmarks of these efforts. Rapid response is also a new necessity, due to the pace of technology globalization and adversaries' demonstrated ability to innovatively employ that technology. The OSD Rapid Fielding Office (RFO) partners with COCOMs and Military Departments to develop innovative concepts and capability prototypes that accelerate the delivery of technical capabilities to support the current war; mitigate cost schedule or technical risk for major acquisition programs; and prepare for an uncertain future and respond to the fast pace of technological change.

The RFO uses the Joint Capability Technology Demonstration (JCTD) program and the Defense Acquisition Challenge (DAC) to develop effective solutions to time-sensitive operational needs, most well inside 24 months. The CLOUDBREAK program is one example of a rapid response JCTD to develop a novel command and control capability for United States Pacific Command. Similarly, the RFO is supporting United States Central Command (CENTCOM) in developing new force protection and battlespace awareness capabilities to counter insurgents. Project examples include hostile fire protection for rotary wing vehicles, and a family of next generation surveillance systems.

Traditional lengthy engineering and risk reduction processes add to cost, and sometimes render systems out-of-date before they are fielded. Our experience with rapid fielding has shown that we can often successfully reduce these timelines using partnership processes without greatly adding to program risk. For example, the "Fire Resistant Ghillie Suit and Accessory Kit" was developed as part of the Defense Acquisition Challenge Program. Started in FY10 and fielded within one year, the project delivered a fire resistant suit with a comprehensive camouflage system, especially designed for military sharp-shooters. The Deer Park JCTD project (also called ADDER) provided an enhanced and crucial ISR capability to the field, deployed in the Lockheed Martin Senior Scout facility aboard a C130 aircraft. It was conceived and delivered in less than a year, and deployed to CENTCOM in January, 2011. The Rapid Reaction Tunnel Detection JCTD, in roughly one year, provided a novel set of tunnel detection capabilities for United States Northern Command and CENTCOM. The technology was provided to CENTCOM as a response to a Joint Urgent Operational Need, and has since been employed along the U.S. southwest border for drug smuggling interdiction.

Going forward, the RFO is investigating investments that would quickly initiate a response to potential force application threats, or tackle a recently identified vulnerability in an adversary's defensive command and control architecture. Rapid fielding has proven to be a valued

contributor in addressing joint, coalition time-sensitive operational needs. It has shown to be able to deliver technologies that can easily adapt to assist in supporting civil agencies here at home or in devising novel concepts to mitigate the risk to an acquisition program, and shorten the delivery time to the end users.

Trusted Systems

The globalization of technology and supply chains increases risk to our systems of maliciously inserted counterfeit parts and other vulnerabilities. The Department has developed processes and capabilities that increase the trust that our systems will perform only as designed and as the operators intend. There is a new acquisition security policy that provides for a coherent strategy for trusted systems to addresses supply chain risks and system design vulnerabilities.

The Department's dependence upon trusted, leading edge microelectronics is a key part of our trust strategy. Microelectronic components typically drive mission critical performance, and are potential targets for fraud and malice. Over the past year the Department has made significant progress in developing a trusted foundry system underpinned by the Defense Microelectronics Activity as a supplier of last resort.

Defense Microelectronics Activity Next Generation Foundry

Most domestic semiconductor foundries will not continue to produce low-volume, high-mix microelectronics since it provides little profit. In fact, industry is rapidly moving away from production of 90nanometer (nm) chips, instead focusing on 45nm and 28 nm chips. For example, Intel Corporation no longer manufactures their 90 nm Pentium microprocessors. Since 90 nm technology is a key size for robust and rugged defense applications the Department must put in place resources to ensure this technology is available in the future. The FY 2013 PBR requests funds for the DMEA to extend its current capability to 90nm. Appropriating the funds now provides sufficient time to buy used equipment at extremely low cost from commercial sources and implement production processes. DMEA will be a provider of last resort operating without commercial conflicts and provide commercial sources the first right of refusal to produce components to meet DoD needs. Without extending the existing foundry at DMEA to 90nm, the DoD could soon be without a trusted and assured source for the repeatable procurement of state-of-the-practice integrated circuits that comprise a vast majority of the U.S. arsenal's microelectronics.

Electronic Warfare Joint Capability Office

For decades the U.S. has enjoyed the strategic advantage of long-range precision sensors and weapons combined with uncontested Electronic Warfare superiority and stealth platforms. Against less technologically advanced adversaries this combination has proven itself unbeatable, yielding a massive overmatch to U.S. lethality and battle space maneuver.

The world in which this advantage was established is changing rapidly. The global pace of technology proliferation coupled with increasingly rapid changes in foreign sensor sophistication, adversary weapon lethality, and expanding weapon engagement ranges are changing the dynamics of warfare.

To meet this challenge, the Department is establishing the Electronic Warfare Joint Capability Office focused on determining the S&T investments that lead to superior means of disrupting

adversary sensors, weapons and control functions by exploring new concepts in electronic attack. This new office will combine the best and brightest among the Service labs, FFRDCs, universities and industry centers across the country to ensure the Joint Forces maintain their technology advantage in electronic warfare.

Science Technology Engineering and Math Initiative

We also ask your support to continue our efforts to ensure a pipeline of personnel with appropriate science, technology, engineering, and mathematics (STEM) qualifications for DoD and the industrial base. We remain concerned with the future availability of high-caliber scientists and engineers. For DoD, we confront an especially challenging environment—a reduced production of graduates in scientific fields that are important to support defense needs, while the existing supply of knowledgeable scientists and engineers declines due to retirements and competing opportunities. Our office is executing a strategy aimed to meet these challenges—The DoD STEM Education and Outreach Strategic Plan.

The strategy is implemented within DoD through a set of programs. One important program is the National Defense Education Program, which includes projects for pre-college, for university students, and for faculty fellowships, specifically fostering interest in defense science. Since its inception, the Science, Mathematics, and Research for Transformation (SMART) program for undergraduate and graduate students, for example, has transitioned more than 430 young scientists and engineers into the DoD, and has involved over 270 institutions of higher learning and research organizations. The National Security Science and Engineering Faculty Fellowship program supports some of the nation's top scientists at prestigious universities around the country, enabling them to focus their research groups on technical areas of critical important to DoD and national security. And the NDEP K-12 program engages DoD scientists and engineers in classrooms around the country to serve as role models, mentors, lecturers, and competition judges. To date, more than 1750 DoD scientists and engineers have been engaged in K-12 activities.

Conclusion

The Joint Forces ability to project power and succeed in operations will be increasingly challenged by new capabilities and tactics. The clear technical advantage our forces enjoyed is not guaranteed – the rise in global research and development investments and the globalization of technology has collapsed the pace of innovation for both the U.S. and our adversaries. Now more than ever the U.S. must maintain its traditional leadership position in research and development. The President's FY 2013 budget request provides the right mix of programs and investments in basic, applied, and advanced research to maintain our leadership position. The S&T enterprise initiatives we are enacting ensure the resources are invested wisely, and with focus, and accelerates the transition of concepts into capabilities. I appreciate Congress' continued support of our S&T efforts and I look forward to answering your questions.