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S. HRG. 109–22, PT. 5

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 2006

HEARINGS

BEFORE THE

COMMITTEE ON ARMED SERVICES
UNITED STATES SENATE

ONE HUNDRED NINTH CONGRESS

FIRST SESSION

ON

S. 1042

TO AUTHORIZE APPROPRIATIONS FOR FISCAL YEAR 2006 FOR MILITARY ACTIVITIES OF THE DEPARTMENT OF DEFENSE, FOR MILITARY CONSTRUCTION, AND FOR DEFENSE ACTIVITIES OF THE DEPARTMENT OF ENERGY, TO PRESCRIBE PERSONNEL STRENGTHS FOR SUCH FISCAL YEAR FOR THE ARMED FORCES, AND FOR OTHER PURPOSES

PART 5
EMERGING THREATS AND CAPABILITIES

MARCH 9; APRIL 11, 22, 2005

Printed for the use of the Committee on Armed Services

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DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 2006

WEDNESDAY, MARCH 9, 2005

U.S. SENATE,
SUBCOMMITTEE ON EMERGING THREATS
AND CAPABILITIES,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

SCIENCE AND TECHNOLOGY BUDGET AND STRATEGY

The subcommittee met, pursuant to notice, at 9:34 a.m., in room SR–325, Russell Senate Office Building, Senator John Cornyn (chairman of the subcommittee) presiding.

Committee members present: Senators Cornyn, Reed, E. Benjamin Nelson, and Clinton.

Committee staff member present: Leah C. Brewer, nominations and hearings clerk.

Majority staff members present: Elaine A. McCusker, professional staff member; Paula J. Philbin, professional staff member; and Lynn F. Rusten, professional staff member.

Minority staff members present: Gabriella Eisen, research assistant; Richard W. Fieldhouse, professional staff member; and Arun A. Seraphin, professional staff member.

Staff assistants present: Andrew W. Florell, Nicholas W. West, and Pendred K. Wilson.

Committee members' assistants present: James B. Kadtke, assistant to Senator Warner; Russell J. Thomasson, assistant to Senator Cornyn; Elizabeth King, assistant to Senator Reed; William K. Sutey and Eric Pierce, assistants to Senator Bill Nelson.

OPENING STATEMENT OF SENATOR JOHN CORNYN, CHAIRMAN

Senator CORNYN. Good morning, and thanks to all of you for joining us today.

This morning the Subcommittee on Emerging Threats and Capabilities meets to receive testimony on the Department of Defense's (DOD) fiscal year 2006 budget request for defense science and technology (S&T) programs. We will also examine the process and guidance used to make decisions on the appropriate level of investment for these programs.

It is critical that our S&T investments produce capabilities which are responsive to current and emerging needs, but they must also

focus on preparing us for the battle environments that we may face in the future.

I would like to thank each of the witnesses and those who have provided the demonstrations in the back of the room for being here today. The displays I think have helped show all of us some of the real-world applications of some of the S&T that we are exploring today and understand how important S&T is in equipping, training, and protecting America's fighting force. It is important to remember that the origins of these successful capabilities were predominantly basic research programs at laboratories and universities around the country.

Our witnesses today are the Department's S&T executives. They will highlight for us their fiscal year 2006 initiatives and explain some of the items on display. They will also describe how they develop their budgets to meet national security missions and corresponding technology strategies.

Decades of investment in basic and applied research have led to a force that is better equipped and better protected. Our military possesses new standoff detection, surveillance, and when needed, lethal capabilities. We have advanced life-saving medical technologies. New command and control systems are coming on line. Achievements in the area of unmanned systems continue to save lives and increase situational awareness. Ongoing work in materials and composites provide enhanced equipment and personnel protection systems.

Another key product of the DOD S&T program that we cannot set on an easel or put in the space of a 6-foot display table is the technical workforce, the creative problem solvers who work in our defense labs and who think up new ideas and how to respond to the needs of those on the front lines.

The committee took steps to enhance training, recruitment, and retention of talented individuals who possess unique national security related technical skills by establishing the Science, Mathematics, and Research for Transformation (SMART), scholarship for service pilot program in the National Defense Authorization Act (NDAA) for Fiscal Year 2005. I look forward to your comments on the status of this effort.

As we listen to the witnesses today and discuss the Department's plans and budget for S&T, we will also explore how to maintain a robust research investment in an atmosphere of competing priorities and immediate operational needs.

I have some questions about the long-term viability of our current investment strategy and some concern about the Department's apparent decision to deviate from previously set funding targets for S&T.

I also have some questions about coordination, transition, and the technical workforce.

I do, however, want to commend all of you on the great work that you are doing. The budget request before us reflects tough decisions made during a challenging time of evolving needs and continuing operational requirements.

We look forward to hearing from each of the witnesses. Please note that your written testimony will be made a part of the record. To allow time for questions and answers, I ask that you summarize

your remarks perhaps in the range of 5 minutes or so, and then we will come back and ask questions. Again, thanks to all of you for being here this morning.

I just want to say from a personal standpoint how glad I am to be working with Senator Reed as the ranking member of this subcommittee. His experience on the subcommittee and on the Armed Services Committee and his service to our Nation in the uniformed services uniquely qualifies him to make a very important contribution to the work of this subcommittee, as he does to the committee as a whole.

We are delighted to have Senator Nelson here with us this morning as well.

With that, I would like to recognize Senator Reed for any comments he would care to make.

STATEMENT OF SENATOR JACK REED

Senator REED. thank you very much, Mr. Chairman. Let me first congratulate you on assuming the chairmanship of this very important subcommittee. I very much look forward to working with you, Mr. Chairman.

I also understand that you are working to develop an energetic oversight agenda for the subcommittee, and I assure you that myself and my staff will work eagerly with you and your staff to get this very challenging agenda accomplished.

Let me thank all the witnesses, as well as everyone who worked on putting together this very impressive display of S&T.

During times of war, clearly our thoughts and efforts are focused on the current threats facing our troops deployed in harm's way. However, in the process of prosecuting operations in Iraq and Afghanistan, we must also think about the future. The Department's S&T program attempts to walk the line between addressing the near-term operational needs and investing in potentially revolutionary future capabilities.

Through this hearing and the technologies we looked at this morning, we are exploring the important role that the Department's S&T program plays in supporting the global war on terrorism and operations in Iraq. The advanced munitions, sensors, and force protection systems displayed here are excellent examples of how we can leverage years of sustained investment in S&T into important new military capabilities for our forces today. The revolutionary advances in engineering, physics, and biology that are also funded by S&T offer the possibility of currently unimaginable capabilities for future forces.

I note with some concern that the President's 2006 budget request cuts S&T by nearly $3 billion as compared to last year's appropriated level. Despite the fact that the overall DOD budget has grown, the S&T request is even below the amount of funding called for in the 2005 budget request.

The request also does not meet the goal of investing 3 percent of the DOD budget in these innovative S&T programs, a goal endorsed by Congress, Secretary Rumsfeld, the Quadrennial Defense Review (QDR), and the Defense Science Board. I hope the witnesses can explain how it was decided to reduce investments in

S&T especially at a time when the benefits of those investments are becoming so easy to see.

The reductions in these programs may severely impact our Nation's universities and hamper their ability to train the science and engineering (S&E) work force of the future. It may also harm our small high-tech businesses who are the real source of many of our most innovative defense technologies. It will certainly enable our global competitors to challenge our leadership in the areas of technology that will save the future battlefield, areas such as biotechnology, nanotechnology, and robotics. At a time when we are worried about new national security threats and global economic challenges, we should not be reducing support for America's innovators.

In order to help us understand these budget decisions and develop the case for increased investment, it is critical to better demonstrate that the S&T program truly addresses the Department's short- and long-term challenges. I hope the witnesses can give us a sense that these S&T programs are not merely reacting to current needs and threats, but have been shaped with the strategic eye to the future so that our forces will maintain their superiority on the battlefields of both today and tomorrow.

Once again, I welcome all of our distinguished witnesses. I look forward to the discussion and thank the chairman for his leadership.

Senator CORNYN. Thank you, Senator Reed. I share some of your concerns. I know in the full committee we have heard from the leadership at the DOD about the budget, and of course, we are all concerned about living within our means, but obviously the most important priority of our Nation is our security. I want to make sure that our budget continues to reflect our security needs, not just the desire to hit a particular bottom line figure. I know the committee, under Chairman Warner's and Ranking Member Levin's leadership, will continue to look at those and examine ways that we can make sure that all of our national security needs are being met.

Senator Nelson, I would be glad to recognize you for an opening statement, if you have one.

Senator BEN NELSON. Thank you, Mr. Chairman. I too thank you for the opportunity to learn more about the experimental and developmental challenges that are being undertaken right now during modern warfare. We appreciate the demonstrations that we have seen. I look forward to more information. Thank you.

Senator CORNYN. Thank you, Senator Nelson.

Our witnesses today are Dr. Ronald Sega, Director of the Defense Research and Engineering (DDR&E). He will be followed by Dr. Thomas Killion, Deputy Assistant Secretary of the Army for Research and Technology and the Army's Chief Scientist. Rear Admiral Jay Cohen is with us, the Chief of Naval Research (CNR). We also have Jim Engle, Deputy Assistant Secretary of the Air Force for Science, Technology, and Engineering, and Dr. Tony Tether, Director of the Defense Advanced Research Projects Agency (DARPA). Gentlemen, thanks to each of you for being here with us.

As I said, your full statements will be made part of the record, and I would like to start with you, Dr. Sega, and we will go down

the line perhaps with about a 5-minute opening statement each. Then we will get into some of the questions.

Dr. Sega.

STATEMENT OF DR. RONALD M. SEGA, DIRECTOR, DEFENSE RESEARCH AND ENGINEERING

Dr. SEGA. Mr. Chairman and distinguished members of the subcommittee, I appreciate the opportunity to discuss the Department's fiscal year 2006 S&T program.

As the DDR&E and serving in the role of the Department's Chief Technology Officer, I would like to highlight a few representative S&T accomplishments within a framework of five established priorities. They include: integrate DOD S&T and focus on transformation; enhance technology transition; expand outreach to the combatant commanders and the Intelligence Community; accelerate support to the global war on terrorism; and fifth, strengthen the national security S&E workforce.

Our fiscal year 2006 DOD S&T budget request is slightly less than we requested last year, but significantly higher than the request of fiscal year 2001. The fiscal year 2006 S&T budget request supports transformation and reflects strategic factors of increased pressures and threats from asymmetric and terrorist activity and increased pace in globalization of technology development.

The Department has increased investments in chem-bio defense S&T by about $200 million; increased funding for sensors, surveillance, radio frequency (RF), and electronic warfare by roughly $100 million; and increased funding for combatting terrorism technology activity, hypersonic propulsion technologies, network-based S&T, and quick reaction special projects.

The first priority: integrate DOD S&T and focus on transformation. Here we have expanded our inputs to our S&T decision-making process to include capturing more information about the global S&T activity. We have enhanced the DOD Defense Technical Information Center's role in electronic data collection and analysis and realigned it under DDR&E.

The Department continues to reshape its strategic planning and investment review process, and we continue to support basic research, ongoing technology initiatives, and near-term technology acceleration.

As a foundation for our S&T capability, the Department's basic research program provides new knowledge and understanding in the areas that underpin national defense.

Basic research performed in universities and Government laboratories also is important because it is an integral part of the education and training of S&Es for the Nation's defense workforce. We are forwarding a legislative proposal in this area to Congress.

We have sustained funding in the three cross-cutting initiatives: the National Aerospace Initiative (NAI), Energy and Power Technologies, and Surveillance and Knowledge Systems.

The NAI is composed of high-speed, hypersonic technologies, space access, and space payloads. NAI was reviewed by the National Research Council last year who found it to be a good program. It supported the direction that we are going in with the NAI. 2004 witnessed two flight tests, National Aeronautics and Space

Administration (NASA)-led/DOD-supported, of an X–43 vehicle at Mach 7 and later at Mach 10.

The second cross-cutting area is Energy and Power Technologies. It is enabling a more electric force. Here we are testing megawatt-sized superconducting motors and generators, developing new hybrid fuel cell and battery systems, and making significant progress in the area of solid state lasers.

The third cross-cutting area is Surveillance and Knowledge Systems. It is the enabling underpinning technology for command, control, communications, computers, intelligence, surveillance, and reconnaissance (C^4ISR). Here is an example of collaboration of the Army and DARPA. You saw that in the back with the command post of the future. It is being used in Iraq today. It also is, in the supplemental, requesting funding for additional command posts of the future.

The second priority area is enhancing technology transition. There are several tools that are available and they are important and we thank you for your support in these areas. One is Advanced Concept Technology Demonstrations (ACTDs). A second is the Technology Transition Initiative. The third is the Defense Acquisition Challenge, and the fourth is the Defense Production Act, title III. You saw an example of the Defense Production Act, title III with the laser eye protection system, and that was in the back as an example. Here, through this title III activity, a domestic manufacturer who had experience in coatings at the laboratory level was able to bring the process to a production state, maximizing coating performance and minimizing the cycle time. They are now capable of producing around 32,000 of these per year.

The third area is expanding the outreach to combatant commands and the Intelligence Community. One example here is a homeland security/homeland defense command and control ACTD. It supports U.S. Northern Command (NORTHCOM), addresses important communications and common operational picture challenges for Federal, State, and local communities. It includes several partnerships across Government, including the Department of Homeland Security.

The fourth area is the acceleration of the support of the global war on terrorism. We are in the third phase of the Combating Terrorism Technology Task Force (CTTTF) activity that was initiated in September 2001. Here we are focusing on force protection and counterinsurgency operations for the global war on terrorism, with a particular focus on Operation Iraqi Freedom (OIF). We have established a research, development, test, and evaluation (RDT&E) site at the Yuma Proving Ground in Yuma, Arizona, and I would encourage Members and congressional staff to visit some of that testing at Yuma.

The fifth area is to strengthen the national security S&E workforce. The future of the U.S. national security S&E workforce is a growing and increasing concern. The declining supply of U.S. citizens awarded degrees in defense-related S&E fields, coupled with recent projections of domestic growth in demand for S&Es by 2010, suggests that the DOD and other Federal agencies with national security functions will face increased competition with domestic

and global commercial interests for top-of-their-class, security clearance-eligible S&Es.

During 2004, the Department was engaged in several activities to help understand and characterize the national security workforce situation both within the Department and outside, to include interagency forums. The National Security R&D Subcommittee, which I co-chair as part of the National Science and Technology Council that addressed this issue, brought together industry, the DOD, the National Defense Industrial Association, and the Aerospace Industry Association. Studies and workshops were conducted, as well as national competitiveness forums such as the National Innovation Initiative.

Last year Congress, as you pointed out, passed the SMART legislation and authorized the Department to carry out a scholarship program with an employment payback component. We appreciate that, and it is ongoing. As we will talk about later, I am sure, it is a very good program. We proposed to expand the SMART pilot and build a permanent program presented in the budget request as SMART-National Defense Education Act (NDEA) Phase 1.

In conclusion, our S&T investment is focused on technology capabilities to enable the warfighters to meet the challenges of today, while preparing them to meet the challenges of the future. We recognize that our future technological advantage depends on the quality of our scientists, mathematicians, and engineers, and we are building our workforce through our proposed NDEA.

In closing, Mr. Chairman, I sincerely thank you and the subcommittee for the opportunity to outline our successes and to review our plans for the future. We appreciate your strong support for our S&T program and look forward to working with you as we transform our plans into actions. Thank you.

[The prepared statement of Dr. Sega follows:]

PREPARED STATEMENT BY DR. RONALD M. SEGA

Mr. Chairman and distinguished members of this subcommittee, I appreciate the opportunity to discuss the Department of Defense's (DOD) fiscal year 2006 science and technology (S&T) program. The Secretary of Defense remains committed to transforming the military with a robust S&T program. Our military capabilities must become more rapidly deployable, easily sustainable, and be able to operate across the full spectrum of operations—from peace to war and transition back to peace again. Our S&T efforts should support transformation by providing the ability to strike with greater speed, agility, lethality, and precision while maintaining increased global knowledge. We remain excited about near-term and long-term transformational capabilities and possibilities that continue to be made possible by Defense S&T.

As the Director of Defense Research and Engineering (DDR&E), serving in the role of the Department's Chief Technology Officer, I want to highlight a few representative accomplishments within the S&T program and our planned efforts for fiscal year 2006 within the framework of my our five established priorities which are:

- Integrate DOD S&T and focus on transformation;
- Enhance technology transition;
- Expand outreach to the combatant commands and the Intelligence Community;
- Accelerate support to the global war on terrorism; and
- Strengthen the national security science and engineering workforce.

These priorities continue to help shape the S&T program. DOD S&T is an enabler for transformational capabilities for our future force and is providing near-term capabilities for the global war on terrorism.

Amid the significant budget pressures from ongoing operations in Iraq and Afghanistan, the Department has maintained its commitment to S&T. Our fiscal year 2006 DOD S&T President's budget request of $10.52 billion is slightly less than $10.55 billion we requested last year. However, the fiscal year 2006 President's budget request is still 28 percent higher than the fiscal year 2001 request of $7.5 billion.

PRESIDENT'S BUDGET REQUEST

[Then year—In millions of dollars]

	Fiscal Year		
	2001	2005	2006
Army	$1,294	$ 1,783	$ 1,735
Navy/Marine Corps	1,463	1,718	1,776
Air Force	1,291	1,919	1,980
Defense-Wide	3,494	5,130	5,031
Total DOD S&T	$7,543	$10,550	$10,522

The fiscal year 2006 S&T budget request supports the transformation and reflects the strategic factors of increased pressures and threats from asymmetric and terrorist activity and increased pace and globalization of technology development. The Department has increased the investment in chemical and biological defense S&T by nearly $200 million in this year's request. We have increased funding for command and control, sensors, surveillance, radio frequency, and electronic warfare systems by nearly $100 million. We have also increased funding for combating terrorism technology activity, which could lead to new capabilities for force protection, improvised explosive device (IED) mitigation, etc. We are increasing our investment in hypersonic and propulsion technologies, network-based S&T, and Quick Reaction Special Projects. Some programs that reflect a decrease in funding from the fiscal year 2005 are Ballistic Missile Defense Advanced Technology Development (generation beyond the emerging generation), traditional Army combat vehicles, and classified programs. Taken as a whole, the DOD S&T program is reshaping to meet the needs of the DOD.

INTEGRATE DOD S&T AND FOCUS ON TRANSFORMATION

We have expanded the inputs to our S&T decisionmaking process to include capturing more information about global S&T activity, increased formal and informal inputs from the combatant commands, more interaction with the interagency processes, and an expanded comprehensive review process with the Services and Defense agencies. These changes help support the Department's strategic planning process and better integrate and align our S&T investments. Mechanisms for assessments of the inputs are being aided by enhancing the Defense Technical Information Center's (DTIC) role in electronic data collection and analysis.

The rate of change and development of S&T on a global basis will continue to increase into the 21st century. Therefore, a key component of our strategy is to gain the best possible insight into technology development throughout the world, and making that information available to all DOD users. The DTIC, which has been realigned under the direction of DDR&E, will be the single repository for global technical information and capabilities with a searchable web portal that will be accessible throughout the DOD.

A key element in achieving an optimal S&T investment strategy, which responds to national security and joint warfighter needs, is a collective understanding of the motivations, requirements, directions, and opportunities of the DOD component S&T organizations that manage S&T resources. Accordingly, we have modified the traditional S&T review process to a "Comprehensive S&T Review" process to better rationalize the program with strategic direction of the Department, and identify additional gaps or emphasis areas. This new 2-year review cycle builds on current processes (e.g. Technology Area Review Assessments, basic research reviews, etc.) and will help guide S&T investment decisions for budget and program planning cycles. While the Department is reshaping its strategic planning and investment review process, we have continued to support basic research, ongoing technology initiatives, and near-term technology acceleration.

As a foundation for our S&T capability, the Department's basic research program provides new knowledge and understanding in areas that underpin national defense. Applying that knowledge and understanding yields advanced technologies

that enable us to increase military system capabilities; makes those systems easier and less expensive to manufacture, operate, and maintain; and improves the way we carry out our missions.

The basic research program is focused on areas with the highest potential for long-term military benefit. Our investment complements other Federal programs and is the major source of funding in selected disciplines critical to defense, such as electrical and mechanical engineering, where DOD provides more than 70 percent of the overall Federal investment in university basic research.

Basic research performed in universities and government laboratories is also important because it is an integral part of the education and training of scientists and engineers for the Nation's defense workforce. We are bringing forward a legislative proposal in this area to expand the technical workforce available to the Department.

We have sustained funding for three cross-cutting initiatives: the National Aerospace Initiative (NAI); Energy and Power Technologies; and Surveillance and Knowledge Systems (SKS). These initiatives address the development of critical DOD transformational technologies and continue to make technical progress.

The NAI is an integrated roadmap for S&T efforts for in high-speed and hypersonic systems, space access systems, and space-based payloads. The National Research Council completed an "Evaluation of National Aerospace Initiative" in 2004 which supported the direction of NAI. Our progress in hypersonics was demonstrated in 2004 when the National Aeronautics and Space Administration (NASA) X–43A, which was supported by DOD, completed two successful flight tests at speeds of Mach 7 and Mach 10. In January 2005, we conducted a successful separation flight test of HyFLY, a high speed system designed to fly above Mach 6. The fiscal year 2006 budget request maintains support of the foundational NAI technologies in the Army, Navy, Air Force, and Defense Advanced Research Projects Agency (DARPA). With the planned funding, three stepping stone projects, HyFLY, Scramjet Engine Demonstrator (SED), and Revolutionary Approach to Time-Critical Long Range Strike (RATTLRS) will have at least one flight each by 2009. A "Space S&T Strategy" was developed in 2004 under sponsorship of DDR&E and the DOD Executive Agent for Space, and was submitted to Congress. There have been several important accomplishments recently in space access propulsion technology under the DOD–NASA–U.S. Industry Integrated High Payoff Rocket Propulsion Technology (IHPRPT) program. The first advanced U.S. liquid rocket engine technology demonstrator since the Space Shuttle Main Engine (SSME), the Integrated Powerhead Demonstrator, has begun full-up engine testing at NASA Stennis Space Center. The successful "hot-fire" ignition in February 2005 is the culmination of 10 years of joint development toward a fully reusable engine. Additionally, the DOD is developing electronic propulsion for satellites, which could provide a significant increase in satellite on-orbit propulsion capability relative to today's systems.

The Energy and Power Technologies initiative continues to advance the goal to transform the electric components of our weapons systems and improve military logistics. The $260 million fiscal year 2006 DOD investment addresses several topics. The demands for primary and auxiliary power, as well as the electric power density for our air, ground, and sea platforms are increasing; which in turn increases the demands for thermal management also addressed in the initiative. We are testing megawatt-size superconducting motors and generators that take a fraction of the space of conventional machines. Rechargeable lithium-ion batteries and state-of-charge battery life indicators for soldier system power are in production. We are developing a new hybrid fuel cell/battery power system for the individual soldier weighing less than half of our current systems.

The SKS initiative comprises a broad set of command, control, communications, computers, intelligence, surveillance, and reconnaissance (C^4ISR) programs intended to give our forces dominant battlespace awareness and understanding. The investment is about $1 billion per year, with 50 percent attributable directly to SKS objectives and the other half leveraged from other development programs that contribute to SKS capability. During the past year we made considerable progress toward the objectives identified in the SKS roadmap with a strong focus on supporting current operations in Iraq and the technical objectives enabling "command and control on the move." During 2004 we successfully prototyped a 20 node mobile, ad hoc network in a realistic C^4ISR demonstration, moving us toward the capability needed for the Department's vision of network-centric operations. Through strong service and DARPA collaboration, we supported operations in Iraq by transitioning acoustic sensing technology from the laboratory to the field to counter the mortar and sniper threats. We also provided forces in Iraq with Command Post of the Future (CPOF) technology allowing commanders to maintain greater command and control in all situations.

The Quick Reaction Special Projects program remains an important tool in addressing the reality of a rapidly changing world. Under the Quick Reaction Fund, projects must be completed in a year. Over the past year, we have developed and proven technologies through the Quick Reaction Fund that range from demonstrating an affordable, more capable seeker to a novel, affordable dry lubricant that can be used on small arms weapons, which will provide improved capability to deployed troops with less logistics and maintenance required.

ENHANCE TECHNOLOGY TRANSITION

We have also enhanced technology transition from ideas to fielded capabilities through continued collaboration with S&T, acquisition, logistics, and user communities. In addition, we have expanded the use of Technology Maturity Assessments to link S&T projects with acquisition programs, ensuring an avenue for transition and support to system development efforts.

The Advanced Concept Technology Demonstration (ACTD) program continues to match innovative joint and coalition technologies with warfighter needs in operational demonstrations. Key aspects of this program are the operational concepts developed and the residual "leave behind" capabilities that are provided, allowing the warfighter to "touch and feel" the technology that is being considered before expensive acquisition decisions are made. A number of products from the ACTD program are being demonstrated and deployed in Iraq, Afghanistan, and other operational theaters. For example, Special Operations Command (SOCOM) was the operational sponsor of the fiscal year 2002 Pathfinder ACTD. This ACTD provides networked communications, real-time urban reconnaissance and targeting for precision weapons within a hostile environment from an unmanned aerial vehicle (UAV). As a result of this successful ACTD, SOCOM has fielded approximately 60 Raven UAVs into combat theaters. The Army has also subsequently deployed several hundred Ravens in response to an "Urgent Needs Statement."

Beginning in fiscal year 2006, we have proposed a Joint Capability Technology Demonstration (JCTD), realigning a portion of the ACTD effort into a new business process that complements the Department's increased focus on meeting the needs of the joint and coalition forces. The JCTD business model would continue to focus on the most critical needs of the combatant commander but move even faster than the current ACTD program with final demonstrations by the end of the third year. JCTDs would provide more of the resources upfront, and would also provide non-S&T resources at the end of a project (Budget Activity 4 and 5) to help address the transition issues. Using this approach, military services' budget processes should be better phased with successfully demonstrated capabilities.

The Technology Transition Initiative (TTI) program and Defense Acquisition Challenge (DAC) program continue to expand transition mechanisms. The TTI program jump-starts funding for critical technologies developed in defense S&T programs. For example, the National Geospatial-Intelligence Agency Semantic Web Network has transitioned to support Marine Expeditionary Forces in Iraq. The system provides a single point of access to multiple data sources, distributed search capability to support operational planning, and is interoperable with other intelligence analysis system tools. The system is being used by approximately 100 intelligence analysts in Iraq, and saves approximately 4–5 hours of manual activity per query.

The DAC program is an "on ramp" for domestic companies to inject new technologies into existing programs of record while supporting the DOD's spiral development strategy. For instance, the DAC program funded a project that replaces traditional fire barrier materials with a flexible aerogel thermal insulating blanket for use on the DD(X) and other platforms. Aerogel has demonstrated many superior characteristics over traditional insulating materials, including lighter weight, better blast, and heat resistance as well as lower costs.

The transition of promising technology also occurs through our domestic production program, the Defense Production Act, Title III. Title III authority was used to establish a production capability for eyewear that provides protection from lasers on the battlefield. A domestic manufacturer had extensive coatings experience in this area but only a laboratory-scale production capability. Under the Title III project, a production process to maximize coating performance and minimize cycle time and cost was funded. The result was an all-new, ISO–9000 certified production facility with a capacity of 32,000 Laser Eye Protection (LEP) spectacle/goggle pairs per year.

Another important tool for technology transition includes Technology Readiness Assessments (TRAs), which serve as a valuable tool metric for assessing the maturity of critical technologies for major acquisition systems. Some of the major TRAs completed during 2004 are the Littoral Combat Ship (LCS); the CVN 21 Next Generation Aircraft Carrier, the Aerial Common Sensor, the Global Command and Con-

trol System-Joint (GCCS–J), and the Distributed Joint Command and Control (DJC2).

We also enhanced transition of technologies initiated through the DOD Combating Terrorism Technology Task Force (CTTTF). For instance, post-September 11, one of the novel technologies identified and supported by the CTTTF, thermobaric explosives, was accelerated, tested, certified, and fielded in 90 days through a collaborative effort that included the Defense Threat Reduction Agency (DTRA), Air Force, Navy, Department of Energy, and industry. Using the fiscal year 2002 Quick Reaction Munitions Funds, the CTTTF built upon this initial investment in thermobaric explosives in response to a requirement from the Marine Corps for an improved Hellfire warhead.

The DTRA worked in coordination with the Army and Navy on the AGM–114N Hellfire development effort. Several candidate thermobaric warhead fills were tested and assessed during final development. The chemical mix selected is substantially more effective in attacks against enclosed structures than the current Hellfire blast and fragment variants. The demonstration program developed weapons in approximately 1 year with an initial delivery of approximately 60 residual assets. Multiple missiles were deployed and successfully employed in the opening of Operation Iraqi Freedom (OIF). Since that time, the Department has invested additional funds in the AGM–114N and will deliver over 100 units to the Marine Corps and SOCOM by June 2005. The AGM–114N is now transitioning to production with a significant increase in production fielded units planned over the next 2 years.

EXPAND OUTREACH TO THE COMBATANT COMMANDS AND THE INTELLIGENCE COMMUNITY

We have expanded outreach to the combatant commands and the Intelligence Community. We work closely with the combatant commands through the Joint Staff Joint Functional Capability Boards to develop the Joint Warfighting S&T Plan (JWSTP), ensuring that our S&T plans support operational requirements and are developed in conjunction with our warfighters.

We continue to interact and collaborate with Federal, State, and local governments in areas that affect both military and civilian mission areas. One important project that the Department has funded with other partners (e.g. Department of Homeland Security) is called the Homeland Security/Homeland Defense Command and Control ACTD. This ACTD links DOD capabilities (e.g. United States Northern Command) with civilian authorities to address important communication and common operational picture challenges for Federal, State, and local communities.

Over the past 2 years, we have conducted net assessments to address global progress in technology areas such as nanotechnology, energetic materials, and directed energy. We will continue to refine the net assessment process and expand it to other technology areas. DDR&E is a formal member of the S&T Intelligence Committee, a National Intelligence Council Working Group, with representation from across the Intelligence Community.

ACCELERATE SUPPORT TO THE GLOBAL WAR ON TERRORISM

The CTTTF continues to coordinate potential solutions to new challenges in the global war on terrorism with the technology communities in the DOD, academia, industry, and other departments of the Federal Government. The CTTTF is currently in its third major phase of operation. The first phase accelerated technologies for homeland defense and the war in Afghanistan, in late 2001. Phase II delivered technology in support of Operation Enduring Freedom and OIF. Technologies were accelerated to field several specialized, unique weapons which focused on specific threats, such as the AGM–114N Thermobaric Hellfire discussed previously and other support to our fighting forces.

The current, third phase of the CTTTF is focusing on technology for force protection and counterinsurgency operations in the global war on terrorism, particularly, OIF. While many specific details on programs are classified, actions are underway to mitigate effects stemming from terrorist use of weapons such as IEDs, mortars, and rocket-propelled grenades. A key focus is on detection and defeat of IEDs; predictive analysis capabilities; ISR and countering the IED kill chain.

The CTTTF has also energized the need to rapidly evaluate technologies within a representative environment. Consequently, the CTTTF established a research, development, test, and evaluation site at the Yuma Proving Grounds in Yuma, Arizona. This site consists of over 10 miles of roads, road interchanges, buildings, and other features found within a representative rural, desert climate. The purpose of the test site is to evaluate new technologies and provide recommendations on the potential of the system or technologies under evaluation. The test site has been a

valuable resource for gathering data and evaluating new prototypes developed by the scientific and engineering community, while enabling the warfighter to assess military utility and maturity.

Promising technologies identified are funded through the Rapid Reaction Fund (RRF) within the Quick Reaction Special Projects Program. The RRF continues to be a vital resource to develop and rapidly transition many new technologies for the global war on terrorism into the hands of warfighters, thereby saving lives. We appreciate your continued support in providing the flexibility to fund emergent technologies for our warfighter.

STRENGTHEN THE NATIONAL SECURITY SCIENCE AND ENGINEERING WORKFORCE

The future of the U.S. national security science and engineering (S&E) workforce is a growing and increasing concern. Since 1999 more than 12 major studies, including a 2002 report from the President's Council of Advisors on Science and Technology, warn of the deteriorating situation within the U.S. S&E workforce. The warnings cite several trends that continue to erode domestic S&E capability to a point where the U.S. may no longer be the primary innovator in several areas crucial to national security. One trend is the declining U.S. citizen S&E workforce. The Partnership for Public Service recently reported that 60 percent of Federal employees are over 45 years old which indicate a significant number of our workforce with valuable skills will soon be eligible for retirement, many of whom benefited from the National Defense Education Act of 1958. The declining supply of U.S. citizens awarded degrees in defense-related S&E fields, coupled with recent projections of domestic growth in demand for S&Es by 2010, suggests that the DOD and other Federal agencies with national security functions will face increased competition with domestic and global commercial interests for top-of-their class, security clearance eligible S&Es. During 2004, the Department was engaged in several activities to help understand and characterize the national security workforce situation both within the Department and outside, to include interagency forums (e.g. National Security Research and Development Subcommittee of the National Science and Technology Council), industry (e.g. National Defense Industrial Association and Aerospace Industry Association studies and workshops), and national "competitiveness" forums (e.g. National Innovation Initiative).

We have enhanced efforts to address this situation and develop an outstanding workforce with 21st century critical defense skills. These new S&Es will be needed to meet tomorrow's S&T challenges. Last year, Congress provided the Science, Mathematics, and Research for Transformation (SMART) legislation that authorized the Department to carry out a scholarship program with an employment payback component. This fall about 25 promising students will enter the 2-year program. To ensure we maintain an effective workforce, we propose to expand the SMART pilot and built a permanent program presented in the budget request as a legislative proposal titled "SMART—National Defense Education Act Phase 1" (or the National Defense Education Program). The proposal would provide additional authorities that would improve our ability to develop, recruit, and retain individuals who will be critical in fulfilling the Department's national security mission. We look forward to your continued support in this critical, foundational area for national security.

CONCLUSION

Our S&T investment is focused on technology capabilities to enable the warfighter to meet the challenges of today, while preparing them to meet the challenges of the future. The budget request continues supports the ongoing transformation of the DOD while simultaneously ensuring we do all we can to provide potential solutions to ongoing, world challenges.

We have successfully transitioned technologies to support the global war on terrorism and we continue to identify opportunities to minimize research and development cycle-time and enhance technology transition. We are expanding our interaction with the combatant commanders and the Intelligence Community; and expanding our global knowledge base to invest in the right priorities and programs. We recognize that our future technological advantage depends on the superior quality of our scientists, mathematicians, and engineers, and thus we are building our workforce through the proposed National Defense Education Act.

In closing, Mr. Chairman, I sincerely thank you and the subcommittee for this opportunity to outline our successes and to review our plans for the future. We appreciate your strong support of our S&T program, and I look forward to working with you as we transform our plans into actions.

Senator CORNYN. Thank you, Dr. Sega.

Dr. Killion, we will be glad to hear from you.

STATEMENT OF DR. THOMAS H. KILLION, DEPUTY ASSISTANT SECRETARY OF THE ARMY FOR RESEARCH AND TECHNOLOGY AND CHIEF SCIENTIST

Dr. KILLION. Mr. Chairman and members of the subcommittee, I would like to thank you for the opportunity to describe the fiscal year 2006 Army S&T program and the significant role that Army S&T has in creating, adapting, and maturing technologies to enhance the current force and enable the future force.

I want to thank the members of this subcommittee for your support of our soldiers who are now at war and for sustaining the investments that will provide tomorrow's soldiers with the dominant capabilities that they will need to defend America's interests and those of our allies throughout the world. Your continued advice and support are vital to our success.

Army S&T is currently supporting our soldiers deployed to fight the global war on terrorism through three mechanisms.

First, our soldiers are benefitting today from technologies that emerged from past investments. Some notable examples include Interceptor Body Armor, cooled and uncooled infrared sensors for soldiers and vehicles for owning the night, and precision weapons that increase probability of kill and reduce collateral damage.

Second, we are exploiting transition opportunities from ongoing S&T efforts in areas such as acoustic and radar sensors for enhanced situational awareness and for force protection.

Finally, we continue to leverage the expertise and experience of our S&E to develop solutions for unforeseen problems and emerging threats. Examples here include armor survivability kits for High Mobility Multipurpose Wheeled Vehicles (HMMWVs) to provide protection against small arms fire and explosive blasts and slat armor for Strykers to counter rocket-propelled grenades (RPGs).

As reflected in these examples, foremost in all of our minds is the need to provide the best available technologies to protect our soldiers.

Beyond those technologies already contributing to the current force, we continue to make significant progress in maturing sensors and kill mechanisms to enable active protection systems. Such systems will significantly increase the survivability of light platforms. We are funding both close-in and stand-off protection systems to defeat chemical energy and kinetic energy munitions. This past year we have successfully demonstrated the ability to defeat RPG's fired from very close ranges. We are sustaining investments in these technologies as well as advanced lightweight armors to provide an integrated survivability suite for the Future Combat Systems (FCS) and other lightweight combat systems, approaching protection levels available today only with heavy armor.

Reflecting our commitment to the future force, our single largest S&T investment remains the pursuit of enabling technologies for the FCS. For 2006, we have over $426 million, or roughly 25 percent of our budget, in technologies planned for spiral insertion into the FCS program. FCS is in the system development and demonstration (SDD) phase and is using a spiral demonstration and

fielding approach that leads to the first full unit of action in 2014. The FCS has been designed so that each part of the system is networked within the whole to achieve an unprecedented synergy. Our technology investments both on our own and in partnership with DARPA address a range of challenges, including networked battle command systems, networked lethality, enhanced survivability, semi-autonomous and autonomous unmanned air and ground systems, and affordable sensors across the spectrum to find, fix, and target the enemy.

Our investments in individual soldier technologies, focused through our Future Force Warrior program, seek to provide dismounted warriors with the connectivity and network lethality that is available today only through platform-based capabilities. In response to congressional direction, we have worked with the program executive officer (PEO) soldier to more tightly couple the Land Warrior and the Future Force Warrior programs and have implemented a business plan that establishes a lead technology integrator common to the S&T efforts and the Land Warrior program. This new business approach will speed transition of technology and promote efficiency in our efforts to field ground soldier system capabilities that include network connectivity for compatibility with future force platforms.

We maintain our commitment to the fundamental research required for new understanding to enable revolutionary advances and paradigm shifts in operational capabilities to enable the Army's transformational goals. Our basic research program invests in world-class expertise in Government, academia, and industry, and in state-of-the-art equipment to explore fundamental phenomena and exploit scientific discovery. These investments are key to the Army's ability to win the race for speed and precision. Today's force has over-matching capabilities enabled by technology developments such as the Global Positioning System (GPS), night vision devices, and precision-guided munitions, and these capabilities can be traced to sustained basic research investments in decades past.

Of course, as has been mentioned here, to maintain technological superiority now and into the future, we need to staff our laboratories and RDT&E centers with top-quality S&Es. We recognize this challenge. The DOD and the Army must compete to obtain its future workforce from a declining national pool of highly-qualified candidates.

We have already taken important steps to attract and retain the best S&E talent available. Our laboratory personnel demonstrations have instituted multiple initiatives to enhance recruiting and reshaping of the workforce, such as recruiting bonuses, pay banding flexibilities, pay-for-performance, incentive awards, and enhanced employee education and development programs. To reverse the trends in smaller numbers of students pursuing science, math, and engineering, we have established an array of outreach programs to attract more students to those disciplines.

We have also provided recommendations based on our experience that are being incorporated into the emerging National Security Personnel System (NSPS).

In closing, the Army must have a diverse S&T portfolio to be responsive to current and future warfighting needs. The S&T commu-

nity seeks technological solutions that can be demonstrated in the near term, explores the feasibility of new concepts for the mid term, and mines the imaginable for an uncertain far-term future. The Army S&T community has committed our intellectual resources, our people, our facilities, and our funding to maintain the momentum of the Army's transformation while the Army is at war.

I thank you for your attention and for your continued support to our Army and our soldiers.

[The prepared statement of Dr. Killion follows:]

PREPARED STATEMENT BY DR. THOMAS H. KILLION

INTRODUCTION

Mr. Chairman and members of the subcommittee, thank you for the opportunity to describe the fiscal year 2006 Army science and technology (S&T) program and the significant role Army S&T has in creating, adapting, and maturing technologies to enhance the current force and enable the future force.

We want to thank the members of this subcommittee for your support of our soldiers who are now at war and for sustaining the investments that will provide tomorrow's soldiers with the dominant capabilities they will need to defend America's interests and those of our allies throughout the world. Your continued advice and support are vital to our success.

S&T CONTRIBUTIONS TO THE GLOBAL WAR ON TERRORISM

Army S&T supports our soldiers deployed to fight the global war on terrorism through three mechanisms. First, we are benefiting today from technologies that emerged from past investments. Second, we are exploiting transition opportunities from ongoing S&T efforts. Third, we are leveraging the expertise of our scientists and engineers to develop solutions for unforeseen problems. The following are examples of the three approaches:

(1) Reaping the return on past investments: Since the mid-1980s, the Natick Soldier Center has pursued advanced fiber technologies, in partnership with industry, to create lighter weight ballistic protection for soldiers. This research produced the technologies to develop the outer tactical vest and components for the protective plate inserts (SAPI plates) that are used by soldiers deployed worldwide today.

(2) Exploiting technologies from current investments: Radio frequency (RF) jamming technology solutions from investments in our electronic warfare technology program have been incorporated into the family of WARLOCK systems being used to defeat radio-controlled improvised explosive devices (IEDs).

(3) Leveraging S&T expertise to solve unforeseen problems: Engineers at the Army Research Laboratory and the Tank-Automotive Research Development Engineering Center have extensive experience in designing armor and appliqués for the Army's combat vehicles. This team rapidly responded to a critical need by designing and demonstrating armor survivability kits for High Mobility Multipurpose Wheeled Vehicles (HMMWVs) to provide protection against small arms fire and explosive blasts. These kits have now been installed on over 12,000 HMMWVs deployed for the global war on terrorism.

Collectively, these efforts are enhancing current force capabilities for fighting the global war on terrorism by applying relevant technologies to satisfy existing and emerging operational needs.

FORCE PROTECTION

Foremost in all of our minds is the need to provide the best available technologies to protect our soldiers. The examples above—Interceptor Body Armor, electronic countermeasures (WARLOCK), and lightweight armor kits for our tactical vehicles—represent a few of the "arrows" in our force protection "quiver." Other examples include:

- Acoustic and radar sensors for detecting and locating the source of rocket, artillery, and mortar fire;
- Infrared technology for counter-sniper operations, providing warning and locations for counter fire; and

- Medical technology to protect soldiers from endemic diseases and provide rapid treatment to save lives, such as the Chitosan Bandage and the one-handed tourniquet.

Beyond those technologies already contributing to the current force, we continue to make significant progress in maturing the sensor and kill mechanism technologies to enable active protection systems (APS). APS will significantly increase the survivability of lightweight platforms. We are funding both close-in and standoff protection systems to defeat chemical energy and kinetic energy munitions. This past year we have successfully demonstrated the ability to defeat rocket-propelled grenades (RPGs) fired from very close ranges. The technologies successfully defeated RPG threats in two different scenarios: defeating a single RPG fired against a moving vehicle and defeating two RPGs fired nearly simultaneously at a stationary vehicle. We are sustaining investments in these technologies as well as advanced lightweight armors to provide an integrated survivability suite for Future Combat Systems (FCS) and other lighter weight combat systems, approaching protection levels available today only with heavy armor.

We continue to pursue multiple technology solutions to identify and defeat IEDs from standoff ranges. Our work is synchronized across the DOD through close coordination with the Joint IED Task Force.

FUTURE COMBAT SYSTEMS

The single largest S&T investment remains the pursuit of enabling technologies for the FCS. For 2006, we have over $426 million or roughly 25 percent of our budget in technologies planned for spiral insertion into the FCS program. FCS is in the system development and demonstration (SDD) phase of acquisition, using a spiral demonstration and fielding approach that leads to the first full unit of action (UA) in 2014. FCS has been designed so that each part of the system is networked within the whole to achieve an unprecedented synergy. The S&T community is maturing technologies for both the initial spirals and the full UA capability.

Key FCS technology investments include:

- Networked battle command systems to enable shared situational awareness and improved decisionmaking;
- Networked lethality through standoff precision missiles and gun launched munitions;
- Enhanced survivability through networked lethality, improved sensors to locate and identify threats, signature management, and active and passive protection systems;
- Semiautonomous and autonomous unmanned air and ground systems; and
- Low-cost, multispectral sensors to find the enemy.

UNMANNED SYSTEMS

The Army S&T program is pursuing unmanned and robotic capabilities that include: unmanned aerial vehicles (UAVs), unmanned ground vehicles, and unattended sensors. These systems' capabilities will be modular in design for spiral technology insertion and rapid adaptation to changes in mission needs. The unmanned systems and technology applications provide capabilities that are not available today, reducing risks to our soldiers while simultaneously reducing logistics demands generated by human needs. Specific capabilities include:

- Persistent surveillance and communications on the move enabled by multi-sensor and communications mission equipment packages for UAVs; and
- Unmanned air and ground systems with lethal capabilities for decisive operations against threats as they are forming.

As an example, the A–160 Hummingbird UAV is being developed to satisfy medium altitude long endurance requirements for communications relay and intelligence, surveillance, and reconnaissance in the UA. The A–160 is the result of a partnership with the Defense Advanced Research Projects Agency (DARPA) and is currently undergoing flight-testing.

SOLDIER SYSTEMS TECHNOLOGY

Our investments in individual soldier technologies seek to provide soldiers with the connectivity and network lethality that is available today only through platform-based capabilities. We are also pursuing technologies to enable a lightweight, low-observable, enhanced armor protection-fighting ensemble. Other key soldier technology investments include lightweight, high-efficiency power sources; embedded

physiological monitoring and limited medical treatments; multi-functional lightweight materials; embedded training; and networked sensors to enable unparalleled situational understanding. The program executive officer (PEO) has restructured soldier systems development under a business plan that establishes a Lead Technology Integrator common to the S&T efforts and the SDD program. This new business approach will speed transition of technology and promote efficiency in our efforts to field Ground Soldier System capabilities that include network connectivity for compatibility with future force platforms.

NETWORK-CENTRIC TECHNOLOGIES

The S&T investments to enable network-centric operations cover the domains of communications, command and control, and sensors. These efforts mature the algorithms, protocols, high data rate processor technologies, and antennas to enable mobile, wireless, tactical networks. The S&T program will develop and demonstrate real-time, continuous situational understanding by integrating data from manned and unmanned air- and ground-based sensors. Technologies include: high performance multispectral sensors (electro-optic, infrared, radio frequency, acoustic, seismic, chemical); fusion algorithms and intelligent agents to integrate data from a wide variety of networked sensors (airborne and ground). Our toughest challenge to enable network-centric operations is to overcome the technical barriers to demonstrate affordable high throughput (greater than 10 megabyts per second) directional antennas. One approach that shows great promise to overcome these barriers uses a distributed multi-element antenna arrays to enable steerable beams.

BASIC RESEARCH PROGRAM

The Army basic research program produces new understanding to enable revolutionary advances and paradigm shifts in operational capabilities to enable the Army's transformation goals. This program invests in world-class expertise (government, academia, and industry) and state-of-the-art equipment to explore fundamental phenomena and exploit scientific discovery. These investments are key to the Army's ability to win the race for speed and precision. Today's force has overmatching capabilities enabled by technology developments such as global positioning systems, night vision devices, and precision-guided munitions. These capabilities can be traced to sustained basic research investments in decades past.

The Army's basic research program has five components: World class university-led single investigator research; focused centers to enable paradigm shifting capabilities such as nanotechnology for the soldier; research centers of excellence that advance solutions to enduring needs in the areas such as micro electronics and materials; industry-led collaborative technology alliances focused on robotics, power and energy, communications and networks, advanced sensors, and decision aids; and Army-unique, in-house research in behavioral science, infectious diseases and combat casualty care, environmental science, and ballistics protection among others.

Some examples of recent progress in Army research are: "liquid armor" to protect soldier's extremities; remote detection of high explosive materials by using new ultra-sensitive polymers; the creation of interactive computer-based avatars for soldier training; biotechnology for improved sensors; flexible displays for soldier applications; ultra-small and inexpensive power supplies using dime-sized microturbines; and the development of hand-sized UAVs with a full suite of sensors for communication and navigation.

SCIENCE AND ENGINEERING (S&E) WORKFORCE

To maintain technological superiority now and into the future, we need to staff the Army Laboratories and Research, Development, and Engineering Centers with top-quality engineers and scientists. We recognize this challenge—the DOD and Army must compete to obtain its future workforce from a declining national pool of highly-qualified candidates. We have already taken important steps to attract and retain the best S&E talent available. Our laboratory personnel demonstrations have instituted multiple initiatives to enhance recruiting and reshaping of the workforce such as recruiting bonuses, pay banding flexibilities, pay-for-performance, incentive awards, and enhanced employee education and development programs. To reverse the trends in smaller numbers of students pursuing S&E, we have established outreach programs to attract more students to math, science, and engineering careers. We have also provided recommendations, based on our experience, for the emerging National Security Personnel System.

TECHNOLOGY TRANSITION

Successful transition of Army S&T products is central to enabling the Army's transformation. We use Technology Readiness Level metrics to assess and communicate the estimated maturity of a technology to our acquisition customers, the program executive officers and program managers, who buy the systems that are provided to our soldiers. The S&T community's outcome-oriented approach to technology development has yielded significant progress over the past few years. Examples of successful S&T efforts that have transitioned to programs of record include:

- FCS to SDD;
- Line-of-Sight Anti-Tank to SDD;
- Objective Crew Served Weapon to SDD;
- Tactical command and control protection algorithms to PM Warfighter Information Network-Tactical (WIN–T); and
- Network Fires (Cooperative program with DARPA) to SDD as Non-Line-of-Sight Launch System.

CONCLUSION

The Army must have a diverse S&T portfolio to be responsive to current and future warfighter needs. The S&T community seeks technological solutions that can be demonstrated in the near-term, explores the feasibility of new concepts for the mid-term, and explores the imaginable for an uncertain far-term future. The Army S&T community has committed our intellectual resources—our people—and our facilities and funding to maintain the momentum of the Army's transformation!

Senator CORNYN. Thank you, Dr. Killion.

Admiral Cohen, we would be glad to hear from you.

STATEMENT OF RADM JAY M. COHEN, USN, CHIEF OF NAVAL RESEARCH

Admiral COHEN. Good morning, Mr. Chairman, Senator Reed, Senator Nelson. First let me say that I am personally honored and humbled to appear before you, along with my colleagues. I would like to thank you on behalf of our marines and sailors in combat for your support in saving their lives and limbs.

I am currently in the fifth year of a nominal 3-year assignment. Eighteen months ago, the Secretary of the Navy, Gordon England, asked me as the CNR to help equip and protect our naval forces who were to conduct difficult combat operations on the ground both in Afghanistan and Iraq. On December 12, 2003, we conducted what has become known as the "county fair" at the Naval Research Laboratory right here in Washington, DC. We had multi-service, multi-agency, industry, and academic representation, demonstrating those technologies which we felt could be brought to bear to allow our marines and sailors to accomplish their mission and to better defend them.

Subsequently, with the strong support of the Secretary of the Navy in what he called Operation Respond, the Chief of Naval Operations (CNO), Admiral Vern Clark, and the Commandant of the Marine Corps, General Mike Hagee, along with the administration and Congress, many of those capabilities have been funded and deployed to Iraq and are in use today.

Building on that, last summer Secretary England challenged me to initiate a "Manhattan Project," as he likes to call it, to detect, defeat, and destroy explosives at range and speed. Gentlemen, this is a basic research challenge which I believe, as do others, will take a few years, nay, many years to solve, but we must get started. With your support, the S&E expertise in America and around the world, we will demonstrate the ability to detect, defeat, and destroy

improvised explosive devices (IEDs) and suicide bombers, and we will deter their misguided actions. This basic research effort goes to the heart of why Congress established the Naval Research Laboratory following World War I and the Office of Naval Research after World War II.

I look forward to your questions. Thank you.

[The prepared statement of Admiral Cohen follows:]

PREPARED STATEMENT BY RADM JAY M. COHEN, USN

Mr. Chairman, distinguished members of the subcommittee, thank you for this opportunity to appear before you to discuss the Department of the Navy's science and technology (S&T) in support of the global war on terrorism, transformation, and beyond.

OVERVIEW

The fiscal year 2006 budget requests $1.78 billion for a S&T portfolio designed to provide the best scientific research and technology in the shortest time to maximize the benefit to our sailors and marines.

We pursue an integrated and comprehensive S&T program, from basic research through manufacturing technology. Programs emphasize integrating basic research with applied S&T, promoting the effective and expeditious transition of discovery and invention into real-world applications. Moreover, "transition" has become of utmost importance, as the success of S&T is not measured simply by the basic science it supports, but also by the active and successful transition of that science to supporting America's sailors and marines in the field: discovery and invention as well as exploitation and deployment of advanced technologies for the Nation's naval warfighters.

NAVAL SCIENCE AND TECHNOLOGY FOR THE GLOBAL WAR ON TERRORISM

> The Government should maintain a great research laboratory to develop guns, new explosives, and all the technique of military and naval progression without any vast expense.
>
> Thomas Edison

You will remember that I came before this subcommittee a few years ago and brought a prototype for demonstration of the Dragon Eye, a small unmanned aerial vehicle (UAV), for small unit tactical reconnaissance. The Dragon Eye is small, light, easy to transport, and easy to fly. This UAV has transitioned into the Marine Corps Force and accompanied the First Marine Expeditionary Force (I MEF) in deployment to Iraq last year. I have pictures of your marines using the Dragon Eye UAV in the battle of Fallujah.

In response to the decision to deploy I MEF to Operation Iraqi Freedom (OIF) II, Secretary of the Navy Gordon England established Operation Respond. It provided a forum and process to articulate urgent operational needs to the senior leadership. It facilitated the procurement of existing systems and rapid insertion of technologies to support our marines and sailors in combat.

Rapid Response to Emergent Operational Medical Problems

The Office of Naval Research (ONR) is taking part in a series of medical initiatives to support both OIF and Operation Enduring Freedom (OEF). One such initiative is a USB Memory device, called the "thumb" drive, for storing medical records. An important problem faced by medical teams in OIF and OEF is the transportation of patients to higher levels of care without their medical records. This means the receiving caregivers are unaware of previous treatment, which results in delays or sub-optimal care. Attaching a "thumb" drive containing patient records to soldiers' dog tags would minimize this problem. Over 1,000 USB "thumb" drives have been provided to I MEF to be evaluated in theater.

A second serious problem in OIF and OEF is that hypothermia resulting from blood loss causes metabolic acidosis and impairs coagulation in the wounded. Currently, casualties are transported in poncho liners or body bags, neither of which provides heat. In a second OIF/OEF medical initiative, ONR has acquired newly Food and Drug Administration (FDA) approved blankets which use chemical heating packs to prevent hypothermia. Currently, about 100 blankets are being sent to I MEF for field evaluation.

Effectiveness and capability of current medical gear is a third area in which ONR is pursuing medical initiatives. The Naval Combat Trauma Registry has been imple-

mented to capture injury data (type, cause, severity, anatomical location, frequency, DNBI, etc.). Data is obtained at Level II medical treatment facilities and above and will indicate medical capability gaps and effectiveness of current gear (e.g., eye protection).

A fourth problematic area of OIF/OEF is the recertification of reservist and corpsmen/medics. The current tempo of operations requires the deployment of these forces, who may or may not be fully up to speed on combat medical procedures. The Tactical Combat Casualty Care (TC3) Training Compact Disk (CD) has been developed to help solve this problem. The TC3 CD provides scenario-based medical training to improve first-responder care and encompasses Care Under Fire, Tactical Field Care, and Casualty Evacuation Care.

Current body armor is designed to protect the torso, leaving the arms and legs exposed to serious injury from a blast. In order to reduce injuries to arms and legs caused by improvised explosive devices (IEDs), another medical initiative is working to develop arm and leg protection equipment. Review of medical data for injury trend evaluation has been done and injury sites for which protection can be provided have been determined. Ballistic testing of proposed material systems has been completed and initial arm and leg protection designs have been completed and given to warfighters. Warfighter feedback has been incorporated and used to modify the original and second phases of the designs. Phase three of the design is currently undergoing evaluation to ensure the appropriate design, as well as lay-up of materials, to ensure warfighter wearability, mobility, and protection.

Counter-IED Efforts

Under the leadership of the Secretary of the Navy, we have focused our efforts on countering IEDs, rocket propelled grenades (RPGs), and mortars. I believe a key S&T goal in resolving the IED threat is to understand the basic phenomenologies involved in the ability to detect, defeat, and destroy IEDs at range and speed. Long-term basic and applied research must be conducted to address the foundations of current and future IED problems. We must exploit our sensor, chemistry, physics, material, and electronic warfare expertise by taking a systems approach to attacking each step in the engagement sequence. When we are successful, this ability could effectively deter this line of attack.

The first step in achieving these goals is the detection of IEDs at standoff distance. This ability must be able to cover a wide range of threats, from generic to specific. It must also be adaptable to developing and changing threats. This requires significant S&T investment, and although there is no clear "Silver Bullet," testing is underway to identify promising technologies. The second phase of this process is the defeat of these explosives at standoff distances. Ongoing testing and experimentation is being conducted to determine the possibilities for future methods to defeat of such threats. The third and final phase is IED destruction at a standoff distance. Some current detonation and deflagration solutions require knowledge and location of IED threats in order to have the greatest destructive impact. These solutions have an adequate impact on the main charge of the IED, but only limited capabilities in the destruction of other components.

Taking into consideration Secretary England's guidance and the progress made thus far, we must continue this effort throughout the naval research enterprise, especially the Naval Research Lab and the University Affiliated Research Enterprise along with the other services, defense agencies, and national science and research academies and foundations. Though a strong cornerstone currently exists, based on the previously outlined solutions, the focus must be shifted and an investment must be made on both the detection of IED threats and advanced long range destruction technologies. Concentration on detection, defeat, and destruction of IED threats, while maintaining the ability to adapt our technologies to developing and changing threats, will allow us to actively and aggressively pursue these initiatives.

Additionally, last April, a special Small Business Innovation Research (SBIR) effort was pushed forward to address three critical areas: technologies to defeat IEDs, anti-RPG technologies, and anti-rocket, anti-artillery, and anti-mortar technologies. We received 259 proposals and a total of 29 SBIR efforts were selected for Phase I funding. At this time we are evaluating promising Phase I efforts in order to select the Phase II recipients. Next year we will be evaluating the Phase II results.

Those are some of our highlights within this S&T budget request for the global war on terrorism. Naval S&T is a sustained journey from discovery to deployment in which innovation and invention leads to experimentation and validation and transform the operating forces. This is a continuous cycle.

I would like to discuss our transformation efforts for the "Next Navy and Marine Corps"—roughly the forces that will emerge over the next 5 to 15 years, and finally the "Navy and Marine Corps After Next"—which we will see in 15 to 30 years.

TRANSFORMATION: FUTURE NAVAL CAPABILITIES

A great deal of our transformational effort is lodged in Future Naval Capabilities (FNCs). The objective of the FNCs is to provide enabling capabilities to fill identified gaps in Naval Power 21 warfighting and enterprise capabilities identified by the requirements analysis staff of the Chief of Naval Operations and the Commandant of the Marine Corps.

We have focused a major portion of our S&T portfolio on FNCs for the "Next Navy and Marine Corps." Approximately two-thirds of our Advanced Technology Development (6.3) funds and about 40 percent of our late stage Exploratory Development (6.2) funds are invested in the FNCs. The FNC process delivers maturing technology to acquisition program managers for timely incorporation into platforms, weapons, sensors, and process improvements. Each of the current FNC focus areas is planned and reviewed by an integrated team with representation from the ONR, a program executive office, the Navy and Marine Corps requirements community, and the fleet/force user community. This gives us constant validation of the relevance of the technologies, and strong buy-in and commitment to transition plans.

Based on the reviews of the FNC Technical Oversight Group we have recently strengthened the alignment of the FNC process with the naval capabilities development process, which establishes our program requirements and priorities in Sea Strike, Sea Shield, Sea Basing, and FORCEnet.

The FNCs, in no priority order, are:

- Advanced Capability Electric Systems—The future of naval warfare is electric. Warships will have revolutionary power plants that permit new hull forms and propulsors, reduce manning, streamline logistics, power advanced sensors, and enable future high energy and speed-of-light weapons. This FNC crosses several of the pillars, including, Sea Strike, Sea Shield, and Sea Basing.
- Autonomous Operations—This program is pursuing a dramatic increase in the performance and affordability of naval air, surface, ground, and underwater autonomous vehicles—unmanned systems able to operate with a minimum of human intervention and oversight. The Autonomous Operations FNC gives us a great potential to operate effectively in what would otherwise be denied areas. It is now aligned to the ForceNet pillar.
- Fleet/Force Protection—We have very capable ships, aircraft, and ground combat vehicles. It's our business to ensure that they don't fall to the sorts of asymmetric threats our enemies pose. This FNC, aligned with Sea Shield, is working to develop effective organic means of protection: weapons, sensors, countermeasures, stealth, and damage control.
- Knowledge Superiority and Assurance—Information technology is as crucial to naval superiority as it is to any other aspect of contemporary life. This program is developing our ability to distribute integrated information in a dynamic network with high connectivity and interoperability. It will ensure knowledge superiority, common situational understanding, and increased speed of command. This FNC is a key enabler of FORCEnet.
- Littoral Antisubmarine Warfare (ASW)—This program is part of our shift in emphasis to littoral, expeditionary operations. The ASW challenge in coastal waters is a tough one, so we are focusing scientific efforts on enhancing our ability to detect, track, classify, and engage enemy submarines by using a layered tactical ASW approach. We do this by first countering enemy submarines near shore, followed by addressing threat submarines prior to their torpedo launch, and then countering any threat torpedoes after launch. Each layer by itself will effectively address its individual objective; and when the layers are viewed in their entirety, it offers an effective "system-of-systems" approach that we believe will adequately address the ASW problem. Sea Shield is benefiting from the enabling capabilities of this FNC.
- Littoral Combat and Power Projection—The enabling capabilities in this FNC are aligned to Sea Strike. This FNC focuses on deploying uniquely capable combat and logistics systems necessary to deploy and sustain the fleet and the force without building up a large logistical infrastructure ashore.
- Missile Defense—This program is focused on technology enabling and supporting lethal engagements of theater missiles, manned and unmanned aircraft at extended ranges in defense of naval forces and assets afloat and ashore. Products being worked will offer ways to expand the battlespace rapidly, identify contacts accurately, and engage threats effectively and efficiently. The Missile Defense FNC is a aligned to the Sea Shield pillar of the Navy's Sea Power 21 operational concept.

• Organic Mine Countermeasures—Because they are cheap, and able to seed the battle space with a menace far out of proportion to their numbers, mines have been and will continue to be deployed against us by terrorists and their state sponsors. We're working to give our forces an organic—that is to say, an inherent—and stand-off ability to detect, characterize, and neutralize mines wherever they may be encountered. Aligned with Sea Shield, this FNC has transitioned several important products. One of them, the REMUS autonomous underwater vehicle, is now in the hands of our operating forces in Iraq where it helped clear the rivers to speed supplies to troops. REMUS emerged from a basic oceanographic research program—another piece of evidence that overnight successes are long in preparation.

• Time Critical Strike—We are substantially reducing the amount of time it takes to hit critical mobile targets, like theater ballistic missiles launchers, command centers, and weapons of mass destruction. One of this FNC's products, the Affordable Weapon System, a loitering cruise-missile-like system that can carry a variety of payloads, transitioned to the acquisition community for development. Time Critical Strike is aligned with Sea Strike.

• Total Ownership Cost—This FNC uses advanced design and manufacturing processes to significantly decrease the cost of buying, operating, and maintaining Navy systems while promoting increased system readiness. We are working to reduce total lifecycle costs during design and manufacturing as well as increase savings realized from reduced manning and better environmental compliance. This FNC supports efforts across all the Sea Pillars.

The relatively mature technologies managed in FNCs do not spring up overnight. In many cases they are the result of long-term investments in research and invention programs in basic research and early applied research funding categories. We focus our research and invention investments on areas where the Navy is the only significant U.S. sponsor, such as Ocean Acoustics and Underwater Weaponry, and on S&T Grand Challenges whose solution would provide significant advances in naval capability, such as Naval Materials by Design. A stable, long-term discovery and invention investment is essential to keep our pipeline full of enabling technologies and to attract the Nation's best scientific talent to focus on naval problems.

TRANSFORMATION INITIATIVES

In addition to the FNCs, there are several ongoing S&T initiatives that may provide game-changing capabilities. They include the hypersonics flight demonstration program (HyFly), superconducting electric drive motors, the Virtual At-Sea Training (VAST), and the Advance Multi-Function Radio Frequency Concept (AMRF–C).

The HyFly, a National Aerospace Initiative, will seek to demonstrate a hypersonic vehicle with a sustainable cruise speed of Mach 6 and a range of 600 nautical miles. To obtain this performance, work is focusing on the Dual-Combustion Ramjet (DCR) concept invented by the Johns Hopkins University Applied Physics Laboratory. Unlike the pure supersonic combustion ramjet—or "scramjet"—which requires highly reactive fuels unacceptable in the naval environment, the DCR relies on conventional liquid hydrocarbon fuels.

The Secretary of the Navy and the Chief of Naval Operations are committed to making the electric ship our ship of the future and we are providing the S&T. A key requirement for installing electric propulsion in a destroyer-sized combatant is a high-power electric motor. Although conventional induction motors can be scaled up to that power level, and there is similar promise in permanent-magnet synchronous motors, the phenomenon of superconductivity offers significant potential for smaller size, higher power density, and quieter running. At very low temperatures, approaching absolute zero, superconducting materials lose virtually all resistance to the flow of electric current, which means that extremely large currents can be carried in smaller wires without excessive heat dissipation. These large currents also generate much more powerful magnetic fields—and hence more electromotive force—in motor windings much smaller than their conventional counterparts. Thus, for the same power output, a superconducting motor can be as much as 70 percent smaller than its conventional equivalent, even including the cooling system needed to maintain sufficiently low temperatures.

The VAST system was first demonstrated in fleet exercises in November 2002 and will be incorporated into the Battle Force Tactical Training program. VAST superimposes a three-dimensional, virtual-reality battlespace on an area of the open ocean and enables ships' crews to conduct live-fire gunnery exercises against simulated land targets at sea. A sonobuoy field planted in the target area locates the fall of each round within the simulated battlespace, and its effect appears on a com-

puter-generated display that shows how a real-world view of the area would appear to a forward observer. Simultaneously, other computer screens show the corresponding radar or visual pictures for fire-control plotters, gunners, and navigators. In the sense that its simulated battlespace can be modeled on actual targets of interest anywhere in the world, VAST provides even more realistic training than a fixed gunnery range ashore. Soon, these same virtual-reality techniques will be extended to support at-sea training for close air support, long-range strike missions by naval aircraft, and undersea warfare.

The growing number of shipboard radio frequency (RF) functions that require topside antennas and apertures creates a serious challenge for the Navy, particularly when own-ship radar signatures must be so carefully controlled. The AMRF–C is focused on a proof-of-principle demonstration of broadband RF apertures capable of performing radar, electronic warfare, and communication functions simultaneously using common, low signature phased arrays. AMRF–C will divide the frequency band into an optimal number of bandwidth segments and use separate, electronically scanned, solid-state transmit and receive apertures in each portion. AMRF–C's initial demonstration will concentrate on the upper band and simultaneously accommodate low-probability-of-intercept navigation radar, satellite and data link communications, and electronic warfare functions, including electronic attack. An AMRF–C test bed that incorporates a prototype control and signal-processing architecture is already in operation, and promising transition opportunities have been identified.

TRANSFORMATION—INNOVATIVE NAVAL PROTOTYPES

The fiscal year 2006 budget requests funding to develop several Innovative Naval Prototypes (INPs). These initiatives include:

- An electromagnetic railgun prototype gun capable of launching precision-guided, hypersonic projectiles at supersonic speeds against targets with flight times measured in seconds and minutes, not hours;
- New concepts for persistent, netted, littoral ASW. Can we integrate multiple unmanned underwater vehicles and other sensors, an associated underwater support infrastructure, into a comprehensive distributed surveillance system that would consist of a substantial number of independent, but mutually communicating, vehicles equipped with tactical or oceanographic sensors for continually searching a shared ocean volume? Cooperating units could dump collected data, replenish power sources, and update mission assignments. Virtually all of the sensor, propulsion, and docking technology needed to implement such a scheme is already in hand, but challenges remain in devising a reliable methodology for "autonomous collaboration" among the participants;
- Technologies to enable Sea Basing—for example, ONR's longstanding investment in naval architecture and marine engineering has supplied the technology—advanced hull types, composite materials, and new propulsion systems—that will enable the design and construction of 50-knot "connector " ships able to deliver 5,000-ton payloads from sea bases to objective areas some 3,000 miles away. Increasing containerization of military cargo and supplies requires corresponding new efficiencies in stowage and handling procedures as well as the ability to transfer containers among ships and to offload them onto lighters—at sea—in conditions up to Sea State 4;
- The tactical utilization of space. In direct response to a Defense Department transformational initiative to facilitate more timely exploitation of space by combatant commanders, NRL will soon launch the first in a series of experimental tactical micro-satellites denoted TACSAT–1. TACSAT–1's concept of operations includes responsive, on-demand space lift, near-real-time tasking by theater commanders, and dissemination of sensor data by means of SIPRNet protocols. TACSAT–1 will be launched into low-Earth orbit. The initial sensor package will include both a thermal imager and a visible light camera with modest, but tactically useful resolution. On orbit, TACSAT–1 will be available to regional combatant commanders for operational experiments intended both to evaluate this initial micro-satellite system and to provide real-world experience with the concept.

I am excited about the INPs. These are the capabilities that promise to fundamentally change how we prepare for and fight wars. A more tangible example of this is the Sea Fighter FSF–1, also known as X-Craft, that we launched in February of this year. The Sea Fighter is a high speed aluminum catamaran that will test a variety of technologies that will allow us to improve our capabilities in littoral, or near-shore, waters. The Sea Fighter FSF–1 will be used to evaluate the hydrodynamic performance, structural behavior, mission flexibility, and propulsion system

efficiency of high speed vessels. The Sea Fighter will be the first Navy purpose built ship to demonstrate mission flexibility. Mission flexibility will be demonstrated through interchangeable "mission modules" housed in the Sea Fighter's large Mission Bay in standard 20-foot container boxes. The Mission Bay will be capable of housing 12 containers, permitting the vessel to be quickly reconfigured to support a variety of potential missions, including battle force protection, mine countermeasures, amphibious assault support, and humanitarian support. A multi-purpose stern ramp will allow Sea Fighter to launch and recover manned and unmanned surface and sub-surface vehicles up to the size of an 11 meter Rigid-Hull Inflatable Boat. From its flight deck, Sea Fighter FSF–1 will be able to support 24-hour-a-day operations for up to two MH–60S helicopters. When turned over to the fleet in May 2005, Sea Fighter, manned by a joint Navy-Coast Guard crew of two dozen will serve as a risk reduction "surrogate" for Littoral Combat Ship (LCS) concept of operations and technical capabilities development.

AND BEYOND—THE NAVY AND MARINE CORPS AFTER NEXT

At the basic research end of the spectrum, ONR-funded investigations are administered in accordance with scientific and technical disciplines—ocean sciences, materials, electronics, mathematics, physics, chemistry, medicine, and others—and their focus is on discovering and understanding new phenomena that hold promise for future application in the Navy/Marine Corps-after-next. Our research investment priorities focus on areas that are uniquely naval and maritime and usually of interest primarily to the sea services and areas where we leverage applicable naval disciplines in conjunction with the rest of America's basic research establishment.

We integrate the Naval Research Laboratory and ONR programs to maintain a strong corporate lab at the Naval Research Laboratory. Thanks to Thomas Edison's vision the Naval Research Laboratory has a long history at the forefront of basic research, including radar, nuclear propulsion, advances in timekeeping for the Global Positioning System, development of satellites, electronic warfare, and today's global war on terrorism "tools" to name a few.

A portion of our applied research (6.2) investment plans are targeted to the harvest of successful basic research concepts and knowledge for use in the FNCs, the INPs, experimentation, and other transitions. We are working to reduce the transition time of the fruits of the discovery and invention to less than 10 years. We also work closely with the other Services through the DOD Reliance process to help rationalize the DOD-wide S&T portfolio.

National Naval Responsibilities shape these basic and early-applied research portfolios, and ONR has earmarked a significant portion of its resources to sustain a critical mass of research and development efforts in these areas. These scientific and engineering disciplines—ocean acoustics, underwater weapons, and naval engineering—are critical for naval missions but are of limited interest to commercial industry and thus unlikely to attract significant private-sector investment. It is vital to keep such fields healthy, not only for the sake of our own capabilities, but to avoid technological surprise as well.

The naval S&T Grand Challenges are large, difficult, challenges that, if met, could give us decisive capabilities 15 to 30 years in the future. We encourage the Nation's scientific community to achieve breakthroughs in difficult but achievable scientific challenges like Naval Battlespace Awareness, Advanced Electrical Power Sources for the Navy and Marine Corps, Naval Materials by Design, and Multifunctional Electronics for Intelligent Naval Sensors.

In conclusion, the Nation's return on investment is clear. Success in the global war on terrorism, naval transformation, and Navy and Marine Corps-after-next, depends on a balanced, long-term, stable, and sustained investment in S&T, validated through a cycle of ongoing experimentation so we can transition new capability to the warfighter.

Thank you for the opportunity to testify.

Senator CORNYN. Thank you, Admiral.

Mr. Engle, we would be glad to hear you next.

STATEMENT OF JAMES B. ENGLE, DEPUTY ASSISTANT SECRETARY OF THE AIR FORCE FOR SCIENCE, TECHNOLOGY AND ENGINEERING

Mr. ENGLE. Mr. Chairman, members of the subcommittee and staff, I also very much appreciate the opportunity to provide testimony on the fiscal year 2006 Air Force S&T program.

The United States Air Force continues to transform to a capabilities-focused expeditionary air and space force based on the concepts of operations (CONOPs) for each of the seven major tasks that the Air Force must be capable of accomplishing to support our combatant commanders. The Air Force is focused on delivering the ability to effectively and affordably train, organize, and equip our military forces. The Air Force Integration Capability Review and Risk Assessment (I–CRRA) master planning process encompasses the effects and capabilities required by the seven CONOPs and is key to ensuring we have a high correlation between our S&T programs and the warfighting capabilities required by these concepts.

As a result of this capability review and risk assessment, the Air Force realigned approximately $500 million of its S&T funding to support higher-priority areas over the Future Years Defense Program (FYDP). These areas included the Battlefield Air Operations (BAO) kit, which I will discuss in more detail in a moment; the commander's predictive environment, which teams our human effectiveness and information technology communities working on network-centric warfare applications; and Air Force-unique nanotechnology efforts in the areas of chemistry, electronics, and materials.

Fiscal constraints, operational demands, and ongoing peacekeeping operations and conflicts in such places as Afghanistan and Iraq continue to place a great burden on our people, our already stressed operational systems, and our supporting logistics. However, the Air Force is working to increase the S&T funding to ensure we maintain our technology options in support of future warfighting needs.

The Air Force fiscal year 2006 budget request for S&T is $1.98 billion. This includes $1.4 billion in core S&T efforts, which represents an increase of over $60 million, or almost 2.3 percent real growth compared to the President's budget request for a similar core amount of S&T investment in fiscal year 2005.

Also with an eye toward maintaining our long-term superior warfighting capability, this year's President's budget request includes $340 million in basic research funding, or about 18 percent of the Air Force's S&T budget. Included in this amount are university research initiatives and high-energy laser basic research programs that were transferred to Air Force S&T by the Office of the Secretary of Defense (OSD) the year before last. These efforts, along with additional high-energy laser programs that also transferred to the Air Force, continue to do well and receive oversight and policy guidance from the OSD while the Air Force works hard to ensure these programs support the diverse multiple military objectives inherent in joint activity.

In addition, the seismic research program for detection of nuclear explosions has been successfully integrated into core Air Force S&T programs. We continue to work with the OSD, the Air Force Technical Applications Center, the Army, and the Department of Energy to ensure the right level of investment in seismic research that will address the operational nuclear explosion monitoring needs of our country.

As the Air Force continues to transform to meet current and future security challenges, we must prepare for a broad spectrum of

capabilities that address three strategic contributions that air and space power provide: persistent C^4ISR, global mobility, and rapid strike. All of this must be done, recognizing that we will, in most situations, be operating in a joint and often coalition environment. We work closely with the warfighter to anticipate new operational needs arising from changing national and world security environments and to develop and demonstrate S&T applications to rapidly mitigate irregular, catastrophic, and disruptive threats, as well as traditional threats.

Our prime example is the Air Force special tactics combat controller BAO kit that I mentioned earlier. Lighter batteries, hearing protection, and more efficient target designation are some of the examples of ongoing BAO kit technology enhancements.

The Battlefield Air Targeting Camera Autonomous Micro-air Vehicle (BATCAM), which I brought with me today—and I think you have all had a chance to look at—replaces the current unmanned air vehicle (UAV) system in the BAO kit with one that is 5 times smaller and 10 times lighter. It still provides covert reconnaissance. It is simple to operate, inexpensive enough to be expendable, and can provide real-time battle damage assessment. These new BAO kits provide a joint capability that will help save American lives and the lives of innocent civilians.

The Bombot robot, which I also brought with me today, provides a joint service capability to aggressively destroy explosive devices. The Air Force was selected to develop Bombot because of our experience and expertise in ground vehicle robotics. The effort resulted in the development of a very small, off-road, remote-controlled, reusable robot that has been deployed to Iraq for destruction of IEDs. The robot uses video feedback or line-of-sight RF to find IEDs, drop the explosive destruction charge and move to safety.

The First Response Expeditionary Fire Vehicle shown in the poster boards behind me today provides a lightweight air-droppable system for effective crash and rescue fire-fighting services starting on day one of deployments. This compact, lightweight system can be transported on military HMMWVs, Gators, or other small vehicles and can effectively extinguish two- and three-dimensional fires with one-fifth the firefighting agent.

As demonstrated in the laser eye protection display today, the Air Force continues its laser countermeasures effort designed to protect warfighters with multiple capabilities and approaches to address laser hazards and threats. These capabilities and approaches include technologies for training tactics, personnel protection, optical hardening, as well as technical data to established DOD policies and international treaties.

The Air Force is also developing technology to better prosecute the offensive portion of the global war on terrorism. The hardened surface target ordnance package (HardSTOP) is an airdrop munitions technology development focused on multi-story targets in urban terrain. HardSTOP is equipped with over 50 mini-penetration charges to allow it to hit targets within multiple-story buildings and soft bunker type targets. Additionally, HardSTOP provides low collateral damage with a precisely selectable explosion diameter of as little as 20 feet.

We are also engaged in other areas and are working to ensure that we transform, as we continue to integrate these expanding capabilities with those of other services and non-military elements of our national power. The technology upgrades to Global Hawk propulsion and power systems are an example of spiral development. Power extraction from the low-pressure turbine will triple the current onboard power capacity, which is currently 25 kilowatts to 75 kilowatts, as an integral starter generator will provide essential in-flight engine restart capability, and low temperature fuel additives will decrease operations and maintenance costs associated with the current fuel mixtures.

In the area of world-class research, Air Force technologies continue to stand out, including directed energy activities at Starfire Optical Range at Kirtland, New Mexico, which is leading atmospheric compensation technology development for use in large ground-based telescopes to image satellites and propagate laser beams through the atmosphere.

Our Information Directorate's networked cyber operation tools research at Rome Research Site in Rome, New York, has also been cited with exemplar laboratory programs.

Finally, the Air Force S&E workforce, as you mentioned earlier in your opening remarks, is another area that we are meeting with great success. The Air Force is generating enough S&Es at the present time to sustain Air Force needs through its developmental education programs and various recruitment and retention initiatives. The Air Force is attracting the best and the brightest. We are getting graduates with 4.0 grade point averages, and many of our recruiting initiatives are aimed at attracting students into the Air Force S&E career field. We also have several education programs within our core basic research program that could enhance our S&E workforce, such as the National Defense Science and Engineering Graduate Fellowship program. The Air Force is committed to continuing to shape its S&E workforce with the vision to enhance excellence and relevance of S&E into the 21st century and appreciates the support Congress has already provided.

In conclusion, the Air Force is fully committed to providing this Nation with the advanced air and space technologies required to meet America's national security interests around the world and to ensure we remain on the cutting edge of systems performance, flexibility, and affordability.

The technological advantage we enjoy today is a legacy of decades of investment in S&T. However, in this post-Cold War world, we cannot afford to rest on our laurels. We are focusing our S&T program to meet the challenges of a new security environment. The global war on terrorism drives a different construct for Air Force S&T, and we are focusing our top talent and investing our funds on many efforts that address this war. Air Force core competencies in S&T enable solutions to meet these emerging threats. The Air Force S&T program continues to provide for the discovery, development, demonstration, and timely transition of affordable technologies that keep our Air Force the best in the world.

As an integral part of the DOD S&T team, we look forward to working with Congress to ensure a strong Air Force S&T program tailored to achieve our vision of a superior air and space force that

can identify and defeat both traditional and global war on terrorism targets.

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

[The prepared statement of Mr. Engle follows:]

PREPARED STATEMENT BY JAMES B. ENGLE

INTRODUCTION

Mr. Chairman, members of the subcommittee, and staff, I very much appreciate the opportunity to provide testimony on the fiscal year 2006 Air Force science and technology (S&T) program. The United States Air Force continues to transform to a capabilities-focused Expeditionary Air and Space Force based on the concepts of operations (CONOPs) for each of the seven major tasks the Air Force must be capable of accomplishing to support our combatant commanders. The Air Force is focused on delivering the ability to effectively and affordably train, organize, and equip our military forces. The Air Force Integration Capabilities Review and Risk Assessment (I–CRRA) master planning process encompasses the effects and capabilities required by the seven CONOPs. This master planning process is key to ensuring we have a high correlation between our S&T programs and the warfighting capabilities required by these CONOPs. In fact, in the fiscal year 2006 President's budget request, the Air Force reprioritized approximately $500 million of its S&T program to address capability needs identified in the master planning process.

The United States Air Force is committed to defending America by unleashing the power of S&T. Our S&T program enables us to achieve our vision of becoming an integrated Air and Space Force capable of rapid and decisive global engagement. The Air Force S&T program is aggressively pursuing high payoff technologies and is focused on current and future warfighting capabilities to address not only traditional threats, but also the global war on terrorism. The Air Force is focusing on technologies to meet the capability needs of the combatant commanders. Many of these technologies could be applicable to a number of different joint uses and the Air Force actively pursues joint programs and sharing of technology with the Services, Defense Agencies, Homeland Security, and others.

A broad foundation of basic, applied, and advanced technology S&T investment enables our scientists and engineers (S&Es) the freedom to innovate and is the key to ensuring the Air Force will meet the challenges of tomorrow. The output of this broad base of science investments provides our leadership the opportunities to respond quickly to a rapidly changing world. A key example of this flexibility is our rapid response to the global war on terrorism with technologies to help defend against both traditional and asymmetrical threats. We are able to deal with the uncertainty of tomorrow because of our broad investment in S&T today—an investment geared towards winning decisively, protecting our forces, and minimizing collateral damage at anytime and any place in the world.

S&T BUDGET/SENIOR LEADERSHIP INVOLVEMENT

Fiscal constraints, operational demands, and ongoing peacekeeping operations and conflicts in places such as Afghanistan and Iraq, continue to place a great burden on our people, our already stressed operational systems, and our supporting logistics. However, the Air Force is working to increase S&T funding to ensure we maintain our technology options in support of future warfighting needs. The Air Force fiscal year 2006 budget request for S&T is $1.98 billion—this includes $1.4 billion in "core" S&T efforts, which represents an increase of over $60 million or almost 2.3 percent real growth compared to the requested amount for similar "core" S&T efforts in fiscal year 2005. An additional $77.8 million in Joint Unmanned Combat Air Vehicle funding was added to the S&T program in fiscal year 2006 only.

Of the programs that were transferred to Air Force S&T the year before last, all continue to do well. The University Research Initiative program plus the High Energy Laser programs, which were devolved to the Air Force by the Office of the Secretary of Defense (OSD), continue to receive oversight and policy guidance from the OSD, while the Air Force works hard to ensure these programs support the diverse multiple military objectives inherent in joint programs. In addition, the Seismic Research Program for detection of nuclear explosions has been successfully integrated into the core Air Force S&T program. We continue to work with the OSD, the Air Force Technical Applications Center, the Army, and the Department of Energy to

ensure the right level of investment in seismic research that will address operational nuclear explosion monitoring needs.

Warfighter and senior Air Force leadership involvement in the planning, programming, and prioritizing of Air Force S&T continues to be a priority. The I–CRRA master planning process, previously mentioned, involves several levels of senior Air Force leadership, including the Secretary and the Chief of Staff of the Air Force plus all the four stars, and promotes a greater understanding within the Air Force of the S&T program and its link to warfighting capabilities. The Chief, along with the Secretary, the Air Force Service Acquisition Executive, and the Air Force Materiel Command Commander, also participates in a full portfolio review of the S&T program similar to the former S&T summits. The Capabilities Program Execution Review continues to provide a forum in which the commander of each major command is afforded a focused look at his portfolio, an opportunity to resolve issues at the system/program level, and insight into the S&T program. Finally, the Applied Technology Councils continue to bring acquisition product centers, logistics centers, major user commands, and laboratory personnel together to review, discuss, and prioritize S&T efforts.

TRANSFORMATION

The objective of Air Force S&T is to develop technologies for lighter, leaner, and more lethal weapon systems and their support structure through the continuing discovery, exploitation, demonstration, and rapid transition of technology to meet users' operational needs. All of this must be done recognizing that we will, in a number of situations, be operating in a joint and often a coalition environment. The S&T world is usually where new weapon systems begin their development process. This is the ideal time to consider the full life cycle cost savings by considering maintenance, sustainment, and disposal costs. During a conflict, it is not unusual for combat-identified problems or needs to be highlighted and near-term solutions developed—the Battlefield Air Operations (BAO) kit and the robotics improvised explosive device (IED) destruction robotic vehicle are examples. Yet, it is imperative that the S&T process considers the entire life cycle cost of a proposed system from development to disposition.

As the Air Force continues to transform from a Cold War to a post-Cold War Air and Space Force, we must prepare for both traditional and new forms of terrorism to include attacks on our space assets, attacks on our information networks, cruise and ballistic missile attacks on our forces and territory, and attacks by adversaries armed with chemical, biological, radiological, nuclear, or high explosive weapons. To address these emerging possibilities, the Air Force has established a process of transformation to achieve and maintain the advantage through changes in operational concepts, organization, and/or technologies that significantly improve its warfighting capabilities or ability to meet the demands of a changing security environment.

When examining the concept of combat transformation, one must remember transformation is not the result of a one-time improvement or change, but rather a continuum of sustained and determined efforts. It is more than new "show stopping" technology as it includes adapting existing capabilities, using them in new ways, changing the organization structure to increase effectiveness, and changing doctrine and our CONOPs. We are also working to ensure that as we transform we continue to integrate these expanding capabilities with those of the other services and nonmilitary elements of national power—we must evolve and embrace joint and coalition operations as we transform. Finally, we do not believe that transformation should be achieved at the expense of ongoing operations in support of the Department of Defense (DOD) strategy of maintaining adequate readiness and infrastructure, conducting critical recapitalization, and attracting quality personnel—to achieve rational transformation, there must be a careful balance between these requirements, which all compete for limited resources.

We work closely with the warfighter to anticipate new operational needs arising from changing national and world security environments and to develop and demonstrate S&T applications to rapidly mitigate traditional and global war on terrorism threats. At almost $2 billion, the fiscal year 2006 budget request for Air Force S&T is funded at a level to achieve the distinctive capabilities that support Air Force warfighting needs.

WORKFORCE

The Air Force S&E workforce is another area where senior Air Force leadership involvement has played a pivotal role; and the steps taken to address S&E workforce issues are meeting with great success. The Air Force is generating enough

S&Es at present to sustain Air Force needs through its developmental education programs and various recruitment and retention initiatives. Our workforce continues to be highly motivated and productive and the fact that approximately 20 percent of our laboratory S&E government workforce is active duty military gives us a direct link to the warfighter, which in turn helps us to focus technology development on warfighting capability needs. The Air Force is committed to continuing to shape its S&E workforce with the vision to enhance excellence and relevance of S&T into the 21st century and appreciates the support Congress has already provided.

TECHNOLOGY TRANSITION

Our goal is to get technology to the warfighter. There are several ways we measure our effectiveness in obtaining this goal. The Air Force believes that looking at legacy systems is one of the most effective metrics available. While not perfect, it does demonstrate the transition of S&T products into operational warfighting capabilities. An excellent example is the F–35. A number of Air Force S&T developed or sponsored technologies that transitioned to the F–35 can be traced back to S&T investments in previous years. These technologies include efforts such as low-observable materials and airframe structures; advanced two-dimensional, thrust vectoring nozzles; new durable turbine engines; airframe design; and advanced radar.

In the space arena, examples of technologies that have transitioned into space "products" include radiation-hardened electronics; longer life, lighter weight lithium ion batteries; lightweight composite materials; compact, more efficient solar cells; and Hall thrusters. In addition, a number of information-related technologies from the Joint Battlespace Infosphere (JBI) program have transitioned into operational and commercial use. The JBI network centric environment provides the framework to establish basic principles and draft standards for a variety of different applications.

Spiral acquisition allows an opportunity for very rapid technology transfer. A good example is our BAO kit, which Air Force ground controllers use to call in air strikes. Changes in this system were rapidly transitioned into use during Operation Enduring Freedom in Afghanistan. The BAO kit is one of the Air Force's top priorities and continues being developed in several different acquisition spirals as the different technology areas mature. The technology upgrades to Global Hawk's propulsion and power system are another example of spiral acquisition. Power extraction from the low-pressure turbine will triple the current on-board power capacity, an internal starter generator will provide essential in-flight engine restart capability, and low-temperature fuel additives will decrease operations and maintenance costs associated with current fuel mixtures.

Technology transition into operational use is the ultimate metric for assessing the value of our S&T investment and the warfighting capabilities it provides to the Air Force. As evidenced by our high technology legacy systems, the technology transitioned from S&T into developmental and operational products is extensive and provides confidence that S&T funding is being wisely invested.

WORLD-CLASS RESEARCH

The quality of our program is assessed by the Air Force Scientific Advisory Board (SAB) through yearly reviews. The SAB conducts an in-depth review of half of the S&T program each year, covering the entire program over a 2-year period. Eleven technical areas were identified as world-class research during the last 2-year cycle of reviews.

The Directed Energy Directorate's Starfire Optical Range at Kirtland Air Force Base, New Mexico, is leading atmospheric compensation technology development for use in large ground-based telescopes to image satellites and propagate laser beams through the atmosphere. They have just developed a sodium laser system that will allow compensation for a significantly larger portion of the atmosphere along the laser's path. This will enable higher-quality, ground-based observations of space objects and enhanced propagation of laser beams through a turbulent atmosphere. Satellite images obtained by using this technology can provide real-time status information that cannot be obtained in any other manner.

The SAB cited the Information Directorate's cyber operations tools research at Rome Research Site in Rome, New York, as an exemplar laboratory program with a strong vision, leading edge research that anticipated operational needs, and having invented and delivered an impressive array of offensive and defensive cyber operations tools to the warfighter.

The SAB also cited the Information Directorate's research in Advanced Computing Architectures, a program that includes technologies dealing with current problems

and technologies of the future. Especially mentioned was the work with the Joint Strike Fighter, unmanned air vehicles (UAVs), and the Joint Tactical Radio System.

Another SAB-rated world-class research program is Directed Energy Bioeffects being worked by our Human Effectiveness Directorate at Brooks City-Base, Texas. Specific research areas include understanding laser effects on humans, radio frequency dosimetry, and the fundamental bioeffects knowledge of lasers. The Materials and Manufacturing Directorate at Wright-Patterson Air Force Base, Ohio, conducts world-class research in probalistic micromechanical modeling of material durability that is based on the physics of failure. Thermo mechanical process modeling of metals is having a significant impact on material standards and process control.

The SAB also rated the Automatic Target Recognition (ATR) work performed by the Sensors Directorate at Wright-Patterson Air Force Base, Ohio, as world-class. ATR enables faster and more accurate detection, identification, and prosecution of time-critical targets. We are developing ATR tools to better detect targets in urban and obscured environments, as well as to change detection algorithms to aid in the detection of improvised explosive devices (IEDs). By fusing detection and cueing tools with signature databases and advanced signature modeling we continue to shorten the "kill chain."

The Space Vehicles Directorate's weather research at Hanscom Air Force Base, Massachusetts, continues to be a SAB-rated world-class technology development program. The weather modeling and simulation capability undergoes frequent spiral upgrades to specify and forecast space weather from the Sun to the ionosphere.

Also, while not specifically identified by the SAB, the Air Force has a significant investment in various aspects of nanotechnology. Scientific breakthroughs and technology advances in the past few years have demonstrated the large potential of nanotechnology to address a number of different Air Force applications. Attributes, such as high strength, could result in lighter and faster air vehicles and could enable miniature satellites. Nanotechnology could also make a significant contribution to advanced energy and energetic materials.

COMBATING TERRORISM

The Air Force S&T program has a considerable portfolio of technology focused on the global war on terrorism. One prime example is the Elastomeric Coating, which the Air Force developed to protect key buildings and installations from close proximity explosions. This easy-to-apply spray coating is contributing to the safety and protection of deployed troops.

As mentioned earlier, the Air Force continues to provide spiral upgrades to the Air Force Special Tactics Combat Controllers BAO kit. Lighter batteries, hearing protection, and more efficient target designation are some examples of ongoing BAO kit technology enhancements. Another enhancement example is the Battlefield Air Targeting Camera Autonomous Micro-air Vehicle (BATCAM). BATCAM replaces the current UAV system in the BAO kit with one that is five times smaller and ten times lighter, yet still provides covert reconnaissance, is simple to operate, inexpensive enough to be expendable, and can provide real-time battle damage assessment. Still another example is the Battlefield Renewable Integrated Tactical Energy System (BRITES). BRITES is designed to replace the various batteries that are currently carried with a system and is 50 percent lighter, but still provides for the same capability. These new BAO kits provide a joint capability that will help save American lives and the lives of innocent civilians. BAO enhancements provide a revolutionary and highly effective way to combat the global war on terrorism threat.

In close coordination with the other services, the Air Force is utilizing its expertise in metal-infused ceramics to develop a more effective, lightweight armor. This new material was being developed by the Air Force for air vehicle applications. It turns out, however, that the new advanced lightweight metal-infused ceramic armor has additional applications and could be used in body protection armor and has been shown to be effective against shrapnel and multiple small arms shots. Additionally, the metal-infused ceramic armor is cheaper, lighter, and easier to produce than the standard plates.

The Bombot robot provides a joint-service capability to aggressively destroy explosive devices. The Air Force was selected to develop Bombot because of our expertise in ground vehicle robotics. The effort resulted in the development of a very small reusable robot that has been deployed to Iraq for destruction of IEDs. The robot is a small, off-road remote controlled vehicle equipped with a small explosive charge delivery system. It is remotely controlled and uses either video or feedback or simply line-of-sight radio frequency to find the IED, drop the explosive destruction charge, and move to safety. This small robot weighs 17 pounds and costs about $3,000.

The Air Force continues to leverage its success in manportable, shoulder-fired missile (MANPADS) countermeasures with the development of the Affordable Laser Infrared Countermeasure Survivability System (ALISS). ALISS provides aircrew with a highly-effective, threat-adaptable, jamming infrared countermeasure to the proliferating MANPADS threat. Even with its emphasis on affordability, ALISS provides missile launch detection and jamming out to beyond the maximum range of existing MANPADS with few false alarms. Additionally, since ALISS is a pod system, it can be retrofitted onto a variety of aircraft platforms, including civilian aircraft.

The Air Force is also developing technology to better prosecute the offensive portion of the global war on terrorism. The Hardened Surface Target Ordnance Package (HardSTOP) is an airdrop munition technology development focused on multi-story targets in urban terrain. HardSTOP is equipped with over 50 mini-penetration charges to allow it to hit targets within multi-story buildings and soft bunker type targets. Additionally, HardSTOP provides low-collateral damage with a precisely selectable explosion diameter of as little as 20 feet.

TRANSFORMATIONAL TECHNOLOGIES

There are many other Air Force technology areas that deserve special mention. Let me highlight just a few examples. Solid state lasers have been around for many years, but we are finally seeing them approach weapons class power levels. These lasers offer great promise as small, efficient, electrically powered systems that can project effects at the speed of light with a magazine that depends only on available power generation. The Joint High Power Solid State Laser program is jointly funded by the Air Force, the High Energy Laser Joint Technology Office, and the Army. In the next few months, we should see three competing systems demonstrating close to 25 kilowatts with the potential of good beam quality over relevant shot times. We are also developing and tracking other promising solid state technologies. There are many potential applications for high-powered solid state lasers such as aircraft self-protection, anti-sensor weapons, and tactical weapons on ground, sea, and air platforms. Following these demonstrations, we will evaluate how to best get these transformational technologies to the warfighter.

The Scramjet Engine Demonstrator (SED) is the culmination of our Hypersonics Technology work at Wright-Patterson Air Force Base, Ohio, and is the cornerstone of future hypersonic capabilities, such as destroying time-critical targets and responsive access to space. The objective of the SED program is to demonstrate the viability of a hydrocarbon-fueled scramjet engine through flight and ground test and, as such, is the first-ever flight demonstration of a hydrocarbon-fueled scramjet engine.

In fiscal year 2006, the Air Force will continue to research and demonstrate a low collateral damage warhead, allowing a "behind-the-wall" threat prosecution with a highly localized lethal footprint. The warhead case consists of a low-density, wrapped carbon-fiber/epoxy matrix integrated with a steel nose and base. The low-density composite case can survive penetration into a 1-foot hardened concrete wall. Upon detonation, the carbon-fiber warhead case disintegrates into small non-lethal fibers with little or no metallic fragments, thus significantly reducing collateral damage to people and structures. The warhead explosive fill is a dense inert metal explosive containing fine tungsten particles to provide a ballasted payload with sufficient penetration mass. The tungsten displaces energetic material so as to reduce the total energetic used. The net results are higher dynamic energy impulse all within a small lethal footprint.

CONCLUSION

In conclusion, the Air Force is fully committed to providing this Nation with the advanced air and space technologies required to meet America's national security interests around the world and to ensure we remain on the cutting edge of system performance, flexibility, and affordability. The technological advantage we enjoy today is a legacy of decades of investment in S&T. However, in this post-Cold War world, we cannot afford to rest on our laurels. We are focusing our S&T program to meet the challenges of a new security environment. The global war on terrorism drives a different construct for Air Force S&T and we are focusing our top talent and investing our funding on the many efforts that address global war on terrorism. Air Force Core Competencies in S&T enable solutions to meet these emerging threats. The Air Force S&T program continues to provide for the discovery, development, demonstration, and timely transition of affordable technologies that keep our Air Force the best in the world. As an integral part of the DOD's S&T team, we look forward to working with Congress to ensure a strong Air Force S&T program

tailored to achieve our vision of a superior Air and Space Force that can identify and defeat both traditional and global war on terrorism targets.

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.

Senator CORNYN. Thank you, Mr. Engle.

Dr. Tether, the floor is yours.

STATEMENT OF DR. ANTHONY J. TETHER, DIRECTOR, DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

Dr. TETHER. Mr. Chairman, Senator Reed, Senator Nelson, thank you very much for inviting me here today to testify on DARPA's decisionmaking processes for strategic directions, priorities, and budgets.

DARPA has many efforts directed at the global war on terrorism which have been described in both my written testimony and in the strategic plan that we delivered with our fiscal year 2006 budget. At the display behind me, there are just a handful of our quick reaction efforts which are today in Iraq helping our guys beat the stuffing out of the bad guys and bring them home safe.

Our Boomerang program, for example, is a low-cost system to locate people shooting at convoys.

Our Command Post of the Future (CPOF) system is a new way to do collaborative command and control where the commanders can stay where they are and do not have to come to a central location. Not only that, it is allowing everyone else on the net to see what is going on so that the fog of decisionmaking and why something was being done is now known to people at very low levels where it was not known before. Major General Chiarelli, who was a commanding general of the 1st Cavalry Division, told us and would tell you that CPOF in use today in Iraq is doing just that, helping them defeat the insurgents, and at the same time saving U.S. lives.

Our gun truck technology is protecting convoys today. Right now the truck uses just steel plates. However, we have a neat, new material technology, really very simple, that is polymer, sort of like a steel-belted tire. It has shown great promise, and if we can show that this has the same capability, we will have more lightweight protection, but more importantly, we will be able to mold it into the right form. Not only that, we also think it might be useful for body armor.

We also have some programs displayed on language, which is a great problem.

However, your letter requested that we spend this time discussing how we shape our strategy and build our budgets. I guess you want to know how the sausage is made; sometimes not a pretty sight. Much of this was addressed in the strategic plan and also in my written testimony. So I am going to, therefore, use the time I have to give you examples and hopefully more insight into what I believe is a very thorough and complete process which has been reviewed at all levels of the Services and the OSD.

A strategic plan has three elements: an objective, a strategy for meeting the objective, and tactics for implementing that strategy.

DARPA's original objective, when created by President Eisenhower in 1958, was to prevent technological surprise such as Sput-

nik. Over the years, that objective has not changed but it has been modified to include not only preventing technological surprise but to create technological surprise for our enemies.

Today's potential technological surprise comes in the form of what is sometimes termed asymmetric threats, transnational threats, threats without a country, or just plain terrorism. We have many efforts directed towards these threats, some of which I will talk about.

Creating technological surprise for the enemy is a major activity. An example of DARPA-created technological surprise is stealth. DARPA has many programs oriented towards creating the same degree of surprise. However, these efforts cannot be discussed in this forum because, in order for something to be a surprise, it should not be known until it is ready. I would be pleased to come and brief any of you on all of these programs at your convenience. But let me assure you that the appropriate staff on your committee have full access and review all of these programs.

DARPA's strategy for meeting these objectives manifests itself in the form of thrusts that change over time, fitting the conditions and problems of the day. Right now we have eight thrusts that center on providing new and enhanced capability. You have these in your plan, but they range from not allowing sanctuary for any surface target, whether it be fixed, mobile, or underground; developing tactical networks; space all the way to biology. There is a ninth thrust which is centered on the continued development of core technologies such as microelectronics, materials, information processing computer science in order to enhance current capability and to enable new capability.

These thrusts have been generated directly from the 2001 QDR and from interactions with senior service and civilians from each of the Services and defense agencies. The thrusts are then used in our budget process to guide what specific efforts should be funded. But we do not pick a thrust and allocate money to it and then look for ideas. You would be very lucky to get the right allocation. The way we work it is we go and look for the ideas. We have the thrust, which we use to tell people what we are interested in and we ask for ideas to come forth, then we fund the ideas. So we build up our budget really from the bottom up, from an idea funding as opposed to a top-down allocating money to thrusts. It is a very different type of process.

But where do the ideas come from? They are found in many ways. We have program managers (PMs) who are only hired if they are the kind of people who can generate ideas. We get ideas from industry, obviously. We get ideas from universities. We get ideas from other S&T organizations within the DOD, and we get ideas from everywhere. We even get ideas from Congress. I did not mean it quite that way. Sorry. [Laughter.]

In addition, senior managers at DARPA meet regularly with senior civilians and military leaders throughout the DOD.

Now, to reinforce this, we have five operational liaisons at DARPA. These are people who are from each Service. We have one from each Service plus the National Geospatial Agency (NGA). They are senior in all respects. They are senior because they are a colonel or a captain in the Navy, usually at the end of their tour,

and they are also old. But they come with a great rolodex. Their job at DARPA is take my PMs and bring them to the warfighter and to marry them. They act as that go-between to bring technology to a warfighter, have the PM describe what he is doing to the warfighter. The warfighter then learns about something new that he might not have known about. Plus, the PM now learns about needs that he might have known about. This program has worked extraordinarily well in both getting ideas and transitioning technologies.

This is something new for DARPA. I put two full-time DARPA people at U.S. Special Operations Command (SOCOM) in Tampa. We have two DARPA people in SOCOM at Tampa acting as operational liaisons between DARPA and SOCOM. Now, why did I do that? Well, SOCOM is a very special place. I consider it our experimental lab, and General Brown knows I feel this way. He agrees with it. He tries out our stuff. We have things. We bring them down. They actually go out and use them and come back and tell us what they thought about it, what is to be fixed or not. In fact, if on occasion we give them 25–30 things, we have outfitted the full force and we all feel good about that. But that is a great program and we have many activities going on with SOCOM and we are in close contact. General Brown reviews our strategic plan on a continuous basis.

We also have a chiefs program where rising star officers from each service come to DARPA on short 2- to 3-month assignments to learn about DARPA. These are warfighters again. We try to get warfighters and operators, not S&T people. We have enough contact with S&T people. But we try to get warfighters and operators, so that when they go back out, and hopefully they become generals and admirals, they will know about technology. In fact, I have a group of them behind me here today. There are three Army, one Marine Corps, and four Air Force interns here with me today. If you all would maybe just hop up and back down. They wanted to come and see how sausage was made, too. [Laughter.]

But the major source of the input is from the constant reviews of the strategic plan and its projects from the service chiefs, the combatant commanders, intelligence officials, and senior civilians from the OSD. In 2004 we had about 100 separate meetings involving literally hundreds of people from across the DOD, as well as congressional members and staffers, to review DARPA's thrusts and projects. For 2005 so far, we will meet another 100 times.

Now, I asked my staff how on Earth could I show to people how many people review our strategic plan, and the best they could do was to give me this book. This book contains the agendas. This is just the agendas. Now, those are one-page pieces of paper for each meeting, but that is about a 2-inch thick set of agendas at various meetings we have had to review the strategic plan.

Let me give you some examples, however. Let me get right down to the meat of it and give you some examples.

One of our thrusts is robust secure self-forming tactical networks. We are heading toward a network-centric force where the network becomes as important as the platforms. This means that the network has to be as reliable and available as the platforms and supports because if the network fails, the capability of our

forces would evaporate. The thrust itself was first started when General Shinsheki asked DARPA to help develop the architecture for tomorrow's Army. This was the FCS which needed to be strategically mobile and have the capability to stay within the decision loop of today's and tomorrow's asymmetric threats which do not fight in an historical linear fashion.

This led to substantial efforts developing networks that are infrastructure-free, that can hold off direct and indirect attacks on the networks as a result of the reviews that we had with the Army. A personal review of the strategic plan and efforts with Generals Schoomaker, Cody, and Byrne reinforced that networks with this quality are still at the heart of our future force, and I think with the latest mobility initiative, that understanding is still there.

We have also reviewed our efforts with General Jumper. General Jumper wants to provide high bandwidth, worldwide capability with satellites whose cross-links are lasers and whose down-links are lasers to airborne platforms. However, we had a problem. He knew he could guarantee getting the data to an airborne platform, but he did not know how to guarantee that a user on the ground had connectivity because clouds get in the way occasionally with respect to lasers.

We responded to this and created an effort called the Optical and Radio Frequency Combined Link Experiment (ORCLE), which would take the data on the airborne platform and down-link it to a user on the ground, using the laser if conditions permitted it, but also having a RF link along with that, so that it would automatically switch from RF to laser as the conditions permit. This way the ground user was always guaranteed a dial tone when he picked up the phone.

I have had the ground users tell me that the only time when communications fail is when you are calling for fire. It always seems that you never get a dial tone when you are trying to call for fire. These are important calls which are very low bandwidth. It does not take much bandwidth for a call for fire or a call for help. But having this kind of a dual mode capability ensures the user, when he picks up the phone, that he has a dial tone and he is going to get connectivity, and if the lasers are there, he is going to get bandwidth and pictures like he has never had before.

During the review of the plan with Secretary Wynne, he was concerned that the network was now going to be so essential that the developers of networks needed to take into account the requirement that the network had to survive. We responded to this by taking the initiative to create a red team capability which would be chartered with evaluating network concepts from their survivability ability from the concept development.

We have had several reviews of the plan in our efforts with DDR&E Ron Sega. One particular issue he is concerned with is that the multi-level security was not being taken into account in designing these networks. Here the issue is that each node in a network is also a relay for messages from which the user at that node may not be cleared. We need to solve this issue in order to have one network and not several which would defeat the purpose of network centric warfare in the first place. We have responded

to this by initiating a multi-level security effort and we are starting to come up with ideas.

Urban area operations are another example. Our newest strategic thrust is urban area operations which further illustrates this process. We were concerned about urban warfare and were studying it even before the conflict in Iraq. It is logical for adversaries to move in the city to resist us. It is easier to hide small caches of weapons, including weapons of mass destruction, and to hide activities in urban style areas where there are thousands of buildings. The conflict in Iraq has brought urban operations center stage and accelerated our move into this area.

We reviewed our strategic plan with Commandant Mike Hagee and General Brown, SOCOM Commander. Commandant Hagee told us that what they needed more than anything else was situational awareness with respect to vehicles, people, et cetera so the troops could deploy quickly to trouble spots and basically be a force multiplier effect. He also said that they really needed better nonlethal weapons in order to be able to control the situation when enemy troops were mixed in with local civilians. We are studying ideas in this area also.

We did respond to this by creating a major effort, which was discussed, in obtaining situational awareness for using small UAVs, cameras, other sensors, and even using the soldier on patrol as a sensor. Commandant Hagee spent 4 hours with us, along with his senior staff, at a Government-only meeting reviewing these efforts and agreed with what we were doing.

We meet with General Brown and SOCOM's front-line warriors, and as a result, we have started a number of very classified programs. In fact, I just met with General Brown last week to go over some of the more classified efforts within the urban operations section that will, undoubtedly, create surprise for the enemy when they are ready.

Cognitive computing. The purpose of the cognitive computing thrust is to develop computers that learn to cope with humans as opposed to today where humans have to learn how to cope with a computer. We believe that if we can do this, we will be able to reduce the number of people required in places like operations centers and so forth. We are attacking not the tooth, but the tail. We are trying to reduce the number of people required in the tail who can then be used for the tooth.

Last month, when we were reviewing our strategic plan with CNO Vernon Clark, he asked us to do an effort for reducing the number of people required to run a carrier. In other words, he would like us to take the number of people who run a carrier down by a factor of two, and we have just started that.

Space. The genesis of our space thrust is directly from Secretary Rumsfeld and Under Secretary Aldridge. About 4 years ago, I went through the interview process and finally met with Secretary Rumsfeld, because he is the one that does pick the DARPA Director. It was an interview that was supposed to last for 15 minutes, but went on for 45 where he explained what he was trying to do. But the point here is that on the way out the door, he said to me, look, there was this commission on space and here is a report.

Space is important. Go do it. Secretary Rumsfeld, by the way, reaffirmed that, and that really created the thrust at DARPA.

Now, we have had several reviews of the strategic plan with Secretary Teets, DDR&E Ron Sega, General Lance Lord, and more importantly, General Cartwright.

Senator CORNYN. If I could ask you to sum up. I could listen to what you are saying all day. It is very interesting and it is very substantive, but we need to get to some questions.

Dr. TETHER. I could go on with lots of examples, as you just said.

Senator CORNYN. Maybe at another time. I would love to do that.

Dr. TETHER. We have had sessions with everybody, and I do look forward to your questions. Thank you very much.

[The prepared statement of Dr. Tether follows:]

PREPARED STATEMENT BY DR. TONY TETHER

Mr. Chairman, subcommittee members and staff: I am pleased to appear before you today to discuss the Defense Advanced Research Projects Agency's (DARPA) fiscal year 2005 activities and our fiscal year 2006 plans to continue transforming our military through technological innovation.

DARPA's original mission was to prevent technological surprises like the launch of Sputnik, which in 1957 signaled that the Soviets had beaten the U.S. into space. Our mission is still to prevent technological surprise, but also to create technological surprise for our adversaries. Stealth is an example of how DARPA has created technological surprise.

DARPA conducts its mission by sponsoring revolutionary, high-payoff research that bridges the gap between fundamental discoveries and their military use.

DARPA is the Department of Defense's (DOD) only research agency not tied to a specific operational mission. DARPA is designed to be the "technological engine" for transformation, supplying advanced capabilities, based on revolutionary technological options for the entire Department.

This is a unique role within DOD. The Department's operational components naturally focus on nearer-term needs because they must meet urgent needs and requirements. Consequently, a large organization like the DOD needs a place like DARPA whose only charter is radical innovation.

DARPA'S EIGHT STRATEGIC THRUSTS

DARPA's strategy for accomplishing its mission is embodied in strategic thrusts. Over time, as national security threats and technical opportunities change, DARPA's strategic thrusts change. DARPA's flexibility and ability to change direction quickly allows it to react swiftly to emerging threats.

The eight strategic research thrusts that DARPA is emphasizing today are:

- Detection, Precision ID, Tracking, and Destruction of Elusive Surface Targets
- Robust, Secure Self-Forming Tactical Networks
- Networked Manned and Unmanned Systems
- Urban Area Operations
- Detection, Characterization, and Assessment of Underground Structures
- Assured Use of Space
- Cognitive Computing
- Bio-Revolution

Urban area operations is our newest thrust, driven partly by Iraq and partly by the increasing likelihood that future conflicts will be fought in densely populated areas. The investments in the urban area operations thrust area are closely integrated with the investments DARPA has in the other seven thrusts. These investments are part of our ever-changing investment strategy for the technologies our future generations of warfighters will need.

Let me tell you about these eight thrusts and the forces driving them, along with some illustrative examples.

Detection, Precision ID, Tracking, and Destruction of Elusive Surface Targets

For many years, the DOD has steadily improved its ability to conduct precision strike against fixed and other predictable targets. However, experience shows we still need better ways to detect, identify, track, and defeat elusive surface targets.

America's adversaries realize they must constantly remain on the move, and hide when not on the move, if they are to survive against the United States' superior precision strike capabilities. For a number of reasons, it remains difficult to strike targets that are hiding, moving, or whose destruction requires near real-time reaction by U.S. forces. Hence, the basic challenge behind this thrust is, "How can we find and defeat any target—and only that target—anywhere, anytime, and in any weather?"

DARPA is assembling the sensors, exploitation tools, and battle management systems needed to meet this challenge by seamlessly melding sensor tasking with strike operations. Success will blur or even erase barriers between the intelligence and the operations functions at all levels of command, which has large implications for U.S. military doctrine and organization.

As an example of our vision, DARPA is working on foliage-penetrating radar that could be used to spot potential targets hiding under forest "canopies" over a large area in all weather. This information could be used to cue laser detection and ranging (LADAR) sensors to look more closely at those potential targets. These LADAR sensors, which are another DARPA project, could provide exquisitely detailed three-dimensional images of the vehicles hiding under trees, allowing us to identify them as tanks or trucks or something else.

We are also developing software to "stitch together" information from a variety of sensors (e.g., moving target indicator radar, synthetic aperture radar, optical, video, and acoustic sensors), and then cue the sensors to obtain more information. For example, changes detected by radar could cue LADAR sensors to watch a new arrival. Conversely, if a Predator operator lost track of a target because it entered a forest, radar could be cued to search for the vehicle. All in all, we are taking a very comprehensive approach to finding, identifying, tracking and destroying targets.

Let me give you some specific examples of what we are doing:

DARPA's Airborne Video Surveillance program succeeded in matching frames from unmanned air vehicle (UAV) video to geospatial reference imagery provided by the National Geospatial-Intelligence Agency with targeting accuracies of 7–10 meters. This automatic linking of UAV video to existing maps is a dramatic and low-cost improvement that will greatly improve the operational flexibility of coordinate-seeking weapons such as Joint Direct Attack Munition, Joint Standoff Weapon, and modern Army artillery. Our current Video Verification and Identification program is building on the success of this work.

Under our Advanced Intelligence, Surveillance, and Reconnaissance (ISR) Management program, DARPA developed a tool for planning, scheduling, and tasking U.S. intelligence collection and surveillance platforms. The tool can perform dynamic replanning as the battlespace situation changes. Its effectiveness was verified in recent Air Force exercises and it is now included in the Collection Management Mission Applications—the system for collection management used by ISR planners and managers.

DARPA's Knowledge-Aided Sensor Signal Processing and Expert Reasoning (KASSPER) program uses topography, terrain features, road networks, and synthetic aperture radar imagery to greatly reduce false alarms and improve the detection of low-speed targets. With KASSPER, false alarms have been reduced by a factor of 100 even in the presence of highly irregular background clutter and we can detect objects moving only half as slowly as we could before. Technologies from KASSPER will start to transition to the Joint Surveillance and Target Attack Radar System (STARS) this year.

Robust, Secure Self-Forming Tactical Networks

The DOD is in the middle of a transformation to what is often termed "Network-Centric Operations." In simplest terms, the promise of network-centric operations is to turn information superiority into combat power so that the U.S. and its allies have better information and can plan and conduct operations far more quickly and effectively than any adversary.

At the core of this concept are networks—networks that must be as reliable, available, and survivable as the weapons platforms they connect. They must distribute huge amounts of data quickly and precisely across a wide area. They must form themselves without using or building a fixed infrastructure. They must withstand attempts by adversaries to destroy, disrupt, or listen in on them. These challenges must be met, as networks are becoming at least as important as our weapons platforms. So, our challenge here is, "How can we build the robust communication networks needed for network-centric warfare?"

DARPA is working to ensure that U.S. forces will have secure, assured, high-data-rate, multisubscriber, multipurpose (e.g., maneuver, logistics, intelligence) networks

for future forces. This means conducting research in areas that include mobile ad hoc self-forming networks; information assurance and security; spectrum management; and anti-jam and low probability of detection/intercept communications.

For example, our Networking in Extreme Environments program is working to create ultra wideband wireless networks for robust and efficient military communications and sensing. Ultra wideband devices should be capable of automatically forming hard-to-detect communications and sensor networks in areas where traditional technologies do not perform well, such as in urban or other cluttered, harsh environments. So far, the program has gained a thorough understanding about how ultra wideband systems interact with current radio systems, one key to determining the ultimate value of ultra wideband.

In the area of information assurance, the threat to military networks from computer worms that have never been seen before, and that exploit previously unknown network vulnerabilities ("zero-day worms") has exceeded current network defense capabilities to mount an adequate defense. DARPA's Dynamic Quarantine of Worms program will develop an integrated system of detection and response devices to quarantine zero-day worms and stop them from spreading before other parts of the network are protected.

Other DARPA-developed network security tools proved to be very effective at the 2004 Joint Warrior Interoperability Demonstration, a virtual military exercise conducted each year by the Office of the Chairman of the Joint Chiefs of Staff. These tools were able to provide protection and help network administrators clean up the network after an accidental security incident. Lessons from these exercises help provide information on which network security technologies the DOD should procure. More generally, technology from our Network Modeling and Simulation program has been adopted by a number of other agencies throughout the DOD, such as Space and Naval Warfare Systems Command, Joint Forces Command, and the Defense Information Systems Agency to do a better job of designing communication networks.

An example of what we are doing in the areas of networks for our forces deployed in Iraq today is the Marine Airborne Retransmission System (MARTS) program. The Marine Corps has an urgent need to securely extend the range of tactical radios in its area of operations. MARTS does this by using a tactically transportable aerostat system, which retransmits through antennas aloft and uses fiberoptics to connect to the ground station radios. An aerostat tethered at 3,000 feet altitude can retransmit a radio signal over an area approximately 160 miles in diameter. The aerostat underwent its first test flight the first week in February, and the first system will be deployed with the Marine Corps in Iraq very soon.

Networked Manned and Unmanned Systems

Fully autonomous unmanned platforms offer great promise as warfighting platforms integrated with other elements of our Joint Forces. DARPA is working with the Services toward a vision of filling the battlespace with unmanned systems networked with manned systems. The idea is not simply to replace people with machines, but to team people with autonomous platforms to create a more capable, agile, and cost-effective force that also lowers the risk of U.S. casualties. The challenge here is, "How can we combine manned and unmanned systems to create entirely new types of capabilities?"

Over the last several years, the Services have come to appreciate that combining unmanned with manned systems can enable new combat capabilities or new ways to perform hazardous missions. Improved processors and software are achieving the dramatic increases in on-board processing needed for unmanned systems to handle ever more complex missions in ever more complicated environments. Networking these vehicles in combat will improve our knowledge of the battlespace, targeting speed and accuracy, the survivability of the network of vehicles, and mission flexibility. A network of collaborating systems will be far more capable than the sum of its individual components.

DARPA is working on a variety of unmanned vehicles for both the air and the ground, ones suited to a variety of missions and levels of environmental complexity. Our A–160 program is working towards an unmanned helicopter for ISR missions, with as much as 32 hours endurance at 15,000 feet. So far, A–160 vehicles have made 28 flights, carried up to 500 pounds, traveled at over 135 knots, and stayed aloft for over 7 hours. A number of other vehicles are part of our support to the Army's Future Combat Systems program. These include the Micro Air Vehicle, which is a backpackable ISR system for dismounted soldiers, the Unmanned Ground Combat Vehicle for fire support, and several other platforms for ISR and tactical strike. Our Netfires program, a fully networked containerized missile system, has transitioned to an Army development program for fielding as early as 2008.

A prominent program here has been Joint Unmanned Combat Air Systems (J–UCAS), which the Office of the Secretary of Defense asked DARPA to manage in fiscal year 2005. J–UCAS is a joint Air Force and Navy program to accelerate the development of networked unmanned combat air vehicles for suppressing enemy air defenses, providing precision strike and persistent surveillance. The program builds on DARPA's earlier work on unmanned combat air vehicles. The program will develop new air vehicles, but the key to J–UCAS will be its Common Operating System (COS), which will manage its network services and other system resources (e.g., sensors, weapons, and communication links). The combination of the air vehicles, control stations, and the COS, in conjunction with other manned and unmanned systems, will create an entirely new and powerful global strike capabilities.

In the last year we have made solid progress in J–UCAS, including several "firsts." A demonstrator vehicle successfully delivered an inert Global Positioning System (GPS)-guided smart bomb from 35,000 feet at 440 miles per hour; the weapon precisely hit the target. Control of a vehicle was handed off to a control station 900 miles away—and back again—while the vehicle was beyond-line-of-sight.

Various features required to operate on a carrier deck were demonstrated. Perhaps most importantly, two demonstrator vehicles flew together as a single team controlled by only one operator on the ground.

In fiscal year 2006, management and funding for the program will move to the Air Force.

In another "first," DARPA held its first Grand Challenge in March 2004. DARPA is using the special prize authority authorized by Congress to recognize outstanding achievements in basic, advanced, and applied research, technology development, and prototype development that have the potential for application to the performance of the military missions of the DOD. The concept is similar to the prize awarded to Charles Lindbergh for his solo flight across the Atlantic Ocean that then spurred Americans toward innovation and development in aviation.

DARPA's first use of the prize authority is to accelerate technology development in autonomous ground vehicles. DARPA offered a $1 million prize to anyone that could develop an autonomous, unmanned ground vehicle that could travel approximately 150 miles in under 10 hours across desert roads and trails between Barstow, California, and Primm, Nevada. The vehicles had to be truly autonomous, and only two commands were allowed—start and stop. The teams would not know the route beforehand—in fact, they received the route navigation points just 2 hours before the start signal.

DARPA designed this grand challenge to spur innovation in a very difficult technical area so as to help DOD meet the congressional goal that one-third of the Armed Forces' operational ground combat vehicles be unmanned by 2015. The autonomous vehicles would remove our men and women from harm's way by letting the autonomous vehicles take over dangerous combat support missions, such as that faced by our supply convoys in Iraq today.

The Grand Challenge for autonomous ground vehicles serves an important part of our overall technical strategy. For years DARPA funded programs to develop the technologies necessary for a truly autonomous ground vehicle, and, still today, there are programs underway at DARPA. While there is measurable technical progress in each of these programs, the progress has not been quick enough on the ability to develop an autonomous vehicle that could navigate a long route, avoid obstacles, and do it with an average speed that is tactically useful to the Joint Forces.

This is where the Grand Challenge helps—to win the prize, teams competing in the Grand Challenge must develop vehicles that can successfully travel tactically relevant distances and speeds. This is a truly daunting technical goal, but not too daunting that no one was interested in trying to win the prize, and a place in the history books.

One hundred and six entrants filed applications to compete, and, through a series of selection processes, 15 teams were selected as having vehicles safe and capable enough to attempt the route for the prize.

Here's what Scientific American[1] reported about the March 13 event:

> Of the 15 vehicles that started the Grand Challenge . . . not one completed the 227 kilometer course. One crashed into a fence, another went into reverse after encountering some sagebrush, and some moved not an inch. The best performer, the Carnegie Mellon entry, got 12 kilometers before taking a hairpin turn a little too fast. The $1-million prize went unclaimed. In short, the race was a resounding success. The task that the Pentagon's most forward-thinking research branch . . . set out was breathtakingly de-

[1] Scientific American 291, 6, p. 6 (December 2004)

> manding. Most bots can barely get across a lab floor, but DARPA wanted them to navigate an off-road trail at high speed with complete autonomy. The agency had expected maybe half a dozen teams, but more than 100, ranging from high school students to veteran roboticists, gave it a try. The race . . . has concentrated the minds of researchers, blown open the technological envelope and trained a whole generation of roboticists. They will be out there again next October.

All across the Nation, from garages to high schools, from universities to corporate laboratories, hundreds—perhaps thousands—of people worked on solving a problem important to the DOD. We had hoped that the Grand Challenge would excite many people, but it grew into something much, much bigger than anyone had imagined. The congressionally-authorized prize authority inspired many smart people who would not ordinarily work on a problem important to the DOD, dedicating long days, nights and weekends toward finding a solution. The Grand Challenge yielded more benefit for the DOD than the technology developed for the vehicles, or the distance the vehicles traveled.

DARPA will run the Grand Challenge again on October 8, 2005. The end goal remains the same: build an autonomous ground vehicle that can travel the fastest across approximately 150 miles of tough desert roads and trails in under 10 hours—but the prize will be $2 million. As of this date, 195 teams have applied to compete in the Grand Challenge from 37 States and three foreign countries. Thirty-five teams are university-based, and three are from high schools. Eventually, we will invite 40 teams to a national qualification event, from which 20 teams will be selected to compete.

Urban Area Operations

Our newest strategic thrust, announced last March, is urban area operations. Like many in the DOD, we have been concerned about the challenges of urban warfare and have been studying the issue. The conflict in Iraq precipitated this strategic thrust and continues to shape it. We held a major solicitation on this topic last year, and the overall thrust continues to take form. Because this is our newest thrust and one that is directly grappling with some of the problems uppermost on everyone's mind, it merits discussing at some length.

Each year the world's urban areas increase in population and area. By 2025, nearly 60 percent of the world's population will live in cities. Our adversaries know that if they present a fixed target on the open battlefield, or even a mobile target on the open battlefield, we will find it and destroy it. So more and more they will choose to resist us in cities. These basic facts suggest that our forces must be increasingly prepared to operate in urban areas.

It is worth considering what makes operating in cities distinctive. A city's geometry and demography are very different than the traditional battlefields of open- or semi-open terrain so effectively dominated by U.S. forces today. Cities have buildings and tunnels and a complex three-dimensional terrain with many places to hide and maneuver. Think of mountain ranges or other rugged terrain, but with a much finer structure—one scaled to cities because they are manmade environments. Cities are densely packed with people and their property.

This has several consequences. Vehicles, weapons, and tactics that work effectively in open—even rugged—natural terrain, often work far less well in the confines of a city. Our current surveillance and reconnaissance systems simply cannot provide enough information of the type needed to understand what's really going on throughout a city. In most cases of urban warfare, standoff attack will not be sufficient, and close combat tends to be chaotic with many casualties.

In cities, uniformed adversaries and their equipment are mixed in among the civilian population, equipment and infrastructure. Insurgents are not just mixed in—they blend in. Operations in cities, perhaps more than in other settings, will be strongly constrained by political considerations. Achieving our political goals will usually not be a simple matter of capturing territory or reducing something to rubble. The fighting in Najaf last summer is a good example of this reality.

In short, the advantages U.S. forces enjoy on traditional battlefields are drastically reduced in cities. This is why our adversaries will be temped to fight us or resist us there; it is a logical response on their part. By drawing us into cities, our adversaries hope to limit our advantages, draw more of our troops into combat, inflict greater U.S. casualties, and, perhaps equally important, undermine our ultimate political goals by causing the U.S. to make more mistakes that harm civilians and neutrals.

The proof of this is in Iraq: the power, pace, and precision of our forces quickly demolished the Iraqi armed forces on the traditional battlefield. The current insurgency is not fighting the same way.

So our challenge is this: "How can we operate as effectively in the cities as we do on traditional battlefields, and what are the new tools we need?" We chose the word "operate" carefully: this cannot just be about traditional force-on-force urban combat, as important as that problem is. We also need to improve our stability and security operations after major combat is over. Just as the tools for combat on the traditional battlefield may not be well-suited to urban combat, the tools for urban combat may not necessarily be well-suited for stability operations. We need better tools across this entire spectrum of operations.

In general, we need far better and different information and coverage from our surveillance systems and sensors, more precision and options in our maneuvers and command and control, and much finer control over the force we apply. Ideally, we would then know much more about what's going on in a city, we could easily discern friend from foe, we could move around quickly—even using the vertical dimension to our advantage—and, when we needed, we could apply well-calibrated lethal or non-lethal force with great precision.

Let me talk in a little more detail about our vision for this thrust and describe some of the things we are working on and would like to expand.

One critical key to improved urban operations will be persistent, staring reconnaissance, surveillance, and target acquisition (RSTA) systems that vastly improve what we know about what's going on throughout a city in all three dimensions and over time. We need persistent staring RSTA systems that are as well tailored to cities as our current RSTA systems are to the traditional battlefield. If you are on an open plain you can see what is going on miles away, but in a city, you may not know what's going on a block away. We have to change that.

We need a network, or web, of sensors to better map a city and the activities in it, including inside buildings, to sort adversaries and their equipment from civilians and their equipment, including in crowds, and to spot snipers, suicide bombers, or improvised explosive devices (IEDs). We need to watch a great variety of things, activities, and people over a wide area and have great resolution available when we need it. This is not just a matter of more and better sensors, but just as important, the systems needed to make actionable intelligence out of all the data. Closely related to this are tagging, tracking, and locating (TT&L) systems that help us watch and track a particular person or object of interest. These systems will also help us detect the clandestine production or possession of weapon of mass destruction in overseas urban areas.

There was a recent incident in Iraq where one of our UAVs spotted some insurgents firing a mortar. Then the insurgents climbed back into their car and drove away. The good news was that the UAV was able to track the car so U.S. helicopters could go after it and destroy it. The bad news was that, at one point, some of the passengers got out. Then we had to decide whether to follow those individuals or the car because we simply did not have enough coverage available. If we had other sensors available, we would have had a better chance of getting all of those insurgents.

If we could quickly track-back where a vehicle came from, it would greatly help us deal with suicide car bombers. It is difficult, if not impossible, to deter the bombers themselves, just as you cannot deter a missile that has already been launched. But, one key to deterrence that has been missing is reliable attribution, or a "return address." If we knew where the car came from, using, for example, RSTA systems that allowed us to quickly trace the car carrying the explosives back to the house or shop it came from, we could then attack that place and those people.

Once people realize that whoever helps launch a suicide attack will themselves be targeted (and since it's unlikely that everyone in a suicide bombing organization has a suicide wish) we would start to deter attacks. At a minimum, we would destroy more of the people and infrastructure behind the attacks, and make subsequent attacks more difficult. We are pursuing this sort of capability with our Combat Zones That See program.

Now, consider a U.S. team raiding a house looking for insurgents. This team has probably never been to the house before, and perhaps has never even been to the immediate neighborhood. In an unfamiliar place with many similar buildings, it's easy to become confused and break into the wrong place, even with GPS. Breaking into the wrong building has two effects: the enemies get away, and, at a minimum, you probably just made some new enemies.

Instead, imagine that the team could prepare for the raid using clear, three-dimensional images of the actual neighborhood and the specific building that had been collected in advance. The team could use those images to practice and "see" their entire trip to the building before they actually start out on their mission so they'd be far more likely to enter the right building. Our Urbanscape program is working on the technologies to do this.

Another typical urban mission could require a U.S. team to pursue adversaries inside a multistory building. Currently, the defenders inside the building have a major advantage in knowing the interior layout. If we had technology that would allow our team to quickly map the inside of the building and, perhaps, even tell them where the bad guys are, this would go a long way to improving the team's effectiveness and safety. Our Building Structure and Activity Assessment program is developing this capability.

Thinking more broadly than RSTA, we are also interested in how to improve our intelligence on general social, political, and economic conditions. In particular, it would help to have tools to predict the onset of a rebellion or, failing that, help us understand more clearly the likely or possible responses to our actions, i.e., tools to wargame our stability operations.

Another major focus of the urban area operations thrust is Command and Control for Urban Warfighting, aimed at developing command and control systems and intelligence analysis tools specifically suited for urban operations. The goal is collaborative systems that allow our warfighters to see and understand what is happening throughout an urban area and then direct their actions in real time. RSTA and TT&L will give us much better information, but we must then use that information to direct what we are doing in a precise way, perhaps reaching down as far as the individual soldier.

Our Command Post of the Future (CPOF) technology, being used today by the Army in Iraq, is an early indication of what we are striving for. CPOF is a distributed command and control system that creates a virtual command post. With CPOF, command and control centers could be wherever the commanders are, without regard to a fixed geographic location. The Army is using CPOF because it gives them more flexibility and insight and allows them to share information and respond more quickly. By studying the steps usually taken after specific types of events, DARPA is working with the Army to enhance CPOF to automatically alert people to take those steps whenever another such events happens, which would allow our warfighters to respond faster. Major General Pete Chiarelli, Commander of the 1st Calvary Division in Iraq, has told us, "CPOF is saving lives."

This thrust also embodies our work in Asymmetric Warfare Countermeasures, including those devoted to countering the threat of IEDs. The IED problem is very difficult, and we are actively pursuing and continuing to search for ideas to detect or disable IEDs. In fact, the IED problem has been central in shaping our thinking about urban operations generally. We have seen the great difficulty we've had with even costly partial solutions to the IED problem, ones which, in many cases, the insurgents are able to quickly work-around. Our discussions with Commandant Hagee of the Marine Corps reinforced our belief that the key to limiting IEDs will be identifying their source; this is one of the reasons for our strong emphasis on RSTA in this thrust.

Finding "sources" is also the key behind DARPA's low-cost Boomerang shooter detection and location system, which we continue to improve based on results from the 50 units deployed so far in Iraq. When you are traveling in a convoy it's difficult to know if you are being shot at because of road noise. With Boomerang, people in the convoy can tell if they are being shot at and where the shots are coming from, so they can defend themselves more effectively.

We are also exploring ways to thwart rocket-propelled grenade (RPG) attacks. We are transitioning an advanced, lightweight bar armor to the Marine Corps to protect High Mobility Multipurpose Wheeled Vehicles (HMMWVs) and trucks. We are testing novel, high-strength nets to stop RPGs and mortars. Our Iron Curtain project will develop and test a system to destroy RPGs and missiles by shooting them down with bullets before they can strike a vehicle.

Another facet of the urban operations thrust is modeling and simulation tools, which we believe will be particularly helpful for improving training. For example, we have leveraged multi-player computer game technology to help train units going to Iraq on better ways to avoid being ambushed. After a few times through the simulation, and after having "died" a few times, the lessons on what to watch for and how to react tend to stick in the warfighters' minds. We have married speech recognition technology with video game techniques to create a Tactical Iraqi Language Tutor that quickly teaches everyone, not just linguists, the Arabic needed to get basic "Who? What? and Where?" information, while getting along with the locals by conducting a civil affairs mission in a PC virtual world. Our troops are even taught the physical gestures and social conventions needed to help establish trust.

With these and other technologies, our strategic thrust in urban area operations promises to make major contributions to our military capabilities.

Detection, Characterization, and Assessment of Underground Structures

Our adversaries are well aware of the U.S. military's sophisticated ISR assets and the global reach of our strike capabilities. In response, they have been building deeply buried underground facilities to hide various activities and protect them from attack.

These facilities can vary from the clever use of caves to complex and carefully engineered bunkers in both rural and urban environments. They are used for a variety of purposes, including protecting leadership, command and control, hiding artillery and ballistic missiles launchers, and producing and storing weapons of mass destruction.

Our challenge here is, "How can we find out what is going on inside deeply buried structures?" To provide answers, DARPA is developing ground and airborne sensor systems with two-orders-of-magnitude improvement in sensor performance, combined with advanced signal processing for clutter rejection in complex environments.

For example, our Low Altitude Airborne Sensor System (LAASS) program should show that sensor payloads on a wide range of air vehicles could dramatically increase search rates and our detailed characterizations of underground facilities. LAASS will be the first sensor system to reveal the connections among underground facilities that were not seen during their construction, and it will be able to distinguish active facilities from those that are abandoned. This will allow prioritization of attacks, as well as allow us to find buried, but inert, targets such as escape tunnels and weapons caches.

Assured Use of Space

The national security community uses space systems to provide weather data, warning, intelligence, communications, and navigation. These satellite systems provide our national security community with great advantages over potential adversaries. American society as a whole also uses space systems for many similar purposes, making them an integral part of the U.S. economy and way of life.

These advantages—and the dependencies that come with them—have not gone unnoticed, and there is no reason to believe they will remain unchallenged forever.

In fiscal year 2001, DARPA began an aggressive effort to ensure that the U.S. military retains its preeminence in space by maintaining unhindered U.S. access to space and protecting U.S. space assets from attack.

There are five elements in DARPA's space strategic thrust:

- Access and Infrastructure: technology to provide rapid, affordable access to space and efficient on-orbit operations;
- Situational Awareness: the means for knowing what else is in space and what that "something else" is doing;
- Space Mission Protection: methods for protecting U.S. space assets from harm;
- Space Mission Denial: technologies that will prevent our adversaries from using space to harm the U.S. or its allies; and
- Space-Based Engagement: reconnaissance, surveillance, communications, and navigation to support military operations down on Earth—extending what the U.S. does so well today.

In our access and infrastructure activities, the Falcon program is designed to vastly improve the U.S. capability to reach orbit or almost anywhere on the globe promptly from bases in the continental U.S. This will improve the military's ability to quickly position ISR payloads, while reducing its reliance on forward and foreign basing. This year, the Falcon program will launch the first of a series of new, low-cost, small launch systems to deliver new hypersonic test vehicles to near-space. By 2008, Falcon will have conducted flight tests of two generations of hypersonic test vehicles, using them to assess designs, components, and materials for reusable hypersonic cruise vehicles that could revolutionize space access and near-space transportation.

The Space Surveillance Telescope program will enhance our space situational awareness by developing a large-aperture optical telescope with very wide field of view using curved focal plane array technology to detect and track very faint objects in deep space. This past year the program successfully demonstrated a subscale telescope sensor composed of a mosaic of curved focal plane arrays, a key technology milestone for the program.

The U.S. national security community and American society depend on communications satellites. We must be prepared for adversaries that might try to deny us their use by jamming them. Under Space Mission Protection, the Novel Satellite Communications program is aimed at keeping our communication satellite systems secure. Last year, DARPA successfully demonstrated a new approach to dramati-

cally improve our satellites' protection against jamming. This year we are developing the technology to fully exploit this new technique; a real-time demonstration of the Novel Satellite Communications technologies is planned for 2008.

In space-based engagement, the Innovative Space Based Radar Antenna Technology (ISAT) program is developing large, revolutionary radar antennas to provide continuous tactical-grade tracking of moving ground targets or airborne targets, such as cruise missiles. These antennas would be extremely lightweight and, when stowed for launch, would be about the size of a sport utility vehicle. Once on-orbit, such antennas would unfold to a structure that could be, in the fully operational version, the length of the Empire State Building. This past year DARPA successfully built and deployed a single section of the antenna on the ground, and we successfully demonstrated techniques that would measure the position and shape of the antenna to within one millimeter on-orbit. Multiple sections of the antenna will be built this next year, combined, and deployed and tested in a thermal vacuum chamber that simulates the space environment. The ISAT space-based demonstration of a one-third-scale antenna is planned for 2010.

Cognitive Computing

Many elements of the information technology revolution that have vastly improved the effectiveness of the U.S. forces and transformed American society (e.g., time-sharing, personal computers, and the Internet) were given their impetus by J.C.R. Licklider, a visionary scientist at DARPA some 40 years ago. Licklider's vision was of people and computers working symbiotically. He envisioned computers seamlessly adapting to people as partners that would handle routine information processing tasks, thus freeing the people to focus on what they do best—think analytically and creatively—and greatly extend their cognitive powers. As we move to an increasingly network-centric military, the vision of intelligent, cooperative computing systems responsible for their own maintenance is more relevant than ever.

Despite the enormous progress in information technology over the years, information technology still falls well short of Licklider's vision. While computing systems are critical to U.S. national defense, they remain exceedingly complex, expensive to create, insecure, frequently incompatible, and prone to failure. They still require the user to adapt to them, rather than the other way around. Computers have grown ever faster, but they remain fundamentally unintelligent and difficult to use. Something dramatically different is needed.

In response, DARPA is revisiting Licklider's vision as its inspiration for the strategic thrust, "Cognitive Computing." Cognitive computers can be thought of as systems that know what they're doing. Cognitive computing systems "reason" about their environments (including other systems), their goals, and their own capabilities. They will "learn" both from experience and by being taught. They will be capable of natural interactions with users, and will be able to "explain" their reasoning in natural terms. They will be robust in the face of surprises and avoid the brittleness and fragility of expert systems.

As an example of how we are working to get the computers to adapt to people—instead of the other way around—our Improving Warfighter Information Intake Under Stress program is designing next-generation Tomahawk missile battlestations that will monitor the weapon operator's cognitive state. The battlestation will then adapt how the battlespace information is presented to operators so that it enhances their ability to make critical strategic and/or tactical time-sensitive targeting decisions.

Bio-Revolution

Over the last decade and more, the U.S. has made an enormous investment in the life sciences. DARPA's "Bio-Revolution" thrust seeks to answer the question, "How can we use the burgeoning knowledge from the life sciences to help the warfighter?"

DARPA's Bio-Revolution thrust has four broad elements:

- Protecting Human Assets from biological warfare includes sensors to detect an attack, technologies to protect people in buildings, vaccines to prevent infection, therapies to treat those exposed, and decontamination technologies to recover the use of an area.
- Enhancing System Performance refers to creating new man-made systems with the autonomy and adaptability of living things by developing technology inspired by living systems.
- Maintaining Human Combat Performance is aimed at improving the warfighter's ability to maintain peak physical and cognitive performance once deployed, despite extreme battlefield stresses such as heat and alti-

tude, prolonged physical exertion, sleep deprivation, and a lack of sufficient calories and nutrients.

• Tools are the variety of techniques and insights on which the other three areas rest.

Let me give you some examples of our work.

DARPA is conducting important work in our Human Assisted Neural Devices and Revolutionizing Prosthetics programs. Our vision is simple but bold: to dramatically improve the quality of life for amputees by developing limb prostheses that are fully and naturally functional and neurologically controlled limb replacements that have normal sensory abilities. The goal is for amputees to return to a normal life, with no limits whatsoever, with artificial limbs that work as well as the ones they have lost.

Our vision includes not only regaining fine motor control, such as the ability to type on a keyboard or play a musical instrument, but also the ability to sense an artificial limb's position without looking at it, and to actually "feel" precisely what the artificial limb is touching. To do this, DARPA's work in materials, sensors, power systems, and actuators will be integrated to develop a highly advanced, multiple degree-of-freedom, lightweight mechanical limb.

Our ultimate goal is to gain full, natural, neural control of this advanced prosthetic limb—durable, lifelike, and complete with sensory feedback. On the way towards this vision, we will create prosthetic arms that are vast improvements over the current state-of-the-art and technologies that will be directly applicable to advanced prosthetics for the lower extremities. DARPA is working closely with the Department of Veterans Affairs to make this a reality.

DARPA's Handheld Isothermal Silver Standard Sensor program is working toward providing our warfighters with a lightweight, handheld detector capable of sensing the full spectrum of biological threats: bacteria, viruses, and toxins. In a laboratory test last year, this sensor achieved nearly perfect detection performance, while minimizing the false alarms that plague today's sensor technologies.

Our Immune Building Program is focused on protecting the occupants of buildings from the release of chemical or biological agents directly inside or very nearby and dealing with the consequences of the attack. The first fully functional Immune Building is scheduled for completion in 2006 at Fort Leonard Wood, Missouri. A portable version of DARPA's chlorine dioxide gas decontamination technology is being developed for use by the DOD, the Department of Homeland Security, and the Environmental Protection Agency.

The Powerswim program is using the highly efficient way sea animals swim to design a new swimming device. Ordinary swim fins push through the water, like oars push a boat, and are about 10 percent efficient. The Powerswim program is developing a device that uses fin lift for propulsion—it basically "flies" through the water—with an efficiency of 80 percent. This could double the speed and range of U.S. Navy SEALs, allowing them to arrive on-shore much faster and much less fatigued. In another maritime example of using biology, we are looking at fuel cells that could produce electric power from plankton and ocean bacteria to power sensors and surveillance systems on the ocean floor for many years.

DARPA's Soldier Self-Care program is developing a highly effective novel pain medication that neutralizes the chemical trigger for pain before it can stimulate the nerves. Progress has been so substantial that we have funded a clinical trial at Walter Reed Army Medical Center in late 2005 to reduce the incredible pain of soldiers following amputation or severe limb trauma whose pain cannot be effectively treated with current medications. If successful, it will be a major step towards obtaining Food and Drug Administration approval of this medication for treating acute pain on the battlefield.

DARPA'S CORE TECHNOLOGY FOUNDATIONS

While DARPA's eight strategic thrusts are strongly driven by national security threats and opportunities, a major portion of DARPA's research emphasizes areas largely independently of current strategic circumstances. These core technology foundations are the investments in fundamentally new technologies, particularly at the component level, that historically have been the technological feedstocks enabling quantum leaps in U.S. military capabilities. DARPA is sponsoring research in materials, microsystems, information technology, and other technologies that may have far-reaching military consequences.

Materials

The importance of materials technology to Defense systems is easy to underestimate: many fundamental changes in warfighting capabilities have sprung from new

or improved materials. The breadth of this impact is large, ranging from stealth technology to information technology.

In keeping with this kind of impact, DARPA maintains a robust and evolving materials program to push new materials opportunities and discoveries that might change way the military operates.

DARPA's current work in materials includes the following areas:

- Structural Materials and Components—low-cost and ultra-lightweight, designed for structures and to accomplish multiple performance objectives in a single system;
- Functional Materials—advanced materials for non-structural applications such as electronics, photonics, magnetics, and sensors;
- Smart Materials and Structures—materials that can sense and respond to their environment; and
- Power and Water—materials for generating and storing electric power, for purifying air or water, and harvesting water from the environment.

We have been working on "multifunctional materials"—materials that combine structure with other functions, such as batteries that can bear loads. DARPA's WASP micro air vehicle uses these structural batteries to combine its power supply with its wings, allowing this small (less than 200 gram, 12-inch wingspan) micro air vehicle to fly for 1 hour with the current sensor suite, almost three times longer than other, comparably equipped vehicles of similar size. (With a reduced payload, WASP has flown for nearly 2 hours.) WASP is being evaluated by the U.S. Marine Corps and the Nimitz Strike Group as a surveillance asset.

DARPA's rapid reaction program in advanced armor materials is developing an updated version of the Vietnam-era "gun truck" to protect our convoys in Iraq. The gun trucks are a standard military 5-ton Army or Marine truck with an armored gun box in place of the cargo container. Thirty prototype gun box kits were recently sent to U.S. forces in Iraq and Kuwait, and preliminary reports from the theater indicate that the gun trucks provide our troops and convoys with protection and comfortable and comparatively spacious operating quarters.

We are also working to develop significantly improved armor materials for these trucks. One DARPA program is pursuing a lightweight composite armor that uses the same steel wire reinforcement found in steel-belted radial tires, and embeds these wires in a polymer matrix. If successful, this novel material could be a moldable, low-cost, easily manufactured, lower-weight alternative to conventional steel armor, while providing the same or greater protection to our warfighters. Initial ballistic tests on these new materials are very promising.

In collaboration with the Navy, we are exploring DARPA advanced material technology to establish the feasibility of a passively cooled jet blast deflector for CVN 21, which could also be retrofit to the existing fleet. This system would be 50 percent lighter by eliminating noisy and heavy hydraulics and water-cooling systems associated with conventional jet blast deflectors, while freeing up space and power for other equipment.

Our DARPA Titanium Initiative aims to completely revolutionize the way titanium is extracted from the ore and fabricated into product forms of interest to the DOD. The goal of the program is to achieve substantially reduced cost (less than four dollars per pound) and increased availability of large volumes of titanium. Our intention is to achieve a revolution similar to that in aluminum, which was transformed from a precious metal to a commodity at the turn of the 20th century. The program is on-track to develop processes that will meet all the DOD requirements for aerospace and other applications.

Microsystems

Microelectronics, photonics, and microelectromechanical systems (MEMS) are three key technologies for the U.S. military, enabling it to see farther, with greater clarity, and communicate information in a secure, reliable, and timely manner.

DARPA is shrinking ever-more-complex systems and enabling new capabilities into chip-scale packages, integrating microelectronics, photonics, and MEMS into "systems-on-a-chip." It is at the intersection of these three core hardware technologies of the information age that some of the greatest challenges and opportunities for the DOD arise.

The future lies in increasing the integration among a variety of technologies to create still-morecomplex capabilities. DARPA envisions intelligent microsystems for systems with enhanced radio frequency and optical sensing, more versatile signal processors for extracting signals in the face of noise and intense enemy jamming, high-performance communication links with assured bandwidth, and intelligent chips that allow a user to convert data into actionable information in near-real-time.

Taken together, these capabilities will create information superiority by improving how the warfighter collects, processes, and manages information—ultimately allowing U.S. Forces to think and react more quickly than the enemy.

An example of the move to integrated microsystems is the 3–D Integrated Circuits program. Conventional 2–D circuits are limited in performance by the long signal interconnects across ever larger circuits and by existing circuit architectures. By moving to three dimensions, we can shorten the signal paths and introduce additional functions in each layer of three-dimensional stacked circuits that will change the way designers can exploit circuit complexity.

Advanced materials are important drivers in developing new, advanced microsystems. An example is the progress being made in wide bandgap semiconductor devices for ultraviolet emitters, microwave sensors, and high power electronics. The ultraviolet emitters are being integrated into a compact, low-cost, biosensor based on multi-wavelength fluorescence for a new class of early warning systems being transitioned to the Defense Threat Reduction Agency. The microwave sensors will extend the performance of future radar, electronic warfare, and communications systems, and the advanced power electronics will reduce the size and weight of the power conversion station in future aircraft carriers or enable tactical electromagnetic weapons.

In the past year, wide bandgap ultraviolet light emitters at 280 and 340 nanometers have been incorporated into a prototype biological threat early warning system. Initial field data shows it outperforms the Army's Biological Aerosol Warning System, with a projected 50 times lower cost. The successful development of a low cost bio-sensor with a low false alarm rate, a key to fielding any sensor system, will revolutionize how biological monitoring and defense is performed.

Also over the last year, our work on wide bandgap radio frequency devices has established new benchmarks for power density from a microwave transistor, with close to a 30-fold increase over conventional approaches. This work will enable high performance radio frequency systems to be deployed on restricted-size platforms, such as unmanned air vehicles.

Finally, our work on wide bandgap power switching devices able to stand-off over 10,000 volts has led to the Navy considering, via a memorandum of agreement between DARPA, the Program Executive Office for Aircraft Carriers, and the Chief of Naval Research, the insertion of compact, multi-level signal conversion stations based on this technology in future aircraft carriers that will reduce the size and weight of the power substation by a factor of two, while adding performance.

Information Technology

The DOD is undergoing a transformation to network-centric operations to turn information superiority into combat power. Supporting this, DARPA's information technology programs are building on both traditional and revolutionary computing environments to provide the kind of secure, robust, efficient, and versatile computing foundation that our network-centric future requires. We will also create radical new computing capabilities to make the commander and the warfighter more effective in the field.

An important part of our work in information technology is machine language translation. In past years, we have reported how DARPA's one-way Phraselator is being used in Iraq and Afghanistan. Recently, we demonstrated the first rudimentary two-way Pashto Phraselator; we are now working towards making a natural two-way speech translator for Iraqi Arabic. In addition, U.S. Central Command now uses technology from two other DARPA human language technology programs to help produce a variety of intelligence reports. Their analysts do this using our eTAP-Arabic system, which combines automatic transcription and automatic translation to convert Arabic newswire and news broadcasts to English text.

I hope my remarks today have given you a sense of our programs, as well as a sense of our vision and ambitions, of which I am equally proud. Thank you for this opportunity to appear today. I would be pleased to answer any questions you have.

Senator CORNYN. Thank you very much. I appreciate what you said about DARPA getting suggestions and ideas from all sources, although I hope you are not relying on Congress to provide you any S&T suggestions. We mostly have warriors here and we need, obviously, those ideas to come from the S&T field.

Let me start out. Since it is just Senator Reed and I here for right now—we may have other colleagues join us—we will just go back and forth here. We do have a series of stacked votes, I am in-

formed, at 11:30. So I want to move rather quickly to try to make sure we cover as much as possible.

But I would like to start with Dr. Sega and just have a response from each of you, going down the line. I want to talk about the overall strategy of our S&T budget and approach. I would like to ask each of you to briefly identify what you see as the Department's biggest technology challenge now and, let us say, in the year 2020. I have heard Senator Roberts say this before. It is one of these "what keeps you up at night" sort of questions.

Dr. Sega?

Dr. SEGA. It is a great question. I think what we have been doing from a strategic point of view over the last 3½ years or so, since I have been there, is to emphasize more in the longer term, as well as transitioning technology in the shorter term. The issue of force protection and counterinsurgency efforts that the technology community can bring to bear additional solutions is the reason why we stood up the CTTTF on September 19, 2001. So on a near-term basis, our focus has been significant in that area, and we have gone through three phases of development of that activity, one focused on Afghanistan, another one in OIF, and now force protection and counterinsurgency.

In the longer term, the enabler for us to advance technologies is people. So it is the technical talent that one needs to carry on and provide the discoveries, innovation, and delivery of technical capability to the warfighter in the out years. It is the one that I look at being fundamental to achieving a variety of things in areas, whether it be in chem-bio, defense-related areas.

By the way, we have a new Director of the Defense Threat Reduction Agency, Dr. Jim Tegnelia. I wanted you to know that. I will have Jim raise his hand there.

That is an area that we have emphasized in this budget, for example, but the two in the near term and the long term are the ones I just stated.

Senator CORNYN. Thank you, Dr. Sega.

Dr. Killion.

Dr. KILLION. I certainly have to echo in the near term the issue of force protection as being a real challenge for all of us in terms of finding technologies to protect our soldiers. Clearly we are doing that today and are trying to exploit every advantage we have from the technology base we have developed from past investments.

For 2020, I would say because we are evolving towards a force that is more dependent upon the network for all of its operations, really network science and understanding of the fundamentals of those networks and how to design them so they have all the appropriate features that you want, scalability, robustness, and protection, is a real challenge for us, particularly for a tactical environment. But part of that, again, as Ron was saying, depends upon having that workforce that has the appropriate background, that has the science, math, and engineering expertise, so that the U.S. maintains its competitiveness in the S&T fields.

Senator CORNYN. Admiral Cohen.

Admiral COHEN. I will give a slightly broader answer for today. The reality in research is that you start with 1,000 flowers that develop into 100 projects which evolve into two or three prototypes

to give you one example, the George Foreman Grill, one profitmaker. In the Department of the Navy—and I think it is true in the rest of the DOD and possibly in industry—any good chief executive officer (CEO) or chief operating officer (COO) would like one flower to result in one project to result in one prototype and result in one George Foreman Grill. The Services are to train, recruit, and equip. We fight today's wars. As you look to the underlying S&T base, the 1,000 flowers, the science projects, you do not know what you do not know, and you have to go up a lot of alleys to figure out which ones are blind. Einstein said, "If you knew the answer, it would not be research."

So the balance between the basic research and the output function is a very great challenge today, and you see that reflected in the budget. That is something that I and my colleagues I know lose sleep over.

In 2020, to continue that thought, if we are to have sustained, unfettered research which will maintain our technical and economic—because this is about our economic engine in the world where ideas are perishable and go across nations—the facts of life are to support the technological development and the underlying research with a capable technological workforce and research force. It is only Congress, in my opinion—only Congress—that has the fortitude, division, and the resources to keep these research efforts going at critical levels.

Thank you.

Senator CORNYN. Thank you.

Mr. Engle.

Mr. ENGLE. Thank you, Mr. Chairman.

Fundamentally, the warfighter does three things. They have to find and fix something. They have to communicate what they found and fixed to someone else, and they have to engage it. We do a pretty good job on the finding and fixing, and we do a pretty good job on the engaging. The command and control or the communications aspect of that is probably the most difficult technical challenge because the human is probably the best communicator ever to emerge out of evolution. We like to communicate. We like to communicate in different ways. We are rapidly adaptable to new forms of communication, and to keep up with a prolifery of expanding technology on ways to communicate makes it very difficult for us to get our arms around the concept of a global information grid, FORCEnet, or many other characterizations of our communication and command and control capability.

I would suggest that our biggest challenge now and over the long term is to bring technology to bear to enable us to do that communication more effectively, more rapidly, more precisely with assurance, and that will continue to be a challenge for as long as we have humans trying to figure out new ways to communicate. We are, in fact, investing a large amount of our resources into that particular piece of those three fundamental things, and we will probably continue to do that over the long term.

Thank you, sir.

Senator CORNYN. Dr. Tether.

Dr. TETHER. I agree with two of the responses. I think it is the network. The network is what really bothers me. At DARPA, we

are constantly thinking of what the force of the future will be. We are now taking our organic capabilities on platforms such as sensors and weapons and moving them off board. The Air Force is counting on having situational awareness piped into every airplane and also having weapons that can be shot by one airplane and commanded by another. The Army clearly wants to be strategically mobile and therefore is fractioning its platforms in order to get them down to smaller pieces. The Navy is into a littoral situation. We did an architecture study for the CNO at his request, and again, the answer is defractionate the weapons and the surveillance. The Marines are the same way.

But the secret sauce in all of those concepts is the network. The secret sauce that they all are assuming is going to be there is that when they pick up that phone, they will get a dial tone and they will get an answer. When they want to get that superb situational awareness, it will come to them. If they want to fire a weapon, that will happen.

These networks are not commercial networks. The problem is that these are special networks. When these forces move into a region, we do not have time for the infrastructure to be set up. We do not have time for people to put up towers. The network now will become an integral part of our warfighting capability. It has to form itself as the forces move in. It has to automatically create itself hands-off. We do not have to worry about people because people will not be able to do it. It has to take the nodes, make a network into it, so forth and so on. It has to figure out what frequencies to go use because Federal Communications Commissions (FCCs) in the rest of the world are not the same as ours.

We are putting a lot of money at DARPA into that area because of that concern. We need to be sure that we have robust, ad hoc, self-forming networks that are also capable of withstanding attack because the enemy is going to come after the network. Why? Because people like me blab about this right here and they know that the Achilles heel of our future force is going to be the network, and if they can take the network down, they have devastated the force. So we have lots of efforts in trying to prevent that. These efforts, as you might expect, are classified, but I would be happy to tell you about them all.

We have efforts on both sides, both on defending networks and how to take down networks because sometimes that helps you figure out how to defend networks too. But I think the network is it and that is the big issue for the future.

Senator CORNYN. Thank you very much for that.

I guess all we need to do is look back. I think back to when my dad flew B–17s in World War II and how much our warfighting capabilities have progressed through the Gulf War to Operation Enduring Freedom, OIF, and we are able to do things today that I am sure back then he could not have even dreamed about, and at the same time, protect civilians from collateral damage and the like and defeat the bad guys.

The things I hear a number of you mentioning in terms of the long-term challenges are communications, networks, and a well-trained workforce. Of course, in the last NDAA, we created a program to try to make sure that we were able to develop that work-

force in the future by establishing a science, mathematics, and research for transformation scholarship for service pilot program. Is that an adequate response, Dr. Sega, Dr. Killion, or are there other things that we need to be doing?

Dr. SEGA. First, we appreciate the legislation in the SMART program and the pilot program that it has created. We formed a team across the DOD to set forth how to implement it. We have sent out the announcement for potential candidates. It closed out I think last week and there were over 600 folks that submitted applications for the 20 to 25 slots that will be available in the pilot program, which was very good.

What we have submitted in the budget is a more expanded version of SMART, the SMART–NDEA. So we have extended that a bit and we also are in the process of bringing forward some legislation to potentially expand some of those authorities. That should be over to Congress in the very near future.

So I would like to continue to discuss not only the needs where we see them, but also the mechanisms. The ability to have a payback feature is a good thing. It does a couple of things well. One is if you know the student, say, in their undergraduate program—currently it is 2 years. Maybe we would like to expand it to their full undergraduate period—that encourages the student and the scientist/engineer in the laboratory to build a relationship. It also helps them understand what they are studying by way of getting hands-on work potentially through internships and so forth. If you know you are going to work in a laboratory after graduation, you tend to do your capstone project in that area. So you are kind of preparing yourself in the field in which you are going to work, at least for a while during your payback period. You hit the ground running. When you come into the defense laboratory, you build a relationship and some mentors in the laboratory system and you are tending to do that work versus some other kind of summer job that you may have during the course of your undergraduate experience. There is the potential of also looking at the clearance process somewhere in that time period in which a student is getting the education.

So we would like to look at expanding upon the SMART program, but we think it is a great start.

Senator CORNYN. Dr. Killion.

Dr. KILLION. I agree with Dr. Sega about this SMART program, the NDEA concept. We really do need to look at how we encourage people at those levels in high school and beyond.

I also want to make sure that we remember that we need to encourage people into the science, math, and engineering disciplines very early on, and we have a number of programs in the Army and in the other services where we encourage people to get engaged very early in the process in grade school, in middle school. Those are critically important if you are going to then reap the benefits of that by having people in high school and in college who are going to be interested in and able to participate in these kinds of programs.

I really appreciate the support we have gotten, particularly from this subcommittee, in the past for our e-cyber mission program in the Army which involves 6th through 9th graders engaging in

projects over the Web, and we have teams that participate every year. That has been growing by leaps and bounds over the last few years. That is the time to get people excited.

I was happy to last week participate as a judge for a science fair here locally, and seeing the 7th and 8th graders who are interested in S&E, even at that level, that is where the talent is going to come from in the future. We need to encourage them and then provide them the opportunities when they get older to get involved in the national defense workforce.

Senator CORNYN. I have one other question for Dr. Sega, and then I will turn the floor over to Senator Reed.

We see that investments made in the 1990s and in previous decades are now paying off in numerous ways. From your position as the Department's Chief Technology Officer, as you look outward to 2015, are there things we should be doing differently to better plan for the future? In other words, are we organized to identify future threats and corresponding capability gaps in a 10- to 20-year time frame?

For example, who was in a position to think about things like IEDs and some of the current technology challenges we have today 10 or 15 years in the past? Do we have people thinking about that? Do we have an organization in place to make sure that we are anticipating new challenges?

Dr. SEGA. What we have continued to improve is the integration among the services and agencies over the last few years. We have just recently adjusted our review process to a comprehensive S&T review in which we not only look at the quality of programs, which we have done in Technology Area Review and Assessment (TARA) processes and basic research reviews, but also to examine those areas that we may find that as we project forward, that there are gaps.

We also are looking more globally in terms of where S&T is going. The creation of knowledge is expanding. We can count on the rate of technology increasing through the 21st century. That more global look is important in this planning process. I think the comprehensive S&T review plan is something that we can go into more detail about at some other time. There are lots of arrows, but I think we have captured it and we have done that together with the services and agencies. So that is an important question and one that we are making some progress toward.

Senator REED. Thank you, Mr. Chairman, and let me thank you all, gentlemen, for not only your testimony but for your valuable work for the military and for the United States.

Dr. Sega, everything that has been said today highlights the critical importance and the critical contribution that your programs make. Yet, the budget is not keeping up with both the demands in the world for your products and obviously all the projects that you are thinking about.

Do we have a plan to get to 3 percent funding in the next several years?

Dr. SEGA. Three percent remains the goal. You are looking at the advocates of the S&T program within the DOD. As the Department brings forward the needs and demands from various sectors, they are weighed, and a balanced investment recommendation goes for-

ward and becomes, of course, part of the President's budget request. So we are in a time with a lot of competing demands and we advocate for a strong S&T program, and the result is the program as we have laid it out.

Senator REED. Thank you.

I know there are projects that have not been able to be funded. Dr. Sega and all you gentlemen, for the record, could you send in a list of those unfunded top priority projects that you think are important but just did not make the cut? That would, I think, be very helpful to us as we make our considerations going forward.

[The information referred to follows:]

Dr. SEGA. The fiscal year 2006 President's budget was developed by balancing priorities across all functional areas. We believe the program submitted best represents the Department's priorities based on available funds.

Dr. KILLION. The Army Science and Technology (S&T) program request in the fiscal year 2006 President's budget is consistent with our S&T objectives of enhancing the Current Modular Force and enabling the Future Modular Force. We believe the program submitted best characterizes the Army's priorities based on available funds.

Admiral COHEN. The Navy has established a mature Future Naval Capability (FNC) program that integrates science and technology with the Navy and Marine Corps requirements development process. The FNC program delivers capability for transition to acquisition programs every 3–5 years. The number of warfighting requirements gaps exceeds the funding available to fill them. Additional funds in later 6.2 and 6.3 would be used for a combination of (1) solving additional warfighting gaps as identified by Navy and Marine Corps requirements processes, and (2) accelerating Innovative Naval Prototypes like Electromagnetic Rail-gun, Persistent Littoral Undersea Surveillance and Sea-Base enablers so that those prototype capabilities are delivered sooner.

Additional funds in basic research (6.1) or early-applied research (6.2) would be applied to the Secretary of the Navy's project to detect and defeat improvised explosive devices at range and speed.

Mr. ENGLE. See attached.

AF S&T TOTAL FY06 UNFUNDED PRIORITY LIST
(IN PE VICE PRIORITY ORDER)

PE	Site	Effort	FY06 ($K)	SecAF UPL*	Capability Area
61102F	AFOSR	Directed Electromagnetic Energy	2,000		Force Application
61102F	AFOSR	Nanomaterials for Structures	1,000		Create and Sustain the Force
61102F	AFOSR	Nanoenergetics	1,000		Force Application
61102F	AFOSR	Deep Information Extraction	2,000		Command and Control
61102F	AFOSR	Nanoelectronics	3,000		Provide Net Centric Enterprise
61102F	AFOSR	Biological Interactions for Lethal/Non-Lethal Boundary	2,000		Protect
61102F	AFOSR	Human Decision Making	2,000		Command and Control
61102F	AFOSR	Revolutionary Hypersonics Concepts	4,000		Force Projection
61102F	AFOSR	Ultra-High Work Turbine Engines	1,500		Force Projection
61102F	AFOSR	Logistics Sustainability	2,000		Create and Sustain the Force
61102F	AFOSR	Spacecraft Protection	2,000		Surveillance and Reconnaissance
61102F	AFOSR	Precise Space Positioning	1,500		Surveillance and Reconnaissance
61102F	AFOSR	Cultural Modeling for Influence Operations	2,000		Intelligence
61102F	AFOSR	Super-Dense, Radiation-Hard, Non-Volatile 3-D Memory	2,500		Provide Net Centric Enterprise
61102F	AFOSR	Software Producibility	2,000		Provide Net Centric Enterprise
61102F	AFOSR	Multispectral Imaging	2,000		Surveillance and Reconnaissance
61102F	AFOSR	Laminar Flow For Increased Range and Endurance	1,500		Force Projection
61102F	AFOSR	Information Operations	2,000		Force Application
62102F	Wright	Aging Wiring Monitoring	2,500	Y	Establish and Generate
62102F	Wright	Materials Models for IVHM	4,000	Y	Establish and Generate
62102F	Wright	Accelerated Insertion of Materials	4,500		Establish and Generate
62102F	Wright	Nanostructured Materials for Advanced AF Concepts	5,500		Surveillance and Reconnaissance
62102F	Wright	Innovative Thermal Protection Systems	3,000		Force Application
62102F	Wright	Low-Observable Materials for High Temperature Applications	2,000		Force Application
62102F	Wright	Hypersonic Materials	8,000		Force Application
62102F	Wright	Biotechnology	3,000		Surveillance and Reconnaissance
62102F	Wright	ERLE (Engine Rotor Life Extension)	4,000		Establish and Generate
62102F	Wright	Nanocomposite Materials	3,500		Establish and Generate
62201F	Wright	Characterization of Airborne Environment for Tactical Lasers	1,500		Force Application
62201F	Wright	Net Centric Technology Assessment Environment	1,500		N/A
62201F	Wright	Consortium for Unmanned Air Vehicle System Certification	2,000		Surveillance and Reconnaissance
62201F	Wright	Urban Operations Simulation Environment	1,500		Surveillance and Reconnaissance
62202F	Mesa	Battlefield Air Operations (BAO) Toolkit Distributed Mission Operations (DMO) Interoperability	1,100		Force Application
62202F	Brooks	Bio-Assessment for RF Weaponry	1,500		Protection
62202F	Wright	Biological Interaction of Nanomaterials (BIN)	3,200		Protection
62202F	Wright	Cellular Dynamics and Engineering (CD&E)	4,300		Protection
62202F	Wright	Biological Computing	3,000		Force Application

*Amounts reflected here may be higher than those shown on SecAF UPL

AF S&T TOTAL FY06 UNFUNDED PRIORITY LIST
(IN PE VICE PRIORITY ORDER)

PE	Site	Effort	FY06 ($K)	SecAF UPL*	Capability Area
62202F	Wright	Cognitive Systems Engineering Approach to Command and Control	7,000		Command and Control
62202F	Wright	Commander's Decision Aids for Predictive Battle-space Awareness	1,000		Command and Control
62202F	Wright	Information Operations Innovation Network (IOIN) Experimentation Support	1,250		Provide Net Centric Enterprise
62202F	Wright	Joint Service Planning for Human System Integration (HSI) Design Support Technology	2,000		Establish and Generate
62202F	Wright	Low-Level Nerve Agent Effects	3,100		Protect
62202F	Wright	Mobile Water Desalinization Using Carbon Nanotube Technology	2,500		Establish and Generate
62202F	Mesa	On-Board Electronic Warfare Training Simulation	1,400		Force Application
62202F	Wright	Persistent Multi-INT Air Intelligence, Surveillance, and Reconnaissance (ISR)	2,000		Surveillance and Reconnaissance
62202F	Wright	Prognostic Biomarkers of Performance Decrement	4,500		Force Application
62202F	Mesa	Reusable High Resolution Database Development	1,700		Create and Sustain the Force
62202F	Wright	Satellite Threat Evaluation Environment Development (STEED)	4,000		Surveillance and Reconnaissance
62203F	Wright	Components and Technologies for Direct Lift Tip Turbine Engine	1,250	Y	Force Projection
62203F	Wright	Thermal Management and Power for Airborne Directed Energy Weapons	9,000	Y	Force Application
62203F	Wright	Robust Scramjet	5,000		Force Projection
62203F	Wright	Components and Technologies for Mach 4+ Turbine Engine	2,900		Force Application
62203F	Wright	Thermal Management for Advanced High Power Access to Space and Space Applications	5,000		Force Projection
62203F	Wright	Components and Technologies for Adaptive Versatile Engine	2,500		Force Application
62203F	Wright	EMI Immune High Power Aircraft	5,000		Force Application
62203F	Wright	Advanced Power for Miniature UAVs	3,000		Surveillance and Reconnaissance
62203F	Wright	All Electric Aircraft for Large Platform	4,500		Force Application
62203F	Wright	Advanced Electrical Starter/Generator System Prototype	3,500		Force Application
62204F	Wright	Persistent Multi-INT Air ISR	2,000	Y	Surveillance and Reconnaissance
62204F	Wright	Electro-Optical/Infrared (EO/IR) Sensing of Urban and Obscured Targets	2,500	Y	Intelligence
62204F	Wright	Radio Frequency (RF) Sensing of Urban & Obscured Targets	1,000	Y	Intelligence
62204F	Wright	Sensor Web Modeling, Simulation, and Analysis	500	Y	Surveillance and Reconnaissance
62500F	Wright	Accelerated Insertion of Materials (AIM) for Space	8,000		Establish and Generate
62500F	Wright	Combined Cycle Engine Components	5,000		Force Projection
62601F	Kirtland	Deployable Structures	5,000	Y	Surveillance and Reconnaissance
62601F	Kirtland	Radiation Hardened Electronics	1,000	Y	Protection
62601F	Kirtland	Responsive Spacecraft	400	Y	Force Projection
62601F	Hanscom	Seismic Technology	2,000		Surveillance and Reconnaissance

*Amounts reflected here may be higher than those shown on SecAF UPL

AF S&T TOTAL FY06 UNFUNDED PRIORITY LIST
(IN PE VICE PRIORITY ORDER)

PE	Site	Effort	FY06 ($K)	SecAF UPL*	Capability Area
62602F	Eglin	Munition Explosive Research Including Nano Energetics	3,100		Force Application
62602F	Eglin	Improved Multimode Warhead Research	1,200		Force Application
62602F	Eglin	Micro Air Vehicle for Bomb Damange Information Gathering	1,000	Y	Force Application
62702F	Rome	Quantum and Biomolecular Information Processing Technology	1,500		Provide Net Centric Enterprise
62702F	Rome	Data Hiding/Stegenography	1,500		Intelligence
63112F	Tyndall	Composite Airfield Matting	2,900	Y	Establish and Generate
63112F	Wright	Laser Eye Protection	16,000	Y	Force Application
63112F	Tyndall	Force Protection	3,000	Y	Protection
63112F	Wright	Prognostics and Embedded Sensors	4,500	Y	Establish and Generate
63112F	Wright	Metals Affordability Initiative (MAI)	2,000		Establish and Generate
63112F	Wright	Lasers for Advanced Manufacturing	4,800		Establish and Generate
63112F	Wright	NDI/E Techniques for Aging Aircraft	4,000		Establish and Generate
63112F	Wright	Corrosion Management for Aging Aircraft	4,000		Establish and Generate
63203F	Hanscom	Locating and Identifying Explosive/Rapid Battlefield Events	3,000	Y	Protection
63203F	Wright/Rome	Persistent ISR for Time Sensitive Targets	5,000	Y	Surveillance and Reconnaissance
63203F	Wright	Advanced Multi Discriminant Sensing for Urban and Obscured Targets	2,500	Y	Intelligence
63203F	Wright/Rome	Symbiotic Communications Radar	6,000		Command and Control
63203F	Wright	Net Enabled Multi-Platform Simulation Tools for Sensor Web	500	Y	Surveillance and Reconnaissance
63203F	Wright	Sensor Web Modeling, Simulation, and Analysis for Automated Target Recognition (ATR)	500	Y	Surveillance and Reconnaissance
63203F	Wright	Wideband Technology Demonstration	5,000		Force Application
63211F	Wright	Military Spaceplane Simulation	3,600		Space Support
63211F	Wright	Rapid Air Vehicle Design and Technology Integration	4,900		Surveillance and Reconnaissance
63211F	Wright	Sense and Avoid Development and Demonstration	6,000		Surveillance and Reconnaissance
63211F	Wright	Austere Mobility Platform Simulation	5,000		Force Projection
63216F	Wright	Advanced Fuel Technologies	3,500	Y	Force Projection
63216F	Wright	Direct Lift Tip Turbine Engine	1,200	Y	Force Projection
63216F	Wright	Mach 4+ Turbine Engine	1,500		Force Application
63216F	Wright	Integration and Demonstration of Adaptive Versatile Engine	1,440		Force Application
63231F	Wright	Air Operations Center Cognitive Work Analysis	1,700		Command and Control
63231F	Wright	Integrated Vehicle Health Management	1,400	Y	Establish and Generate
63231F	Wright	Netted Lab Environment for Demonstrating Human System Integration (HSI) Technologies	7,000		Provide Net Centric Enterprise
63231F	Brooks	Optical Systems for Force Enhancement	2,500		Force Application
63231F	Wright	Persistent Multi-INT ISR	500		Surveillance and Reconnaissance
63231F	Brooks	Remote Steep/Alertness Induction	1,550		Create and Sustain the Force
63270F	Wright	Combat Laser Infrared Countermeasures	4,500	Y	Protection
63270F	Wright	Sensor Web Modeling, Simulation, and Analysis for Electronic Warfare (EW)	500	Y	Surveillance and Reconnaissance
63270F	Wright	Persistent Threat Location	4,000	Y	Force Application

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Dr. TETHER. We do not have any unfunded requirements for fiscal year 2006.

However, Phase III of our High Productivity Computing Systems Program (HPCS) would require $50 million more than we have programmed in fiscal year 2007 in order to continue two teams as opposed to only one. Fiscal year 2008 and fiscal year 2009 have yet to be finalized, but additional funds would be needed in both years in order to maintain two teams.

We are soliciting the Department of Energy and the National Security Agency to provide the additional required funding for the program to have an additional team since they are major beneficiaries of the technology.

Dr. Killion, we all recognize that you have done a lot of work on the IED issue. With respect to remote control IEDs in Iraq, they are causing a great deal of damage. We have some jamming devices. There are several products I suspect. But the question really

AF S&T TOTAL FY06 UNFUNDED PRIORITY LIST
(IN PE VICE PRIORITY ORDER)

PE	Site	Effort	FY06 ($K)	SecAF UPL*	Capability Area
63270F	Wright	Proactive Electro-Optical Threat Attack Technologies	1,000	Y	Force Application
63401F	Kirtland	Hyperspectral S&T Payload	5,000	Y	Surveillance and Reconnaissance
63401F	Kirtland	Responsive Spacecraft Bus Technology	600	Y	Force Projection
63401F	Hanscom	Signature Exploitation for Missile/Low Observables	2,500		Surveillance and Reconnaissance
63401F	Kirtland	Space Object Identification and Characterization	1,000	Y	Protection
63444F	Maui	Visible Wavelength Photometer Optimized for the 1.2m Telescope	250		Intelligence
63500F	Hanscom	Hypersonic Aerospace Sensor Technology	3,000		Force Application
63500F	Edwards	Upper Stage Engine Technology	7,000		Force Projection
63500F	Edwards	On-Orbit, High Maneuverability Hall Thrusters	2,500		Force Projection
63601F	Eglin	Low Collateral Damage Munition Research	2,500	Y	Force Application
63601F	Eglin	Urban Area Weapon	2,900	Y	Force Application
63601F	Eglin	Weapon Data Link	4,000	Y	Force Application
63601F	Eglin	Submunition Fuze	1,300		Force Application
63601F	Eglin	Agile Missile Technology Flight Demonstration	5,000		Force Application
63601F	Eglin	Fuze Research	4,700		Force Application
63601F	Eglin	Agent Defeat Munition	7,000		Force Application
63601F	Eglin	High Speed Cruise Missile	6,500		Force Application
63601F	Eglin	Weapons Integration (Weapons Handling and Modification)	3,500		Force Application
63605F	Kirtland	Beam Control Risk Reduction	2,500	Y	Protection
63605F	Kirtland	Counter Improvised Explosive Device Development/Target Identification	1,350		Protection
63605F	Kirtland	Solid State Laser (SSL) Aircraft Demo Requirements	1,200	Y	Force Application and Protection
63605F	Kirtland	Advanced Tactical Laser Aero-optics	750	Y	Force Application and Protection
63605F	Kirtland	Solid State Laser Testbed	3,900	Y	Force Application and Protection
63605F	Kirtland	Active Denial Sniper Detection	1,200		Protection
63605F	Kirtland	Autonomous Low Cost Optical Augmentation	400		Protection
63605F	Kirtland	Beam Control Field Demonstrations	1,500	Y	Force Application and Protection
63605F	Kirtland	Tactical Laser and Bomber Defense	1,800		Force Application and Protection
63605F	Kirtland	Advanced Sensor for Field Beam Control Testing	165	Y	Force Application and Protection
63605F	Kirtland	Laser Technology for Aircraft Protection	700	Y	Protection
		TOTAL	393,605		

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comes, why are we not fielding them as quickly as it seems that the field forces need them?

Dr. KILLION. That is a question, honestly, somewhat outside my purview since I handle the S&T piece, but not acquisition.

Senator REED. Right.

Dr. KILLION. I think the Army does have a strategy for the fielding of such devices. We have worked hard to accelerate the fielding of such devices. It would be useful to have the opportunity to come in and lay out for you exactly what the strategy is and the time lines for fielding of different types, both the current generation of devices and what we are looking at for the next generation of capabilities which will provide enhanced protection.

Senator REED. Let me just follow up. To be fair, you are not in the acquisition business, and this is an acquisition problem. But, I do have a few questions.

One, the technology exists. This is not a situation where you are looking around for adequate technology. Is that a fair estimate?

Dr. KILLION. There are technologies available that address a certain range of the control devices that are out there, yes.

Senator REED. This has been made a high priority for you to search for the best products and to talk to the acquisition people and to move this forward. It is high priority?

Dr. KILLION. It is a very high priority to me, and in fact, we have made additional investments in the 2006 budget for enhanced survivability for both ground and air vehicles.

Senator REED. Let me raise a question for both you, Dr. Killion, and Dr. Tether. We have talked about networks. We have talked about being able to get that dial tone, but somebody has to be able to say something. A lot of what we will be doing in the next several decades is in cultures where we do not have language skills, cultural sensitivity. We could have the best network in the world, but if we have people who do not know how to speak the language or do not know how to interpret the signs and signals of the local community, then all this technology will help but it will not be decisive.

What are we doing in the realm of DARPA and Army R&D to accelerate linguistic training, to provide the resources we need to be effective in these different cultures? Do you want to go first, Dr. Tether, and then Dr. Killion?

Dr. TETHER. DARPA has a major program in language because that is a major problem. Either we are going to have to teach our troops 16 different languages or we are going to have to give them something that does it for them. In fact, in the back there are a couple displays that show some of those capabilities.

We have had a major language program for years. In fact, in Iraq we had a program where we were creating an "Early Bird," an Iraqi Early Bird, where we were taking the previous day's TV broadcast and newspapers and creating that Early Bird that has a summary and then the article itself. That proved to be extraordinarily helpful. The military phase is over and now you are told to control the country, but you do not know what is going on around you. That was extraordinarily valuable for them. It saved a lot of lives. It saved lives in the sense that there would be incidents in a town 20 miles away that we would not have heard about

for days, as it went through the normal chain, but this Early Bird allowed us to deploy and save kids' lives.

Senator REED. By the way, you have discontinued that I think——

Dr. TETHER. Yes. I know you were on the Internet. The person who did it just got tired and we are trying to automate it more and bring it back on line. Actually, it is not discontinued. U.S. Central Command (CENTCOM) still has a version of it that they are still using.

The Phrasealator is an example of a technique, a little Phrasealator where you speak into it in English and out comes a phrase in any of eight different languages.

We are now trying to develop a two-way. We are on the verge of developing a two-way where a person speaks into it in English, and it comes out in whatever language the person speaks back, and he hears it in English. We believe that we can get a reasonable capability up in perhaps 6 months to a year.

But we have a major program that is just starting up, and our objective is basically to get rid of all the linguists and analysts. I probably just made a few more enemies, but we want to basically have a capability where the language goes in and the output comes in so that the warfighter can get it directly. He does not need an interpreter with him. He can understand the person talking to him. If he gets a document, he can put it into a computer and out it comes in English that he can understand. It does not require somebody else to type it in. We believe that we can get to what the Defense Language Institute (DLI) people would call a level 3 capability in a very short period of time. So we have a major program. It is a major problem.

Senator REED. Dr. Killion, any comments?

Dr. KILLION. Actually we are partnered with Dr. Tether in a number of the programs in this area. I think a good example of this sort of additional approach the Army is taking is the Avatar that you see over on the table from the Institute for Creative Technologies, which is a tool that can be used. It is artificial intelligence driven. It can be essentially programmed to represent any culture and any language and provide training to an individual interacting in that type of realistic environment and faced with realistic scenarios without necessarily having to have a cadre of people available to you, which can be expensive and also trouble in terms of having them available readily for anybody throughout the United States. You can provide access to that training widely and fairly cheaply, put it on an X-box or a game-based-type environment and provide training to the individual so he is better prepared for the culture he is going into.

With regard to the speech recognition. I will know that Dr. Tether has succeeded when Toys-R-Us sells bears that will talk to you and understand you. So that is my challenge to Tony.

Senator REED. Which raises the question, are we working with Toys-R-Us?

Dr. KILLION. There you go. [Laughter.]

Senator REED. Admiral Cohen.

Admiral COHEN. Senator Reed, it is not just about understanding and being able to communicate with the enemy. Today with coali-

tion warfare, it is critically important that we be able to effectively use our allies. Two years ago CENTCOM came to me in my overseas office in London and asked for something which we then fielded immediately. It was called Coalition Chat Line.

What Coalition Chat Line gave us the ability to do was, because we had the ability to do written translation at about a 90 percent accuracy rate, give command and control with our European and other allies using existing networks at an unclassified level. We could type in English and it would come out in Polish. They would type in Polish; it would come out in English, Dutch, et cetera. That is still in use today, and it is highly effective. It is not where we want to go. Dr. Tether and the Army are doing wonderful work in that area.

But the second thing that we did—and this comes out of the operation Secretary England headed—when, over a year ago, we were losing translators—now, these were for-hire and embedded translators with our troops, our marines, as they are kicking down the doors, et cetera—we went ahead and we established back in the United States a call room. We did this under contract using an iridium phone through satellites, et cetera. This was not ideal and there was a lot of push-back, especially when the guy is kicking in the door to hold up the iridium phone, saying please, bad guy, talk into it. That is now how we used it. We used it to rapidly debrief individuals that we needed to get real-time intelligence from in the field.

What we found was—and Dr. Tether is more sensitive to this probably than I am—a number of dialects. I mean, I come from New York City. I have had trouble communicating my whole life. So, I understand dialects. The chat line gave us the ability to have an individual harm's way, who sensed what that dialect was on the phone; to refer it to someone else in that call room so we got accurate—and that is critically important—translation so we had actionable intelligence in the field at the pointy end of the spear.

So the point of those two stories is while the future is promising and these technology developments are moving very fast, we do what we can do today with what we have.

Senator REED. Thank you.

Mr. Chairman, will we have a second round perhaps?

Senator CORNYN. Absolutely.

Senator REED. Okay. Thank you.

Senator CORNYN. Senator Nelson.

Senator BEN NELSON. Thank you, Mr. Chairman.

Dr. Sega, the Defense Experimental Program to Stimulate Competitive Research (DEPSCoR) has been described by a lot of folks as a very important program, and it has been particularly important for researchers in Nebraska and a number of other States and has developed a number of new technologies that have enhanced the Nation's military capabilities. So I was alarmed to note that in your 2006 budget request you have actually reduced the investment in this program by over 30 percent relative to the 2005 appropriated level, and even down below the 2005 budget request.

I guess because the program is run out of your office, I would like your opinion as to the value of the program, and if you have some concerns about it, is there anything that can be done to raise

your confidence so that we do not see a continuing reduction in the budget in the future?

Dr. SEGA. I believe the goals in the DEPSCoR program itself are important. The only office I established within the Office of the DDR&E was that of Deputy Under Secretary of Defense for Laboratories and Basic Sciences. Within that office are universities and workforce-related responsibilities as well. Dr. John Hopps led that and oversaw the DEPSCoR program. He passed away last year.

Now, I would like to take the details of your question for the record, but suffice it to say that the ability for us to capture ideas from all parts of the country is something that we value.

[The information referred to follows:]

There is value in research performed under the DEPSCoR program, as well as the larger amount of research performed under other DOD Research, Development, Test, and Evaluation programs by academic institutions from States eligible for DEPSCoR. The fiscal year 2006 request for DEPSCoR is $8.913 million which is 9 percent less than the fiscal year 2005 request in real terms. The reduction is a reflection of difficult decisions made in the current budgetary environment.

Senator BEN NELSON. Well, there seems to be concern among the academics that their role is being minimized in the process, and I think that is why the concern has been raised. Obviously, you want to get the best ideas. It is alarming to see, if in fact this is the case, the academics' role reduced unless there is a particular reason for doing it. If they are inadequate or something like that, is there something that could be done to re-elevate their contributions? Because it seems that that is what may be happening here.

Dr. SEGA. If I could get back with you on that to better address it.

[The information referred to follows:]

There was no budget decision to deliberately reduce academic institutions' participation in DOD Research, Development, Test, and Evaluation (RDT&E), and we are not aware of any evidence that shows a reduction. There are scientific and technical opportunities to be explored if additional resources were available for basic research, the portion of RDT&E within which academic institutions from all States make their greatest contributions. However, we must maintain a balance among DOD investments in the various components of RDT&E.

Senator BEN NELSON. Sure.

Thank you, Mr. Chairman.

Senator CORNYN. Thank you, Senator Nelson.

I want to reiterate a request that Senator Reed made just so we are all clear for the record. I wanted to make sure that we get your unfunded S&T opportunities. In other words, we understand that you had to meet a budget goal and presumably there are things that you would have asked for if funds had been unlimited, which they are not. But if they were, what things that you have not requested would you request? If you would give that to us please in writing by the end of April, we would appreciate that very much.

Dr. Sega, military threats have been categorized as traditional, irregular, catastrophic, and disruptive. The QDR will reportedly look at how to mitigate risks in each of those four areas. How is the DOD currently working to integrate identified capability gaps in each of these four threat areas into its S&T investment strategy?

Dr. SEGA. The details—the QDR is an internal document at this point. But the National Defense Strategy and National Military

Strategy were released last week. In there are the various challenges of conventional, irregular, catastrophic, and disruptive threats. We are participating in all of the forms that go into the QDR to assure that the importance that we feel, in terms of S&T's impact in dealing with the challenges of the future, is addressed. I can assure you that we are participating in that, and that the recognition of the irregular, the catastrophic, and the disruptive—and the disruptive, in particular, has a heavy focus on disruptive technology and understands the global environment and how technology is being developed and sometimes the unintended uses of it have to be thought through as well. We are participating in the process and I believe the Department feels it is important as well.

Senator CORNYN. Does that make up part of your investment strategy, though, how to address capability gaps in each of those areas?

Dr. SEGA. Yes. As I mentioned before, the issue of the comprehensiveness of the review is to help us identify gaps that we believe we potentially have in certain areas and to address those in the context of not only where the Department is going by way of strategies that are outlined, including the QDR, but also the context of the global environment. We have a responsibility not only to look at the pull part, if you will, from warfighter needs, but also have a part of our investment portfolio looking at the technology push aspects.

Senator CORNYN. Hopefully, the money that the American taxpayer is investing in S&T through your collective efforts has a benefit above and beyond, not just our defense or national security matters, but will be available across agencies. I am thinking particularly of the Department of Homeland Security and the Department of Justice.

A recent Government Accountability Office (GAO) study reported a slow pace of information sharing between fingerprint databases at the Department of Homeland Security and the Department of Justice. The DOD is working on a number of more advanced security access devices and personnel recognition technologies.

What mechanisms for coordination and sharing of technologies exist among various Departments of the United States Government to ensure that we can both accelerate the sharing of critical information and also update new and available, more reliable and effective technologies? Dr. Tether, do you have a view on that subject?

Dr. TETHER. Yes, I do.

I have met with Chuck McQuery and Dave Bolka at the Department of Homeland Security, and we have gone over what we are doing with them in great depth, again one of these agendas. We are very fortunate, however, in that the Department of Homeland Security has a DARPA-like organization. Quite a few of the people that are there are people from DARPA. People at DARPA are only around for 4 of the 6 years. I like to say we are all really summer hires. The deputy is Xan Alexander. She used to be my deputy at DARPA. A few of the PMs that used to be at DARPA are there. So, we have great relationships. In fact, we have joint programs. We have programs in radiation decontamination of buildings. We have joint programs in portal security, basically how do you detect mail, people, so forth and so on. We have a good relationship there.

We also have a relationship at the Department of Energy. We briefed Secretary Card before he left on our plan. We actually have a joint program with the Department of Energy at Yucca Mountain both in our titanium initiative and in our robotic initiative to have a robot that can scrabble over rubble and make sure everything is okay.

We have relationships with the Central Intelligence Agency (CIA), the DDR&E, joint programs again, congressional staffers, and the National Security Agency (NSA). In the past we have had programs with the Federal Aviation Administration (FAA), Transportation Security Administration (TSA), so forth and so on.

My PMs are entrepreneurs. If they have an idea, they will go anywhere to get that idea used.

Senator CORNYN. Dr. Sega, are you satisfied that we are doing everything we can to not just develop science leads and technology within the DOD, but that we are cross-fertilizing with other Federal Government agencies and not just looking inwardly, but looking outwardly to look at other ways to apply this technology to other needs? For example, I am thinking about the transfer of some UAVs by the Air Force to the Air National Guard to do border security, as well as ground sensors along the Rio Grande to deal with the border security issues. Are you satisfied we are doing all we can and all we should be doing in that area?

Dr. SEGA. Mr. Chairman, I believe this is a goal that we always have to work hard on moving toward. This is a work in progress. I think we can always try to improve what we are doing. As conditions change, we have to relook at how we are doing things. We have, I think, improved in many aspects. Tony has mentioned a few. The interagency forums have also brought forward another mechanism of doing collaboration. For example, in high-end computing, we signed a memorandum of agreement with the Department of Energy and the NSA. So we do have mechanisms to collaborate, but I think this is an area that we have to continue to pay attention to and work hard on. It will be a work in progress forever, but we have to work, spend time and spend energy and focus on that continuously.

Senator CORNYN. This is my last question. Then I will turn the floor over to Senator Reed.

A number of you mentioned your long-term concerns having to do with our networking capability and perhaps a global grid. This does not affect any of you immediately, but I worry when I see one of our important agencies, the Federal Bureau of Investigations (FBI), for example, give up the development of a virtual case file program and basically more than $100 million goes down the toilet. I wonder whether we are comprehensively—and this is not just a DOD issue, obviously—across the Government looking at the best strategies to develop information technology. Obviously, a lot of the concerns are similar with secure communications and the like. That concerns me and it is certainly something that, as we go forward, I want to have a continued conversation with you about.

Admiral COHEN. Mr. Chairman, sometimes programs can be too big. One of the advantages of S&T is its agility. So I have been investing about $1 million a year for the last 3 years with our Naval Criminal Investigative Service (NCIS). I do not take credit for the

TV show, but what NCIS did ask for was the ability to better leverage their existing computer network to put together disparate pieces of information, seemingly unconnected, so that pattern recognition and focused surveillance, all within the bounds of the law, could take place. That now is being exported to other criminal agencies within the U.S. Government.

When we talk about the relationships, we all have these memorandums of understanding and informal and formal agreements with different Departments and services, et cetera, but I also look at the broader needs of our society. From precise time measurement came the GPS. The GPS has created a multi-billion a year industry in the United States, around the world. It changes how we work, how we fly, our leisure time.

If you will remember about 3 years ago we were in crisis in electrical transmission and generation in this country. The Navy is going electric. The DD(X) and CVN–21 will effectively be all electric ships. So we are looking at directed energy weapons. We are looking at the electromagnetic rail gun. We are going to launch aircraft using Paramount and Walt Disney technology for linear accelerators for roller coasters. But we are heavily invested in both high temperature and low temperature superconducting both in Massachusetts and in California, competing technologies which I believe will give this country not only the military advantage that an all-electric, compact, high efficiency force brings, but will enable us to beat back the challenges in electrical transmission, high wire, right-of-ways, et cetera and put us back in a leading position in the world for export of that important industrial capability.

Senator REED. Thank you very much, Mr. Chairman.

Dr. Sega, one of the great assets that the DOD has is the S&Es in the laboratories. I know you have been working with respect to the new NSPS to look at or compare, at least, the flexibilities that might be offered there to the flexibilities in these demonstration programs. I know there is one program at the Naval Underwater Warfare Center (NUWC), which is very much appreciated there.

Have you done any of the detailed comparisons yet of the NSPS and the demonstration programs? Do you have any observations at this point?

Dr. SEGA. The demonstration programs I think were very important in actually structuring and developing aspects of the NSPS. So the experience gained in the demonstration programs I believe was important in development of the NSPS program.

We have had an input by way of our demonstration and laboratory experience.

Now, the phase that we are currently in is a release of the naval regulations in The Federal Register, and they are fairly broad. The next phase is those that are implementing regulations, and it will be, as those are developed and presented, that we can have a comparison in terms of the demonstration labs and how the flexibilities compare. So that is down the road a little bit.

[The information referred to follows:]

We can make the analysis, comparing the relative NSPS features and flexibilities to those of the laboratory demonstrations, available to interested Members of Congress upon request once it is completed.

Senator REED. When you come to that juncture, I would be very interested in seeing the tradeoffs before any commitments are made. We do want to maintain the flexibility in the labs and the strength of the labs. Their strength really is attracting the very best S&Es.

Let me turn to both Admiral Cohen and Dr. Tether. I understand that DARPA and the Navy are making significant investments in developing new undersea technologies, including weapons systems, sensor devices, and new concepts of submarines. What is the scale of your investment, if you can sort of lay that out, and what are the major initiatives? To what extent is the NUWC participating? Admiral Cohen or Dr. Tether?

Admiral COHEN. Thank you for that question. Of course, the NUWC at Newport is unique in the world and has been doing this for some time. When I first came to the Office of Naval Research 5 years ago, the Navy was just finishing the transition from blue water dominance, which we still enjoy, to a focus on the littoral, which Dr. Tether has already addressed. What we found was that our deepwater premier torpedo, the Mark 48 ADCAP torpedo, which the NUWC was so critical in developing, really was not optimized for the littoral, shallow water, background scatter, et cetera. Plus we had the challenges of mines.

So we looked to go ahead and develop under our Swamp Works program, which is the naval version of Skunk Works. It smells about the same. High risk, and we chose the NUWC at that time to do that, and within 18 months they had transformed the deep ocean torpedo into what we call half-torp, half-length, so we could put 52 instead of 26 in a 688 submarine, doubling its load, and with the precision to find and destroy a 1-meter tethered mine in the littoral with countermeasures present because if we could find a 1-meter mine, we could find a 3-meter or a 5-meter submarine, but the other way is not there. So the intellectual capital and the long-term investment that you have there paid big dividends.

We have just, at the direction of the CNO, initiated what we call an innovative naval prototype entitled Persistent Littoral Undersea Surveillance (PLUS). I have about $150 million invested in that over the FYDP. It does not have a transition partner, but it is looking at distributed sensors, weapons, taking the littoral where we deal in the non-RF, and making by a wide variety—and I will leave it unclassified—sensor capabilities, some of which we are working with DARPA on, to take undersea targets and turn them into RF signals, which can pop up and turn that target into the common operating picture. So for our battle forces in littoral, it becomes just one more time-critical strike target. It is exciting, and NUWC will be a key enabler, along with academia and industry, in achieving that over the next 4 to 8 years.

Senator REED. Thank you.

Dr. Tether, any comments?

Dr. TETHER. Yes.

Four years ago, the amount of interaction DARPA had with the Navy was very small. It was sort of cyclical. We were at the small side.

In a meeting with the CNO, the CNO asked us to do an architecture study on the—actually I call it the "literal." In the part of New York I come from it is "literal," not littoral.

Admiral COHEN. Dialects. [Laughter.]

Senator REED. Who is from the Bronx?

Dr. TETHER. Neither of us, I do not think.

So at the end of that architecture study, we really entered into a major program, which is joint, by the way, with Naval Research, on persistence surveillance. That is the issue, especially if you are talking about the Taiwanese Straits and having to know what is going on there under the water and above the water. Most of it is classified.

Another major program that we have that just started off is a small submarine program that we call Tango Bravo. Now, this resulted from an idea that somebody had that said, gee, we do not need a shaft to push a propeller around. We could actually put—I am sure the people will cringe at this—propulsers on the outside of a submarine and use those to drive the submarine.

What would be the benefit of doing that? Well, if you can get rid of the shaft of the submarine, you have a whole bunch of tradeoffs now that you can make. You can, for example, take the reactor and move the reactor to the rear of the submarine and get rid of some of the shielding.

We had studies done. This was a study that was joint between DARPA, Naval Research, and the CNO to see what would come out being able to get rid of the shaft in the submarine. The study showed that we could probably reduce the size of the submarine by a factor of two. The constraint was the same warfighting capability. That was very interesting. A factor of two displacement. You do buy submarines by the pound. You also could get a decrease in the cost because it is just less touch labor in trying to make it.

That program is just underway. We are in source selection. The NUWC is an important player in it obviously. They will be in it. We are just about ready to make the awards to basically look at two of the major technologies in doing that. One question is, can you really put these propulsers on the outside of the submarine and get the same acoustic quality as well as the ability to go at fast speeds? The other thing to get the size down is you put the torpedoes outside the pressure hull. So can you take your torpedoes and put them outside the pressure hull? If you can do that, you could have a submarine with greatly reduced manning, and all that comes with it. So we have a major program.

Senator REED. Thank you.

Thank you, Mr. Chairman.

Senator CORNYN. Recently, I had a chance to go back home to San Antonio and talk to some of the leadership at Brooke Army Medical Center and Wolford Hall Hospital at Lackland Air Force Base. We learned a little bit more about how dramatically the military medicine has improved the likelihood of survival of our troops when they, unfortunately, do receive injuries.

I am also reminded, as Senator Reed I know has done too, as we go visit the troops wherever they may be, at Bethesda, Walter Reed, or back home in our States, that the nature of the injuries that our troops are receiving has changed. It used to be that high

velocity gunshot wounds were the predominant cause of casualties. Today 38 percent of all injuries and 41 percent of all fatalities are the results of blasts, and we have alluded to some of these earlier in your testimony.

Research in the area of blast injury prevention, mitigation, and treatment is increasingly critical as we look for ways to protect and care for our men and women in uniform. I know we have alluded to that in a number of responses here before, but I wonder perhaps, Dr. Killion, if I can ask you to outline for us now efforts underway in each of these three areas? Could you especially provide us with information on areas in which progress could be accelerated with the application of additional resources? Are there additional projects you would recommend for these areas if additional funding were available?

Dr. KILLION. I would be happy to do that. I think it is probably best that I give it to you in detail separately as a follow-up to the hearing.

I had a recent experience at Walter Reed that I thought was sobering, enlightening, and actually encouraging for the S&T community, probably similar to visits some of you have had. I was visiting recently and met a female helicopter pilot who had lost both of her legs. I was introduced to her and she said, "Oh, good, I did not know who to thank." That kind of took me aback because that was not exactly what my response would have been necessarily. She realized my consternation and said, "Oh, no, you do not understand. The technology that I was given worked perfectly. The body armor protected my torso and I am alive today because the body armor was there to do that. The NOMEX flight uniform protected me from burn injuries so that my arms were not burned any more severely." She had very minor burn marks on her arms. Then she said, "The helmet work that designed the hearing protection and the visor for face protection saved my eyesight, saved my hearing." So the technology worked. So she was happy that we had given her what we had. Obviously, our goal is to provide even greater protection.

Her helicopter was hit by an RPG. So both the blast and fragmentation effects are issues. In fact, part of our problem with our databases is distinguishing those. So, I need to get some clarification on the numbers. Some of the trauma injury databases when they say blast effects also include fragmentation effects.

We do have specific ongoing efforts that are looking at trying to counter the blast injury from things like thermobarics that are a special case as opposed to the body armor that we are using today, the Small Arms Protection Insert (SAPI) plates and the protective vest, which are primarily aimed at protecting you from fragmentation and bullets as you suggest.

I will follow up with information on this.

[The information referred to follows:]

Blast protection from all threats, to include IEDs and mines, is a formidable challenge. During OIF, a large number of blast injuries have been incurred by warfighters riding in vehicles. The recent up-armoring of tactical vehicles to include the HMMWV has provided added protection. This effort was the result of efforts on improved armor performed by the Tank Automotive Research, Development and Engineering Center (TARDEC) and the Army Research Laboratory (ARL). Blast protection improvements for the deployed dismounted warfighter, however, are limited be-

cause the inherent add-on weight of current protective materials restricts the soldier's mobility and range of motion.

Current Army research in blast injury prevention and mitigation is focused on enhanced lightweight protective materials for both vehicle and personnel armor, improved materials processing techniques, and innovative concepts and prototypes with potential to increase protection while minimizing added weight burden. Current research efforts include the following:

- The TARDEC and ARL are investigating new composite material concepts/designs and active protection systems in the area of vehicle protection.
- The Natick Soldier Center is researching high-strength fibers such as M5 and Zylon, along with post-processing treatments that could improve the fragmentation protection of soft armor systems. In addition, new methods of production and innovative architectures for protective materials (e.g., non-woven, unidirectional fiber layers; novel backing materials; and flexible resin impregnated fabrics) are being assessed for soldier protection.
- The Natick Soldier Center, in conjunction with the Medical Research Materiel Command, began an effort in fiscal year 2003 to develop a concept for soldier protection designed specifically to address pressure blast effects that could be incurred within buildings or enclosures.
- ARL is exploring advanced transparent armor materials and material processing methods such as microlamination that are applicable for both vehicle (i.e., windshields and windows) and individual (i.e., face) protection. ARL is also investigating new concepts, such as shear thickening fluids ("liquid armor,") to assess their ability to provide increased protection and flexibility at much reduced weights.

We recognize that blast injury treatment is critical to the care of our men and women in uniform. The Army's medical research program currently has investments in trauma treatment research that are directly applicable to the types of blast injuries incurred in OIF. These efforts are focused in the areas of neuroprotection, physiological sensors, and resuscitation.

In addition to these ongoing efforts, Army medical research in the area of resuscitation will begin a new phase in fiscal year 2006 that will focus on resuscitation fluids and how the effects of blast-related head trauma determine fluid resuscitation requirements. Standard field treatment of injuries resulting in blood loss or extreme head trauma involves the use of resuscitation fluids to help stabilize the patient. However, when the brain is traumatized there is a disruption of the blood-brain barrier that allows these normal resuscitation fluids to leak through the blood-brain barrier, increasing the risk of brain swelling. Research will be conducted in developing new resuscitation fluids that would mitigate the brain swelling when the blood-brain barrier has been disrupted. We believe that this research is important given the number of casualties due to head and neck injury experienced in OIF. This research will potentially lead to the optimal use of resuscitation solutions in the field.

The current Army S&T programs in these areas represent a balanced portfolio addressing both near-term and long-term warfighter needs to optimally identify potential solutions. The current approaches show promise for improving blast protection, mitigation and treatment.

Senator REED. Mr. Chairman, if I could interrupt. Dr. Killion was talking about Major Tammy Duckworth of the Illinois National Guard who, when I saw her, assured me she is going to fly again in uniform in the United States Army. She will need a little help with technology, but just a little. She will do it on her own.

Senator CORNYN. I appreciate your sharing that story with us. I guess the most amazing reaction we hear from our troops when they are in the hospital is when can I get back to my unit, even from some who have suffered, unfortunately, significant injuries.

Let me just ask two other questions. First of all, Dr. Killion, if you could get us that additional information in relatively quick order. We are going to leave the record open and submit some additional questions to each of you in writing, which we would ask you to turn around as soon as you reasonably can, since obviously time will not allow us to ask all of those verbally in the hearing.

Dr. Sega, I would like to touch on advanced semiconductor technology, and I would like for you to take this one for the record and

get back to us. If you have any comments now, of course, I would welcome those.

Having advanced semiconductor technology is critical to maintaining America's military advantage. Making chips has become increasingly complex and there are many challenges that must be overcome to continue to make them faster, denser, and more powerful. Of course, research drives these advances. I believe the industry spends about 17 percent of its revenue on R&D.

Given the advantages that the military has gained through this advanced technology, I would be interested to know what steps the DOD is taking to ensure that we maintain our technological edge in this area. If you have any brief comments now, I would be glad to hear those, but if you would like to take that for the record and get back to us, that is fine as well.

Dr. SEGA. We do work with the semiconductor industry on individual technologies, as well as the associations that represent the Semiconductor Industry Association. There are activities that focus on their concerns. Focused Research Centers is one of them. But the question is one that I think would be best done for the record so we can lay out the program.

[The information referred to follows:]

The national security community has a requirement for advanced semiconductor technology. Many of our requirements are met by the industry as a whole. However, there remain specialized requirements for low-volume quantities and radiation hardened components. We maintain an active program to address these concerns. Programs in rad-hard by design, 3D microsystems, and maskless lithography are several initiatives the DOD pursues in this area.

Over the years, the DOD has maintained a strong technology investment in leading-edge semiconductor technology and we have worked closely with industry. We are currently working with industry to establish a focused basic research program. This program will not only generate new ideas but will help grow the scientific and engineering talent necessary for continued innovation in semiconductor technology.

Senator CORNYN. Thank you.

I have one last question and then I would be glad to see if Senator Reed has any others before we wrap up. Unfortunately, we have four stacked votes starting at 11:30, so we are going to have to go do our duty there as well.

My question has to do with the industrial base. Let me start off first by saying I understand the Department's Office of Industrial Policy has been conducting a series of evaluations on the capabilities of the defense industrial base. As technology and manufacturing processes play a key role in industrial base issues, which also have had an impact on the availability of a well-trained technical workforce, what has been your role in contributing to discussions on the development of these reports? Dr. Sega, if you could comment on that.

Here again, I hear and read concern expressed from time to time that if we discontinue a certain kind of project, we risk losing our base. Obviously, going to a sole-source procurement is always of concern because we know we typically benefit from competitive bidding on various projects. I wonder if you have any observations to make on that issue.

Dr. SEGA. Our area of responsibility is principally in the development of the technology and the military-critical technologies pro-

gram, now under DDR&E. So that is an important function to establish the technical base for those technologies.

The area of industrial policy and its study is out of our area, but we would work with that office and provide an answer to your question.

Senator CORNYN. I would just ask you to take this and get back to us as part of the questions. Would you describe for us the investments that you are making to ensure we are developing the next generation of innovative manufacturing technologies that will enable us to have that domestic industrial base required to support the good work that each of you are doing in your S&T field so we will actually be able to produce those products here in the United States?

Dr. SEGA. Mr. Chairman, on the manufacturing technology, we have again a Defense Science Board study of manufacturing technology. It also represents one of the areas of focus in our research and engineering goals which we recently have distributed. We will be happy to provide that as well.

[The information referred to follows:]

Army, Navy, Air Force, Defense Logistics Agency, and Missile Defense Agency each has Manufacturing Technology program elements to address core service and agency manufacturing requirements. OSD, through the Joint Defense Manufacturing Technology Panel (JDMTP), works with the military departments and defense agencies to encourage investment synergy and collaboration where possible. We work with manufacturing initiatives such as Next Generation Manufacturing Technology Initiative (NGMTI), Composites Affordability Initiative, and Metals Affordability Initiative to identify candidate technologies that support DOD S&T strategic plans and have the potential to the benefit the warfighter. Most recently, we established a Defense Science Board task force to assess the DOD Manufacturing Technology program and provide recommendations as to how ManTech can be strengthened to improve benefits to the DOD.

Senator CORNYN. Senator Reed, do you have any follow-up questions?

Senator REED. I have one question if I may, Mr. Chairman.

Dr. Sega, you have been recently designed the Chief Technology Officer to the DOD. I wonder if you need any additional legislative authorities to flesh out this role of Chief Technology Officer. We presume that this would be similar to positions in the private sector that are designated Chief Technology Officer, and I wonder if you have the same responsibilities and authorities. So you might respond briefly here today, but please follow up in writing if you feel you need more responsibilities and more detailed authority.

Dr. SEGA. Senator Reed, that is another area where we are actually getting some help from the Defense Science Board as they look at the roles and responsibilities of the DDR&E. I met on two occasions with their task force. I will also look at what their findings and advice are prior to formulating the recommendation that goes forward. So I will be glad to get back with you, but I think this is an area where we will learn more and have another input, in this case from the Defense Science Board, that is addressing exactly that question.

Senator REED. Thank you very much.

Thank you, Mr. Chairman.

Senator CORNYN. Gentlemen, thank you very much for your participation here today. We will leave the record open until, let us say, 5 o'clock on Friday for any members of the committee to sub-

mit additional questions in writing, and we would appreciate your prompt response to those questions. It will give us the information we need so presumably we can help you make sure you have what you need in order to continue to do the outstanding job that you are doing.

It is truly impressive what we have seen displayed here today. The promise of the research and investments that you are making now for the future are equally exciting, although we know we have challenges that we have discussed here today, that we have not yet met that are very real and occurring today, particularly in the area of IED mitigation and dealing with, obviously, that tremendous challenge in a new and different kind of theater.

Thank you for being here. Thank you for your service to our country.

This hearing is now adjourned.

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR JOHN CORNYN

SCIENCE AND TECHNOLOGY BUDGET REQUEST

1. Senator CORNYN. Dr. Sega, Dr. Killion, Admiral Cohen, Mr. Engle, and Dr. Tether, when developing and following a carefully constructed strategic plan, corresponding budget decisions are necessary. Programs must sometimes be canceled, redirected, or initiated. What decisions have been made in the fiscal year 2006 budget request—programs cancelled and started—as a result of the science and technology (S&T) strategy for the current and future national security environment?

Dr. SEGA. The fiscal year 2006 DOD S&T budget request contains several new or redirected S&T efforts in support of our five priorities: integration of DOD S&T and focus on transformation; enhanced technology transition; expanded outreach to the Combatant Commands and the Intelligence Community; accelerated support to the global war on terrorism; and a strengthened national security science and engineering workforce. Within Defense-wide S&T:

Transformation:

- Reduced funding for missile defense in favor of new and transformational initiatives
- Established the Trusted Foundry program to provide an assured source of non-exploitable micro-circuit chips
- Initiated a focused program to support insensitive munitions development

Transition:

- Restructured the Advanced Concept Technology Demonstration (ACTD) process—now adding Joint Capability Technology Demonstrations (JCTDs)—and realigned funding among RDT&E budget activities to enhance transition

Outreach:

- Increased funding for the U.S. Transportation Command for quick-turn projects to enhance distribution and transportation systems
- Realigned the Defense Technical Information Center (DTIC) to DDR&E to increase the synergies between research and engineering and related knowledge systems

Support to global war on terrorism:

- Increased funding for novel biodefense initiatives which take advantage of biotechnology and genetics advances
- Increased funding for the Rapid Reaction/New Solutions within the Quick Reaction Special Projects to support the global war on terrorism

Workforce:

- Funded a proposed expansion of the Science, Mathematics, and Research for Transformation (SMART) pilot program into a permanent program called the SMART/National Defense Education Act (NDEA)—Phase I to maintain an effective workforce.

Dr. KILLION. Since we are an Army at war, it is extremely important to balance the needs of the future with current needs. In the 2006 budget request, Army S&T

made some difficult choices. For example, during this preparation for overseas movement (POM) we canceled the Army's portion of the cooperative effort with the Defense Advanced Research Projects Agency (DARPA) in the Unmanned Combat Armed Rotorcraft (an unmanned rotorcraft designed to be the Comanche companion), the development of mission equipment packages for Class 1 unmanned aerial vehicles (UAVs), and munitions specifically designed for unmanned systems. We redirected ongoing efforts to focus on affordable missile technology, technologies to enable a counter mortar capability, and ground vehicle survivability. We initiated new efforts in the area of aviation survivability, network mining, and network science.

Admiral COHEN. No significant Navy S&T programs have been canceled. However, the fiscal year 2006 President's budget request ($356.9 million) is less than the fiscal year 2005 request ($375.8 million), or −$18.9 million. The primary area of disinvestment is the High Frequency Active Auroral Research Program (HAARP) (fiscal year 2006 $0 million versus fiscal year 2005 $16.0 million = −$16.0 million) which is consistent with a Navy/DARPA memorandum of agreement. The remaining reduction (−$2.9 million or less than 1 percent) will not cause significant disinvestment for this line.

Future Naval Capabilities (FNCs) were aligned with Navy defined capability gaps, and a specific focus is planned for urban operations and asymmetric threats.

To take advantage of technology opportunities outside of conventional requirements and acquisition processes, Navy has introduced the Innovative Naval Prototypes (INP) initiative in the fiscal year 2006 budget request. The fiscal year 2006 INP program consists of the following: Electromagnetic Rail Gun; Persistent Littoral Undersea Surveillance (PLUS); Tactical Space; and, Sea Base Enablers. Also, the fiscal year 2006 budget request includes $4 million basic research (6.1) funding to initiate planning and design activities for University National Oceanographic Laboratory System (UNOLS) fleet renewal requirements. This proposed investment is based on Navy's "Report to Congress—Requiremnts and Plans for University National Oceanographic Laboratory System Fleet Renewal" dated February 2003.

Mr. ENGLE. The Air Force S&T investment is shaped by a master planning process called the Capabilities Review and Risk Assessment (CRRA), which is key to ensuring we have a high correlation between science and industry: programs and the warfighting capabilities required by the concepts of operations (CONOPs) for each of the seven major tasks the Air Force must be capable of accomplishing to support our combatant commanders. In fiscal year 2006, the Air Force reprioritized approximately $500 million of its S&T program to address capability needs identified in this master planning process. A few notable examples include shifting funding from aircraft fuels, precision-guided weapons and control, and high power gas lasers to support higher Air Force priorities such as Battlefield Air Operations kit efforts, the Commander's Predictive Environment, and Air Force-unique nanotechnology efforts.

Dr. TETHER. The best example of how our strategy has changed recently in response to a threat is our new strategic thrust in urban operations, which is increasingly coming together in fiscal year 2006. That thrust is aimed at making our forces operate as effectively in cities as we do on the traditional open battlefield. DARPA had a few programs in this area before the Afghanistan and Iraq campaigns, but the thrust was brought center stage by these conflicts and some of the difficulties our forces faced in urban areas. While the thrust continues to be shaped by that experience, DARPA believes adversaries will continue to try to fight U.S. forces in urban terrain, and we are looking at future capabilities for the joint forces. I've met with U.S. Marine Corps Commandant General Hagee and U.S. Special Operations Command (SOCOM) Commander General Brown to discuss DARPA's research. They've told me DARPA's emphasis on vastly improving the joint forces situational awareness in cities is in total sync with their view. In creating our strategic thrust in urban operations, we went from an area we were concerned about, to immediate challenges, to program ideas, to a better understanding of the problem, to even more ideas and a greater focus and budget for the area.

A specific program we've canceled is Responsive Access, Small Cargo, Affordable Launch (RASCAL), which was aimed at lowering the cost to orbit for small payloads and making that access more responsive. After some effort, the increasing costs to develop RASCAL exceeded what was felt to be practical. Continuing it would not have been a prudent investment. DARPA is collaborating with the U.S. Air Force on Falcon, a program that is exploring other concepts for low cost access to space, for example, launching a rocket from a C–17.

An area where we are taking a strategic pause is advanced lithography. We have funded work there for many years, but more recently the needs of the broader commercial sector and the Department of Defense (DOD) have increasingly diverged. So in fiscal year 2006 we are reassessing the opportunities to relieve the DOD's prob-

lems in access to lower cost, very low volume, specialized electronics—a solution that will also prove beneficial to U.S. foundries.

2. Senator CORNYN. Dr. Sega, the fiscal year 2006 request marks the first time since passage of the National Defense Authorization Act (NDAA) for Fiscal Year 2000 that the request for S&T programs is less than the previous year's request. The S&T budget request represents an increase of less than 2 percent over inflation compared to the previous budget request. Section 212 of the NDAA for Fiscal Year 2000 requires the Secretary of Defense to submit to Congress a certification or a statement explaining the request's impact. The section also requires a Defense Science Board report assessing the impact of the proposed budget on defense technology and the national defense. What is the status of each of these required actions?

Dr. SEGA. A strong and stable science and technology program is important to maintain our technological edge. Each year the Department makes an effort to fund the S&T program at a level appropriate to maintain the technological superiority we have enjoyed to date. The fiscal year 2006 President's budget was developed by balancing priorities across all functional areas, and we believe the S&T budget is funded at the proper level. Using fiscal year 2000 as a baseline and adjusting for inflation, our fiscal year 2006 request of $10.552 billion is 23 percent higher than fiscal year 2000. The Department continues to place a high priority on ensuring adequate funding levels for S&T.

NAVY BASIC RESEARCH

3. Senator CORNYN. Admiral Cohen, the fiscal year 2006 budget request for the Navy Basic Research (6.1) account includes funds to design a research vessel. The request for Navy Basic Research is also down 6 percent from the fiscal year 2005 request and is down nearly 10 percent compared to appropriated amounts. Could you explain the reason for including design and ship funds in a Basic Research account instead of the usual ship construction account?

Admiral COHEN. The fiscal year 2006 RDT&E,N budget request includes $4 million Basic Research (6.1) funding to initiate planning and design activities for University National Oceanographic Laboratory System (UNOLS) ocean class fleet renewal requirements. This proposed investment is based on Navy's "Report to Congress Requirements and Plans for University National Oceanographic Laboratory System Fleet Renewal" dated February 2003. The Basic Research account was selected for the following reasons:

- Current DOD policy allows the use of RDT&E,N for this purpose. DOD policy (DOD Financial Management Regulation Vol. 2A, Chapter 1 Section 010213.C.8.a) states, "An experimental test bed type of ship or an experimental ship will be financed by RDT&E appropriations." The UNOLS vessels are test beds for testing new equipment and conducting research in support of the critical scientific disciplines in Ocean Sciences.
- Research ships construction was most recently funded using the RDT&E,N appropriation (i.e., fiscal year 1998 $45 million congressional add for oceanographic ship, PE 0604528N). Previously, SCN appropriation was used to fund such costs.
- The planned research ships support ocean sciences programs which are funded in Navy Basic Research (6.1). Therefore, Navy and Office of the Secretary of Defense (OSD) comptrollers concluded that it is appropriate to include costs associated with the construction of these ships in the Basic Research account.

It is noted that the fiscal year 2006 $4 million budget request involves planning and design activities for the research ships, not actual construction activities.

4. Senator CORNYN. Admiral Cohen, what is the Navy's long-term strategy for its Basic Research effort? What would be the impact on 6.1 programs over the next few years if this request is filled?

Admiral COHEN. Navy long-term strategy for Basic Research (6.1) funds the preponderance of the Navy S&T Discovery and Invention (D&I) portfolio which seeks to enable the Navy and Marine Corps to achieve technological superiority primarily in capabilities essential to the naval mission. Investment priorities, in decreasing order, emphasize (1) naval unique research, where Department of the Navy (DoN) must be the world leader; (2) strong participation in research communities important to future naval applications, but not necessarily lead by DoN; and, (3) harvesting and advancing research results from all sources in areas of potential naval pay-

off. Basic research disciplines include ocean sciences, underwater weapons and sound, naval architecture, ocean engineering, and those studies which could enable expeditionary warfare and other warfare applications made more challenging in the naval environment. Additionally, Basic Research contributes to funding the Naval Research Laboratory (NRL) and the 6.1 component of naval warfare centers. Basic Research areas shall be integrated among NRL and other naval research providers who are resourced through the Office of Naval Research to avoid duplication of effort.

QUESTIONS SUBMITTED BY SENATOR JOHN THUNE

EXTENDING THE LIFE OF VETERAN AIRCRAFT

5. Senator THUNE. Mr. Engle, what new technology and research and development (R&D) efforts is the Air Force looking at that could make significant strides to extend the life of older aircraft like the B–1 bomber and F–16, until next generation aircraft come off the assembly line?

Mr. ENGLE. Overall, the Air Force has an aggressive investment in aging aircraft R&D of over $55 million per year. A few exciting areas of work include the development of an improved nondestructive inspection technique that minimizes the number of aircraft fasteners that need to be removed in order to inspect the area. The lead aircraft for this effort is the B–1 and this improved technique enables us to look deep, down through multiple layers of metal, to detect cracks around the fasteners—something we haven't been able to do before. We estimate savings/cost avoidance of $4.5 million and around 18,000 maintenance manhours at the depot. Further, we save wear and tear on the B–1 and other applicable aircraft because we don't have thousands of fasteners to remove and replace. Another improved nondestructive inspection technique focuses on the B–52 and also involves multiple layers of metal, but this technique detects corrosion. We estimate that this one-time inspection of the B–52's splice plate located on the wing near the fuselage will result in savings/cost avoidance of approximately $15 million and 54,000 depot maintenance manhours, as well as further minimizing wear and tear to the B–52. We are also doing great work with material substitution. The F–15 is the lead aircraft for this project, which involves replacement of the wing structures with a corrosion-resistant aluminum alloy that will result in a stronger, more resistant wing. Again, estimated savings/cost avoidance are significant at $2.1 million and about 5,580 depot maintenance manhours. Savings are expected to grow as the entire fleet goes through programmed depot maintenance and the old wing structures are replaced with the new alloy.

6. Senator THUNE. Mr. Engle, has the Air Force looked into a technology called friction stir welding (FSW) and assessed its utility to overhaul veteran aircraft by reinforcing/revitalizing aircraft structures and weld points?

Mr. ENGLE. Yes, the Air Force has been instrumental in maturing the FSW process. Partnered with industry via the Metals Affordability Initiative (MAI) consortium, the Air Force is working to develop and apply FSW to aerospace components. The MAI team successfully transitioned FSW technology to the C–17 Ramp Toe (installed on aircraft beginning with plane number 136) and is currently working to adapt the process to the C–17 cargo door torque box. Both of these applications involve 7000 series aluminum. The MAI team is also working to apply FSW to the Delta 4 upper stage tanks, which would involve aluminum lithium alloys for space applications.

7. Senator THUNE. Mr. Engle, the South Dakota School of Mines and Technology (SDSM&T) is perhaps the leading developer of this technology, which has developed to a stage that it can soon be put to use in aircraft maintenance/overhaul facilities—both for civilian and military aircraft. Will the Air Force be willing to take a look at the process developed by SDSM&T to see if it may provide a benefit to planned Air Force depot maintenance facilities?

Mr. ENGLE. The Air Force would be happy to review the SDSM&T's FSW process to assess if it would provide a benefit to planned Air Force depot maintenance facilities. We will make contact with SDSM&T and offer them an opportunity to show us their work.

QUESTIONS SUBMITTED BY SENATOR EDWARD M. KENNEDY

INNOVATION CENTERS

8. Senator KENNEDY. Dr. Sega, you and I have spoken about the importance of S&T in the Base Realignment and Closure (BRAC) process. I am very concerned that the BRAC criteria is very quantitative and may not fully value the unique needs of the DOD's innovation centers.

Many economic theorists, including Michael Porter of Harvard, have highlighted the value of regional technology clusters as the best way to stimulate innovation and establish valuable partnerships between the Federal Government, industry, and academic researchers. The regional proximity of these centers enhances the innovative capabilities of DOD labs and accelerates the process of moving technologies out of the labs and into the hands of warfighters—or into the commercial sector. This type of innovation has been the engine of our economic growth, as well as the source of our military superiority.

I know for example, the great synergy created by the close proximity of the Massachusetts Institute of Technology and the Army's Institute for Soldier Nanotechnologies to the Natick Soldier Center and the large defense contracting community in the area is helping the DOD leverage millions of dollars in private sector R&D and will speed the transition nanotechnologies to warfighter. Are you familiar with the work of Michael Porter and others on the value of technology clusters?

Dr. SEGA. We appreciate cooperating for the purpose of working together for mutual benefit or interest. We rely on the full spectrum of technology providers to develop the best possible capabilities for the Department. We rely on DOD labs, working with industry, universities, and other Federal labs to develop the capabilities.

9. Senator KENNEDY. Dr. Sega, are you confident that the Department's BRAC decisionmaking process fully values the need for the DOD to keep its centers of innovation co-located with our academic and industrial centers of innovation?

Dr. SEGA. I am confident that the Department has considered the impact of a large number of factors, consistent with the statutory requirements, in evaluating facilities.

10. Senator KENNEDY. Dr. Sega, are you comfortable that the DOD's BRAC process fully appreciates that most technical people will not relocate to a new location following a BRAC decision—therefore costing the DOD valuable scientific and technical expertise once the relocation is complete?

Dr. SEGA. The BRAC process is thorough, and during the evaluation period, we considered a large number of factors and possible impacts. The DOD BRAC process accounts for personnel relocation challenges. We are also committed to increasing the pool of scientists and engineers available to work on national security issues and partnering with universities, industry, and others, to meet DOD technology goals. A national challenge is to ensure that we have a technical workforce to meet the needs of the Department and Nation.

11. Senator KENNEDY. Dr. Sega, how do you plan on reconstituting that expertise following the BRAC round?

Dr. SEGA. The availability of scientists and engineers is an important issue facing DOD and the Nation. The Department has submitted a legislative proposal titled "SMART—NDEA Phase 1". The proposal would provide additional authorities that would improve our ability to develop, recruit, and retain individuals who will be critical in fulfilling the Department's national security mission. We look forward to your continued support in this critical, foundational area for national security.

QUESTIONS SUBMITTED BY SENATOR JOSEPH I. LIEBERMAN

LABORATORY WORKFORCE ISSUES

12. Senator LIEBERMAN. Dr. Sega, this committee has been concerned over the failure of the DOD to utilize the personnel demonstration authorities provided to the Secretary to ensure that our research facilities are able to hire and retain the top quality people they need. Last year, section 1107 of the NDAA required the Under Secretary of Acquisition, Technology, and Logistics and the Under Secretary of Personnel and Readiness to work out a process for expediting and expanding the use of the demonstration authority, since it continues to operate outside of the Na-

tional Security Personnel System (NSPS). Have the laboratories been part of this review?

Dr. SEGA. Yes, the laboratories are participating in the development of the plan required by section 1107. Hiring and retaining top quality people in our research facilities is of foremost importance to the Department and to its laboratories.

13. Senator LIEBERMAN. Dr. Sega, what specific authorities have the laboratories requested as part of this review?

Dr. SEGA. The Plan required by section 1107 will be completed and reported to Congress by December 2005. At this time, no additional authorities have been requested.

14. Senator LIEBERMAN. Dr. Sega, do you feel that these requested authorities may improve laboratory performance?

Dr. SEGA. The laboratory demonstration projects have shown that effective personnel authorities can improve laboratory performance. The Department will consider any new and promising laboratory authorities resulting from the plan required by section 1107. Based on progress to date in defining NSPS, I believe that the new system should be sufficiently flexible and adaptable to apply eventually across the Department, including laboratories and technical centers.

DOD BASIC RESEARCH

15. Senator LIEBERMAN. Dr. Sega, the recent National Academy of Sciences study, chaired by General Larry Welch, on the DOD Basic Research program made a number of recommendations for the program. Among these are a change in the official DOD definition of basic research, development of a cadre of experienced and empowered program managers to run basic research programs, and an expansion of "unfettered" research in the account. What steps do you intend to take to implement some of the study's recommendations?

Dr. SEGA. After the National Research Council (NRC) released its report, I asked the Defense Basic Research Advisory Group (DBRAG) to advise me on which of the NRC recommendations they thought DOD should implement. The DBRAG is chaired by the acting Deputy Under Secretary of Defense for Laboratories and Basic Sciences and includes senior managers from Military Department and Defense Agency offices that oversee or carry out Basic Research. We'll be happy to keep your committee staff informed as the DBRAG completes its assessment of the issues raised by the NRC report and we make progress on possible actions to resolve them.

CLASSIFIED RESEARCH PROGRAMS

16. Senator LIEBERMAN. Dr. Sega, Dr. Killion, Admiral Cohen, Mr. Engle, and Dr. Tether, note that since 2001, there has been significant growth in the classified portion of our DOD S&T portfolio. Although there is a role for classified research in our national security technology development strategy, I am concerned that if too much of our research portfolio is classified that traditional performers of innovative research like small businesses and universities will have difficulty participating in the programs. There is also a concern that classified research limits our ability to spin off technologies into the commercial sector—where it is often perfected and brought back into the military at lower cost and with more capability.

Understanding the need for some of the research that is done to be classified, how are you working to mitigate some of these negative aspects of the increase in classified research?

Dr. SEGA. I share your concern regarding an appropriate level of funding in the classified portion of our DOD S&T portfolio. The fiscal year 2006 request for DOD classified S&T programs is less than the amount we requested in fiscal year 2005. As a percent of the DOD S&T budget request, classified programs have accounted for between 1.3 percent and 2.9 percent since fiscal year 2001. The percentage for classified programs in the fiscal year 2006 request is 1.5 percent and I feel this is appropriate.

Dr. KILLION. The Army's S&T classified budget has been relatively small and stable over the past 5 years, averaging only a 2-percent increase. Classified research and technology development is limited to those activities that require a higher level of security and control. The work done under these auspices is planned and accomplished with full cognizance of work being done within the commercial sector. Many classified efforts have related unclassified aspects that provide small businesses, nontraditional suppliers, and universities ample opportunity to participate in basic

research, applied research, and engineering activities that contribute to the classified programs. The Army conducts its advanced technology development phase of these efforts in collaboration with industry partners capable of participating at the appropriate security level.

Admiral COHEN. The Office of Naval Research does not have classified contracting authority, so the science and technology work we fund is available to unclassified researchers at universities, non-government labs and small, innovative businesses.

Mr. ENGLE. A portion of the research conducted within the Air Force S&T program is by necessity classified. I believe we have an appropriate mix of both classified and unclassified opportunities in which our commercial sector partners can participate. The Air Force is an ardent supporter of the innovative research conducted by small businesses and universities and reaches out to them through our Small Business Innovation Research (SBIR) program and our basic research programs. For the most part, neither our SBIR outreach program nor our basic research programs involve classified material. These programs have grown substantially over the last 5 years, increasing the opportunity for small businesses and universities to participate. Further, our policy with respect to universities is in accordance with the National Security Decision Directive 189, which states that, to the maximum extent possible, the products of fundamental research remain unrestricted.

Dr. TETHER. DARPA is always interested in great new ideas, wherever they come from. Classification typically only becomes important the closer we get to an actual military application. If and when we must make some information classified, we are well prepared to sponsor willing organizations or even individuals into the National Industrial Security Program, which is the program that gives non-government organizations access to classified material.

It is true that there has been significant budget growth in our most highly classified programs. However, the overwhelming majority of our efforts, which have grown as well, remain unclassified or are not highly classified. For example, almost all of our SBIR work, which is devoted to small businesses, is unclassified. Our basic research, which has more than doubled since fiscal year 1999, is all unclassified. In short, DARPA has many opportunities for organizations with good ideas, and those that are willing to participate in classified programs can (provided they can be properly cleared, of course.)

Our Grand Challenge for autonomous ground vehicles highlights our commitment to getting good ideas from anywhere. With universities, high schools, small companies, garage mechanics, etc. that competition is wide open. In fact, we picked our Challenge specifically to get a very wide variety of organizations involved.

17. Senator LIEBERMAN. Dr. Sega, Dr. Killion, Admiral Cohen, Mr. Engle, and Dr. Tether, what should universities and small businesses do in order to be able to participate in these classified research programs?

Dr. SEGA. They should seek sponsorship into the National Industrial Security Program, which is a program that gives non-government organizations access to classified material.

Dr. KILLION. As with its unclassified research programs, the Army engages with the commercial and academic communities to support the Army's classified research programs. In those situations that a business or university has the appropriate facilities for performing classified research and have the personnel with the proper level of security clearance, they may participate directly in the performance of the classified research. Such secured facilities and personnel are more often found in the business sector than in the academic sector. In academia, it is more common for universities to support the classified research programs by performing basic research that is fundamental in nature, and as such, does not require a restricted classification.

Admiral COHEN. The Office of Naval Research does not have classified contracting authority, so the science and technology work we fund is available to unclassified researchers at universities, non-government labs and small, innovative businesses.

Mr. ENGLE. Small businesses and universities are not excluded from participating in classified research programs if they can demonstrate the ability to protect sensitive national security information and get the appropriate security clearances for their personnel. However, in a lot of instances, it would be cost prohibitive for most small businesses and universities to obtain these security clearances and the infrastructure necessary to handle, store, and publish classified reports. One approach that has worked well is teaming arrangements with larger defense companies that can provide the infrastructure and, in some cases, the people through contract arrangements. In the case of universities, we have seen very little interest in participating in classified research programs due to restrictions on publication.

Dr. TETHER. In terms of small businesses, we are well prepared to get those that need to be cleared into the National Industrial Security Program. Moreover, in some cases, when a small business is a subcontractor to a prime that already has access to classified information, the prime can sponsor the small business into a program too.

The same is true for universities. We are prepared to work with them to set up the safeguards needed for classified programs, just like other performers.

SEMICONDUCTOR INDUSTRY

18. Senator LIEBERMAN. Dr. Sega, Dr. Killion, Admiral Cohen, Mr. Engle, and Dr. Tether, as you are aware, East Asian countries are leveraging market forces through their national trade and industrial policies to drive the migration of semiconductor manufacturing to that region. If this accelerating shift in this manufacturing sector overseas continues, the U.S. potentially could lose the ability to reliably obtain high end semiconductor integrated circuits. Semiconductors impact every aspect of a warfighter's mission including secure communications, smart weapons, precision targeting, navigation, and guidance.

Specifically, the photomask industry is of particular concern, especially given that this is the only area in the fabrication process where raw data is handled for laying down a complex pattern for circuitry. This offshore shift in semiconductor manufacturing is occurring at a time when these components are becoming an even more crucial defense technology advantage to the United States. For example, network-centric capability demands ever faster real time processing for defense purposes and also because of the increasing need for such high-end components in the Intelligence Community.

What research efforts are in place to mitigate this national security risk, and are these efforts adequate to fully abate this serious issue?

Dr. SEGA. Photomasks are important for large volume electronics, typical of most commercial production. The offshore migration of portions of the semiconductor industry, including the photomask industry, is influenced strongly by economic considerations. The Defense Department has critical needs in the production of leading edge, low volume integrated circuits. Mask costs are a significant component of the cost of low volume integrated circuits. To address future requirements in low volume electronics, DARPA has sponsored research efforts in maskless lithography which could eliminate the requirements for photomasks.

Dr. KILLION. The OSD is in the lead on this issue and Army S&T leadership coordinates its efforts in electronics R&D with OSD through the office of the Deputy Under Secretary of Defense for S&T.

Admiral COHEN. Office of Naval Research (ONR) has substantial investments in network-centric technologies, and is keenly aware of the need to maintain availability of secure electronics processing. In the near term (next 5 years) this need should be met through the Trusted Foundry agreement being negotiated between the U.S. DOD and IBM Corporation. In addition; the DOD Advisory Group on Electron Devices has recently completed a Special Technology Area Review on Field-Programmable Gate Arrays which considered some of the ramifications of increasing offshore processing of this type of high performance electronic circuits, and the final report of this review will include recommendations for DOD actions. ONR does not support research in processing science for current generation silicon electronics, both because the scale and proprietary nature of such research is best met by other institutions. ONR does, however, support research in novel electronics technologies that in the long term may supplant the current technologies. This support includes our pioneering and continuing investments in both nanoelectronics, and in multifunctional electronics (including magnetics, optics, superconductivity, acoustic, etc. technologies monolithically integrated with semiconductors). Securing and maintaining U.S. leadership in processing capability for such next-generation electronics is expected to at least partly mitigate the increasing shift of conventional electronics processing offshore.

In summary, the currently supported efforts by ONR are largely directed towards "beyond silicon" technology. ONR is increasingly cooperating with NIST in the pursuit of flexible fabrication processes for diverse types of electronic devices. The Naval Air Systems Command is involved in the pursuit of an industry based Mask Initiative Consortium (MIC) that is composed of the major U.S. companies in this field (materials, mask makers, and tools).

Mr. ENGLE. The DOD has robust R&D investments in several key areas tied to the semiconductor industrial base. This investment has several benefits, including: maintaining a knowledge base of scientists and engineers by supporting university

and industry research; investigating and developing technologies that are beyond the risk of industry due to current economics, but that may have commercial value after they mature; and, most importantly, providing technological superiority over current and future adversaries. I defer to Dr. Sega to further address these questions.

Dr. TETHER. In fiscal year 2005 DARPA is funding research in Advanced Lithography focused on developing Maskless Lithography for cost-effective fabrication of low- to mid-volume, Application-Specific Integrated Circuits (ASICs), as well as emerging MicroElectroMechanical Systems (MEMS), and nano-photonic devices fabricated with feature sizes of 100 nm and below. This new lithography technology will be capable of directly patterning complex circuits down to feature sizes of 45nm and below without use of photo masks. Currently, this program is evaluating both optical and electron-beam based approaches to Maskless Lithography. These tools are specifically aimed at meeting DOD needs, and therefore address only the low- to moderate-volume production of specialized DOD circuitry.

DARPA's Advanced Lithography program will take a strategic pause in fiscal year 2006 to reassess opportunities. DARPA continues to evaluate new technologies which have the potential to improve semiconductor chip fabrication and thereby better support the warfighter. Higher volume DOD semiconductor needs depend increasingly on commercial off-the-shelf semiconductor devices. The DOD continues to be concerned about the shift in semiconductor manufacturing offshore. The military departments have recently responded to this concern by establishing a Trusted Foundry at IBM to meet specialized DOD semiconductor needs.

MANUFACTURING TECHNOLOGY

19. Senator LIEBERMAN. Dr. Sega, Dr. Killion, Admiral Cohen, Mr. Engle, and Dr. Tether, the U.S. trade deficit in manufactured goods increased $94.5 billion in 2004 from the $536 billion reported in 2003. Our largest goods deficit is now with China, standing at $162 billion, an increase of $37.9 billion from 2003. We are running major deficits with China in defense critical manufacturing areas, such as computer hardware ($25 billion) and electronics machinery and parts ($23 billion) as U.S. production drifts offshore. We are transferring major portions of our circuit board, semiconductor, machine tool, and weapon system metal casting manufacturing to China because of low wage and production costs. Without productivity breakthroughs, the U.S. defense manufacturing base particularly, second and third tier small manufacturers will continue to erode. What research efforts are in place to address the needed innovation in manufacturing and are these efforts adequate to fully abate this serious issue?

Dr. SEGA. Army, Navy, Air Force, Defense Logistics Agency, and Missile Defense Agency each has Manufacturing Technology program elements to address core service and agency manufacturing requirements. OSD, through the Joint Defense Manufacturing Technology Panel (JDMTP), works with the Military Departments and Defense Agencies to encourage investment synergy and collaboration where possible. We work with manufacturing initiatives such as Next Generation Manufacturing Technology Initiative (NGMTI), Composites Affordability Initiative, and Metals Affordability Initiative to identify candidate technologies that support DOD S&T strategic plans and have the potential to the benefit the warfighter. Most recently, we established a Defense Science Board task force to assess the DOD Manufacturing Technology program and provide recommendations as to how ManTech can be strengthened to improve benefits to the DOD.

Dr. KILLION. Within the Army, we have established an approach, where appropriate, in which we conduct manufacturing S&T efforts that are fully coordinated with and complementary to our most innovative and advanced technology maturation and demonstration programs. We want to reduce the cycle time from technology transition through development to production while making our systems more affordable. A specific example of this parallel development is the Flexible Display Initiative. The Flexible Display Center, in particular, will set up the first integrated pilot line in the world to manufacture affordable flexible displays. This is a collaborative effort among the Army, academia and several sector representative companies from the U.S. industrial base. The Army Manufacturing Technology program is also investing in high strength steel manufacturing processes to strengthen the U.S. forging industrial base supplying material for next generation gun barrels. Both efforts stress the development of manufacturing techniques that enable the affordable production of this state-of-the-art technology. In newly emerging areas of interest, specifically nanotechnology and biotechnology, the Army has established centers of technology excellence. Both the Institute for Soldier Nanotechnology and

the Institute for Collaborative Biotechnology have incorporated industry partnerships to examine early the scale up of manufacturing processes for production.

Admiral COHEN. The Navy's primary investments in production process technology are through the Manufacturing Technology (ManTech) and the Small Business Innovation Research (SBIR) Programs. ManTech investments are used to improve the productivity and responsiveness of the Navy industrial base by developing manufacturing technologies that are beyond the risk that industry is able to assume. The program develops moderate to high risk process and equipment technology needed to support emerging acquisition program requirements that address warfighting capabilities. For example, on the next generation destroyer class, DD(X), numerous warfighting capability requirements drove the design of the topside structure to utilize composite materials. Given that the hull would remain steel, industry required an effective and efficient means of joining the different materials. To address this issue, ManTech developed an adhesive bonded joining technology for marine applications. It is now being incorporated into the baseline design for DD(X) and the technology is available for other applications.

The Navy SBIR program is one of the major sources for funding small business in the development of new and innovative manufacturing processes, materials and software. The Navy SBIR office continues this focus and through Executive Order 13329, "Encouraging Innovation in Manufacturing" is receiving more visibility from small business and acquisition programs that have a desire to use the SBIR program resources to help address American defense manufacturing needs. Through SBIR funding, one small business has developed automated production planning software that creates piping production plans directly from the 3–D model of the ship and information about the pipe shop facilities. This software, which promises significant savings in planning time and cost, is being tested in industry for application on the CVN–21.

Both ManTech and SBIR are focused on Navy acquisition program requirements and, as such, are unlikely to have an impact on overall industrial competitiveness and the balance of commercial trade. In the case of the electronics industry, the DOD share of the overall market is less than 1 percent. Industry investments in electronics product and process development are based on the needs of the commercial market. Therefore, the Navy's manufacturing research done in electronics is not focused on productivity improvements for semi-conductors, circuit boards and other commodity items. Instead, it focuses on military unique items such as traveling. wave tubes and on packaging commercial electronics to meet military requirements. The situation is similar for machine tools and metal castings. The market in these sectors is also heavily weighted toward commercial sales.

Mr. ENGLE. Maintaining a strong domestic industrial base is a key element to ensuring the DOD with first and assured access to critical components from trusted domestic sources. The DOD Manufacturing Technology program aids in this quest by developing manufacturing technologies that enable affordable production and sustainment of current and future weapon systems. The Air Force strives to develop resources onshore where possible, but in some cases we are forced to go overseas for resources, materials, or technologies that do not exist domestically.

In the case of semiconductors, current military requirements are met predominantly by the large vertically integrated United States defense manufacturers. Companies such as BAE Systems, Lockheed, Northrop Grumman, Raytheon, and Honeywell have design, fabrication, and production capabilities to ensure military unique performance and security requirements are met. Of course, the concern is with the move offshore of materials and components that are used in building the devices. Over 70 percent of the manufacturers of items such as ceramic packages, high-purity silicon wafers, die materials, quartz products, resins, and optical equipment are foreign based or owned. These items are not unique to military parts and their economics and technology are driven by the commercial market.

The DOD is evaluating three alternatives to address its requirements. The first would establish and maintain a facility dedicated to production of components for national security applications. Current plans call for a short-term solution that establishes a "trusted foundry" to produce parts for those systems defined as critical or requiring mission assurance. The second is to focus investments on revolutionary technologies. Long-range planning within DOD's S&T community is focused on enabling and emerging technologies as they relate to defense requirements. Investment in areas such as optoelectronics and nanotechnology may not only provide a significant increase in military capability, but may also have domestic commercial economic implications that surpass trying to retain current technologies. The third alternative is to use DOD funding to strengthen the current commercial industrial base. However, with less than 2 percent of total market sales, DOD investment may not be adequate to overcome industry economics.

Finally, the Defense Production Act, Title III program has limited funding to conduct a preliminary analysis of the Mask Industry Consortium's proposal to use Title III funding to provide incentives to the mask infrastructure (mask writing, mask inspection, and mask repair tools) to assure the domestic availability of state-of-the-art photomasks for military integrated circuits. However, initial estimates indicate that this could require a DOD investment in excess of $100 million over 4 years.

Dr. TETHER. One process technology which could change the trade deficit is our Titanium Initiative to dramatically reduce the cost of titanium and enable new types of alloys. Titanium is an incredible material, but its use is partly limited by it cost—just like aluminum's use was many years ago. We want to do for titanium what was done for aluminum. Titanium costs $16 to $32 per pound now. We are developing a process which will reduce that to at least $4 a pound, and maybe below $2. At that point, many new uses will open up, from replacing the pipes aboard ships to maybe even ships themselves made of titanium.

We've also developed a technology to manufacture bulk quantities of structural amorphous metals, sometimes called glassy metals. These metals are extraordinarily strong, tough and corrosion resistant, but only small quantities could be made until DARPA's recent research. Uses might include ballistic hardening for ships or replacing the depleted uranium in antiarmor rounds.

As I mentioned, our work in microelectronics also shows how we work on process technologies to reach a new capability for DOD. For example, our Focus Centers Research Program is looking at concepts for microelectronics and computing devices beyond the current international roadmap for semiconductors; this includes process technologies. Our wide bandgap semiconductor programs are working on the materials and devices needed to use wide bandgap semiconductors for high power and high frequency applications. DARPA is funding research in Advanced Lithography focused on developing Maskless Lithography for cost-effective fabrication of low- to mid-volume ASICs, as well as emerging MEMS, and nano-photonic devices fabricated with feature sizes of 100 nm and below. This new lithography technology will be capable of directly patterning complex circuits down to feature sizes of 45nm and below without use of photo masks. Currently, this program is evaluating both optical and electron-beam based approaches to Maskless Lithography. These tools are specifically aimed at meeting DOD needs, and therefore address only the low- to moderate-volume production of specialized DOD circuitry.

Our Radiation Hard by Design program also illustrates DARPA's approach. Radiation hardened electronics, which are needed for things like spacecraft, currently require expensive specialized fabrication facilities. As a result, they constantly lag the most advanced generation of electronics. Instead of trying to improve the rad hard manufacturing process, DARPA's approach is to make such a process unnecessary by designing the chip in such a way that a rad hard chip can be manufactured in an ordinary, and up-to-date, fab.

I am confident that as DARPA continues its historical work of keeping our military on the technological cutting edge, we will continue to help create the process technologies needed for those radical new capabilities.

20. Senator LIEBERMAN. Dr. Sega, Dr. Killion, Admiral Cohen, Mr. Engle, and Dr. Tether, are the efforts in your areas coordinated with the Defense Industrial Base Capability Studies (DIBCS) that are currently underway? Are your research priorities aligned with the priorities identified through these studies?

Dr. SEGA. Yes. DOD Science and Technology (S&T) efforts and investment strategies are driven by warfighter requirements identified in the Joint Warfighting S&T Plan (JWSTP). The DIBCS, along with other DOD and commercial studies, can provide valuable insight for how best to invest scarce resources.

Dr. KILLION. Army Manufacturing S&T priorities, like our overall S&T research priorities, are aligned with the needs of the warfighter. We do review results of studies such as the DIBCS to identify and mitigate possible challenges to future production of technologies being developed. In addition we have also commissioned assessments by independent groups, such as the National Center for Advanced Technologies, to inform us regarding manufacturing science and technology issues that helped us prioritize.

Admiral COHEN. The Defense Industrial Base Capability Studies (DIBCS) are being produced by the Deputy Under Secretary of Defense (Industrial Policy). The DIBCS are based on the Joint Staff's Joint Functional Concepts (JFCs), which are focused on defense needs in the 2015–2020 timeframe. The JFCs provide a starting point for the analysis of Science and Technology gaps that must be filled in order to meet the joint warfighting vision in the 10–15 year horizon. As such, the Navy's Science and Technology (S&T) investments are loosely coordinated with the DIBCS through the Joint Requirements Oversight Council's definition of future warfare

needs. However, the Navy's research priorities are not aligned directly with the DICBS priorities because industrial base issues are but one factor among many that must be considered in the prioritization process.

Mr. ENGLE. The first study of the DIBCS was released in January 2004 with the final study scheduled for release in May 2005. The Air Force S&T community is currently evaluating DIBCS findings and recommendations in order to incorporate these into our research and investment plans as appropriate. In some cases, DIBCS findings have validated ongoing programs as with the Air Force Manufacturing Technology Advance Electronically Scanned Arrays project, which is supported by findings contained in the Battle Space Awareness DIBCS. In other areas, DIBCS findings may stimulate new or additional investment.

Dr. TETHER. As part of the DIBCS process, the Office of the Deputy Under Secretary of Defense (Industrial Policy) (ODUSD(IP)) takes into account the S&T community's plans, particularly since the early capabilities for a new technology may only exist in research labs. At the same time, myself and other members of my staff have participated in, contributed to and reviewed some of their studies.

Our research priorities are aligned. For example, one study identified a concern about the supply of Maser clocks for global positioning systems (GPS). Our program for a chip scale atomic clock might help there. Similarly, we may be able to offer solutions to other potential problems in the areas of pulsed plasma thrusters and hypersonics propulsion systems. There are likely to be other things we have underway which might help.

So, as ODUSD(IP) identifies specific problems and possible solutions, we will fold those issues into the mix we consider while formulating DARPA's research programs.

21. Senator LIEBERMAN. Dr. Sega, Dr. Killion, Admiral Cohen, Mr. Engle, and Dr. Tether, what is your current role in the completion of the DIBCS efforts and is there additional participation needed by your teams?

Dr. SEGA. We understand the final part of DIBCS, Focused Logistics, will be published before the end of this fiscal year. The S&T community welcomes the opportunity to participate in evaluating and understanding the capabilities of the industrial base with regard to DOD goals and priorities.

Dr. KILLION. Army S&T does not currently participate in the DIBCS efforts. However, as part of the Army's S&T mission to foster innovation and develop new capabilities, we have identified technology areas where the Army would benefit in terms of technology availability and affordability from improved manufacturing capability and/or strengthening of the industrial base. The Army has determined that pursuing advanced technology in parallel with manufacturing technology development works to accelerate an affordable capability to the warfighter.

Admiral COHEN. The Defense Industrial Base Capability Studies (DIBCS) are being produced by the Office Deputy Under Secretary of Defense (Industrial Policy) (ODUSD(IP)). Four studies covering Battlespace Awareness, Command and Control, Force Application and Protection have already been published. The final DIBCS study, covering Focused Logistics, is planned for publication in May. The Navy has not had a role in developing these reports. Since the final report is almost complete, additional involvement is not recommended at this time. However, once ODUSD(IP) moves into the implementation phase of DIBCS the Navy Science and Technology community will need to be engaged.

Mr. ENGLE. The Air Force did not formally participate in the DIBCS as service participation was limited to Joint Staff representation on requirements teams. Future Service participation will depend on how the OSD implements DIBCS recommendations.

Dr. TETHER. ODUSD(IP) and DARPA are both part of Acquisition, Technology and Logistics, so we have organizational proximity that facilitates understanding what each other is doing. DARPA has helped review some of their reports. So I think the current level of interaction works quite well and suits our various roles in the research, technology, product life cycle.

As ODUSD(IP) moves toward the implementation phase of their DIBCS work, I fully expect them to engage us in looking for solutions when S&T investments by DARPA would be appropriate. I will take their assessments into consideration when formulating what research areas DARPA might move into.

QUESTIONS SUBMITTED BY SENATOR JACK REED

CHEMICAL AND BIOLOGICAL DEFENSE PROGRAM COORDINATION

22. Senator REED. Dr. Sega and Dr. Tether, I am concerned that the Department's programs and efforts in chemical and biological defense S&T are not adequately coordinated with other Federal agencies, particularly the Department of Homeland Security (DHS) and the National Institutes of Health (NIH). This includes whether there is adequate cooperation and a system for avoiding duplication among these agencies. I am also aware of concerns that DARPA's efforts are not sufficiently coordinated and integrated with the Department's overall chemical and biological defense program. Would you agree that there are both room and need for improvement in the coordination of the DOD programs with other Federal agency efforts, and with the DARPA program?

Dr. SEGA. In any complex enterprise such as this area there is "room for improvement," and we have, and will continue to stress the importance of coordinating interagency and intradepartmental S&T.

Dr. TETHER. You should have no concern as the DARPA Chemical and Biological Warfare (CBW) Defense Program is well coordinated both inside and outside the DOD. The DARPA CBW Defense Program is completely integrated and synergistic with the DOD CBW Defense Program and with other Federal programs. Coordination and integration of these DARPA programs into the broader Federal programs are done through a variety of mechanisms including interagency coordinating committees, community outreach briefings, and partnerships for the transition of technologies to the operational arena.

The DARPA CBW Defense Program coordinates its efforts with numerous organizations, including the Deputy Assistant to the Secretary of Defense for Chemical and Biological Defense, Defense Threat Reduction Agency (DTRA), Joint Program Executive Office, Chem-Bio Defense (JPEO–CBD,) and the DOD Guardian Program, as well as with non-DOD entities such as the DHS, Homeland Security Advanced Research Projects Agency (DHS–HSARPA), and the Environmental Protection Agency (EPA). Through Project Reliance, DARPA formally participates in the coordination of the DOD Chem Bio Defense Technology Area Plan. As part of this process, DARPA also participates in the biannual Technology Area Review and Assessment process. In addition, a DARPA Senior Executive is a member of the DOD Senior Advisory Group for CBW Defense. The Advanced Diagnostics portion of the DARPA BW Defense program is closely coordinated with the U.S. Army Medical Research and Materiel Command and DARPA program personnel attended meetings of the Common Diagnostic Systems interagency Scientific Steering Committee that participated in strategic planning for Defense Technology Objective CB.26 (Common Diagnostic Systems for BW Agents and Endemic Infectious Diseases).

Several examples of successful transition of programs from DARPA highlight the strong coordination among the DOD's CBW programs both within the DOD and throughout relevant Federal agencies:

1. Immune Building (IB) Program. The IB program was initiated to develop technologies to protect military buildings from internal or external attack with chemical or biological warfare agents. Program objectives include protecting human occupants, quickly restoring building to function, and preserving forensic evidence. Early on in the program, DARPA developed a core team of military service representatives to review the design and testing of the system and offer recommendations to help meet operational requirements. The goal of transitioning this DARPA program to a military customer was made a reality when Fort Leonard Wood agreed to not only install a demonstration system at their site, but to also assume ownership and follow-on testing of the IB system after the demonstration.

2. Building Protection Toolkit (BPTK). DARPA met the challenge of implementing the IB technologies in other buildings through the development of the BPTK. The BPTK utilizes validated modeling and simulation tools for tailoring protective designs to buildings of various sizes, construction and uses and to enable cost/benefit analysis. The U.S. Army Corps of Engineers Protective Design Center in Omaha, Nebraska, which specializes in chemical, biological, and radiological weapons of mass destruction building protection, recently hired additional personnel to specifically use BPTK to develop new and to modify existing facility designs. The BPTK software is transitioning to the Joint Warfighting Center at Fort Monroe, Virginia, for integration into the Joint Conflict and Tactical Simulation. The National Institute of Standards and Technology in Gaithersburg, Maryland, will use the BPTK modifications made to CONTAM, a multizone indoor air quality and ventilation analysis computer program, in their future modeling and standards work to assess and validate protective strategies.

3. $C1O_2$ Based Building Decontamination. While $C1O_2$ has been in use for some years, there was a need to extend the system functionality and to construct a portable building decontamination system. DARPA completed both of these objectives in fiscal year 2004 and will complete testing of the system effectiveness against viral, toxins, CW, and select toxic industrial chemicals in fiscal year 2005. DARPA is currently working with DHS–HSARPA, EPA, and JPEO–CBD to jointly develop validated CONOPs and to test system effectiveness in full building tests against anthrax stimulant. The portable $C1O_2$ building decontamination system is planned for transition to both DHS and EPA in fiscal year 2005 and fiscal year 2006 for use in full building decontamination activities.

4. TIGER Program. The goal of the Triangulation Identification for Genetic Evaluation of Biological Risk (TIGER) program was to develop a universal BW sensor system that would support "gold standard" classification of all biological agents. This sensor has the potential to revolutionize biomedical evaluation of natural pathogens, including emerging infectious diseases and genetically engineered agents, while simultaneously monitoring for biological weapons attacks. The U.S. Army Medical Research Institute of Infectious Diseases at Fort Detrick, Maryland, has acquired a TIGER system for analysis of emerging pathogens. The National Biological Forensics Analysis Center of the DHS has procured a TIGER system to provide high-throughput rapid agent identification and strain typing. The system will be deployed in fiscal year 2005. The Naval Health Research Center (NHRC) in San Diego, California, will use a TIGER system for environmental and clinical surveillance for human pathogens. An example of specific NHRC research utilizing the TIGER is a study which monitors Marine recruits for respiratory illnesses.

5. Pathogen Countermeasures Program: A number of promising medical countermeasures have been transitioned for more advanced development within the DOD. A few examples within the last 12 months include the following:

> CPG: DARPA has supported research into the ability of specific sequences of microbial DNA (called CPG) to activate the innate part of the immune system. DARPA researchers realized that CPG was essentially functioning as an immune activator, and proved that CPG had potential as a new vaccine adjutant. DARPA demonstrated the feasibility of this approach; DTRA is now supporting a human clinical trial of CPG to enhance responses to the current anthrax vaccine. We believe that the series of six shots can be reduced to only two, or perhaps even one, when administered with CPG. The initial human trial will be finished later this spring.
>
> PlyG: For several years, DARPA has supported research investigating specific viruses (called phage) which infect and kill harmful bacteria, such as anthrax. DARPA investigators proved that specific enzymes from these phage not only kill, but actually disintegrate, anthrax. DARPA demonstrated the feasibility of this approach, and now DTRA is funding these investigators for further development of new antibiotics. Clinical trials are expected to begin in 2006.
>
> Caspase Based Anti-Viral Therapeutics: DARPA has most recently transitioned to DTRA the development of a completely new approach to kill many classes of viruses by inducing a suicide signal in cells which are infected with a virus. By killing the infected cells, the virus cannot propagate and kill the host. This is a very novel approach, but one which now appears to be at least technically feasible.

The DARPA program is also coordinated with efforts outside the DOD. A panel of chemical and biological defense experts is routinely consulted by DARPA to evaluate programs and to ensure that NIH efforts are not being duplicated. In addition, the Pathogen Countermeasures program is fully briefed to National Institute of Allergy and Infectious Diseases (NIAID) every 6 months, and NIAID program managers regularly attend the principle investigator meetings. There is also a developing close partnership between DARPA and the Food and Drug Administration (FDA). Center and office directors at FDA have been fully briefed on DARPA initiatives, and FDA personnel are now working cooperatively with DARPA to identify regulatory issues and provide input as appropriate. FDA scientists now attend pertinent DARPA principle investigator meetings.

Additionally, from October 2004 through January 2005, DARPA hosted a series of conferences focused on DARPA programs in the chemical and biological defense area. The goals of these events were to ensure that the government R&D community (both DOD and non-DOD) is informed of DARPA investments in this area, and to promote awareness of potential upcoming product transitions. The governmental organizations that attended are listed below and additional meetings are planned for May 2005.

DARPA CBW Defense Community Briefings—October 5, 2004, December 21, 2004, January 25, 2005 Participating Agencies

- Department of Health & Human Services, Bureau of Health
- Department of Health & Human Services, FDA
- Department of Health & Human Services, Office of R&D Coordination
- DHS, S&T Directorate—HSARPA
- DHS, S&T Directorate—Programs, Plans, & Budget
- DHS, S&T Directorate—Systems Engineering & Development
- DHS, Transportation Security Administration
- EPA, Environmental Response Team
- EPA, Hazardous Sites Cleanup Division
- EPA, National Homeland Security Research Center
- EPA, Office of Pesticide Programs
- EPA, Office of Research and Development
- EPA, Office of Solid Waste & Emergency Response
- EPA, Office of the Administrator
- EPA, Superfund Remediation & Technology Innovation
- Executive Office of the President, Office of S&T Policy
- Joint Chiefs of Staff, J8
- Joint Program Executive Office, Chem-Bio Defense
- Joint Requirements Office, Chemical, Biological, Radiological, and Nuclear (CBRN) Defense
- NIH, National Center for Research Resources
- NIH, National Institute of Allergy & Infectious Diseases
- OSD, Armed Forces Institute of Pathology
- OSD, Armed Forces Medical Intelligence Center
- OSD, Chem-Bio Defense
- OSD, Defense Logistics Agency
- OSD, DTRA
- OSD, Director, Operational Test and Evaluation (DOT&E)
- Pentagon Force Protection Agency, CBRN Directorate
- U.S. Air Force, 313 Human Systems Wing
- U.S. Army, Army Research Laboratory
- U.S. Army, Corps of Engineers
- U.S. Army, Edgewood Chemical Biological Center (ECBC)
- U.S. Army, Headquarters, G–8 Force Development Branch
- U.S. Army, Medical Research Institute of Infectious Diseases
- U.S. Army, Research, Development, & Engineering Command
- U.S. Army, Medical Research Institute of Infectious Diseases
- U.S. Marine Corps, Systems Command
- U.S. Navy, Naval Research Laboratory
- U.S. Navy, Naval Surface Warfare Center
- U.S. Navy, Office of Naval Research
- U.S. State Department, Bureau of Diplomatic Security
- U.S. State Department, Bureau of Nonproliferation
- U.S. State Department, Office of Medical Services
- U.S. State Department, Overseas Building Operations

I hope this information fully alleviates any concern you may have had regarding the DARPA program's interactions with both DOD and other Federal programs.

23. Senator REED. Dr. Sega and Dr. Tether, how do you believe these two concerns can best be addressed?

Dr. SEGA. As regards the interagency cooperation, four senior officials in the Department are actively engaged in various integration and coordination forums set up by the National and Homeland Security Councils; DDR&E, ASD(Homeland Defense), ASD(Health Affairs) and ATSD(NCB). I believe that these forums are comprehensive in scope and effective. As regards internal DOD cooperation and integration, Dr. Klein (ATSD(NCB)) is the lead official for execution of RDT&E programs in this area and he has been actively working to address this as a response to the Major Action Item from the 2004 Chemical-Biological Defense Technology Area Review and Assessment (TARA). It is through mechanisms of R&E oversight such as TARA that continuing improvements can be effected.

Dr. TETHER. DARPA continues to participate in all venues for coordination and integration while seeking additional avenues to ensure maximum DARPA program effectiveness and to prevent duplication. We understand this coordination is essential within DOD as well as across all Federal agencies and private industry and academia.

As detailed in our answer to question 22, I feel that the two concerns are bring addressed.

JOINT UNMANNED COMBAT AIR SYSTEMS

24. Senator REED. Mr. Engle, the Air Force's fiscal year 2006 S&T budget request includes $78 million for the Joint Unmanned Combat Air System (J–UCAS). Could you please explain why this program has been transferred to the Air Force from DARPA?

Mr. ENGLE. The OSD transferred program management of the J–UCAS program to the Air Force to establish a joint program office with Navy representation and to advance the program. The Air Force and Navy have been tasked to restructure the J–UCAS program with emphasis on the development of air vehicles that will contribute to future warfighting concepts of operations.

25. Senator REED. Mr. Engle, why will this improve the program?

Mr. ENGLE. Transition of the J–UCAS program to the Air Force will allow for an early focus on joint warfighting concepts and increased emphasis on timely fielding of J–UCAS capabilities. The development of war fighting concepts and capabilities, and the subsequent incorporation of these capabilities into overall joint warfighting operations, is not an area that DARPA is structured to perform. For this reason, as the technology matures, it is important to transfer DARPA's "tech push" efforts to service leadership. With the extensive work the Air Force has done in this area, we are well prepared to take the lead for the J–UCAS program.

26. Senator REED. Mr. Engle, The J–UCAS program is being partially funded in S&T again. Is this a more accurate reflection of the state of maturity of the system's technologies?

Mr. ENGLE. Yes, the $77.8 million transferred into the Air Force S&T Program in fiscal year 2006 reflects the relative maturity of the J–UCAS program. This S&T funding provides for completion of technology development and facilitates transition of this technology into the formal development program. The majority of funding for J–UCAS was transferred into the J–UCAS Advanced Component and Prototype Development Program Element, which better reflects the more mature nature of this system's technology.

27. Senator REED. Admiral Cohen, what is the Navy's role in the J–UCAS program?

Admiral COHEN. The Navy is integral to the joint program. Navy personnel from the Office of Naval Research, Naval Air Systems Command, CNO staff, and other organizations comprise a substantial portion of the J–UCAS program management, technical, engineering, and support staff. A J–UCAS Field Office has been established at NAS Patuxent River. Navy objectives have been set for the program, and have a major influence on system design, development, and demonstration plans.

28. Senator REED. Admiral Cohen, what is the fiscal year 2006 Navy investment in the program?

Admiral COHEN. In fiscal year 2005, all Navy Unmanned Combat Air Vehicle (UCAV–N) funds, including those that had been allocated in future years, were included in the Defense Wide program element supporting the J–UCAS program. Beginning in fiscal year 2006, this funding will be transferred to an Air Force program element. The Navy continues to support the program with personnel and material resources as described in the response to QFR 27.

NON-LETHAL WEAPONS DEVELOPMENT

29. Senator REED. Dr. Sega, a variety of Department programs are developing non-lethal weapons capabilities that may be deployed to our forces. I am concerned that some of these new systems may be sent overseas as prototypes for demonstration or experimentation purposes without proper policy oversight, testing of the technology, or training of end users. How are you working with the Joint Non-lethal Weapons Program to develop new non-lethal weapons capabilities and transition them to the field, while assuring adequate policy review and testing of these systems and adequate training for the forces who will use them?

Dr. SEGA. My office, as well as several other offices within the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics (OUSD(AT&L)) interact frequently, both formally and informally, with the Joint Non-Lethal Weapons

Program and the Office of the Assistant Secretary of Defense for Special Operations and Low Intensity Conflict (OASD/SOLIC), which has policy oversight for the development and employment of non-lethal weapons.

The DOD policy directive on non-lethal weapons, DOD Directive 3000.3, assigns responsibilities for the development and employment of non-lethal weapons. Non-lethal weapons are developed and fielded using the same general processes as those used for the acquisition of lethal weapons. Non-lethal weapons policy considerations are addressed early in concept development and encompass areas such as intended effects, human test protocols, concept of operations and employment, and legal and treaty compliance.

30. Senator REED. Dr. Sega, what is the process for policy review of these systems prior to their deployment?

Dr. SEGA. The Office of the Assistant Secretary of Defense for Special Operations and Low Intensity Conflict (OASD/SO–LIC) has policy oversight for the development and employment of non-lethal weapons. The DOD policy directive on non-lethal weapons, DOD Directive 3000.3, assigns specific responsibilities for the development and employment of non-lethal weapons within the Department.

DARPA EXPERIMENTAL HIRING AUTHORITY (SECTION 1101)

31. Senator REED. Dr. Tether, Congress has given DARPA a special hiring authority which DARPA has used successfully to hire a number of technical experts to manage research programs. Please described how DARPA has made use of this authority to date and what plans are for its future use.

Dr. TETHER. Since March 1999, DARPA has successfully used its Section 1101 experimental personnel authority to hire highly skilled term employees as program managers, deputy office directors and office directors. The authority currently has 40 billets; it was expanded from 20 billets in 2000. Section 1101 has allowed DARPA to compete for, and expeditiously hire, highly-skilled individuals from industry and academia that would otherwise be lost due to salary disparities and a lengthy hiring process. The Section 1101 authority allows us to offer a salary up to the Executive Level III cap; offer recruitment, retention, relocation, or performance bonuses up to $25,000 per employee, per year; and, it allows us to make on-the-spot hires with as little as 1 week for in-processing time. This is in contrast to being able to offer only the limited top grade and step of the General Schedule. Moreover, it also prevents DARPA from losing potential talent because of the protracted regular hiring process, which has exceeded 6 months in some cases. When competing for the kind of talent DARPA needs, compensation incentives and expeditious hiring are critical to attracting highly sought after candidates and closing the deal.

The Section 1101 authority granted to DARPA will expire September 30, 2008. However, in the spirit of embracing the NSPS, DARPA has recently switched to using the new Highly Qualified Expert (HQE) authority, modeled after the Section 1101 program, for all new, eligible hires from industry. One advantage of the Section 1101 authority has been that we control and manage the entire hiring process. As we transition to the HQE authority I hope that we'll be able to manage our HQE hiring in the same manner as we managed Section 1101 and that everything will be running smoothly before Section 1101 expires. My goal is to be able to hire the same quality of people for the same kinds of positions as we have under the Section 1101 authority, and just as quickly.

32. Senator REED. Dr. Tether, I understand that DARPA is now working to make use of authority within the NSPS that will enable it to hire "HQEs" to work at the agency. Could you describe how DARPA is making use of this new authority?

Dr. TETHER. We have been delegated authority from the Under Secretary of Defense for Personnel and Readiness to manage the HQE program at DARPA and received a block of 60 allocations to use from Washington Headquarters Service (WHS). We also have a Memorandum of Understanding with WHS to assist us with the mechanics of ensuring our HQEs are properly entered into the Civilian Personnel Data and Payroll Systems.

Additionally, we have written an interim pay plan, which mirrors the Personnel and Readiness implementation guidance, pending a final internal DARPA Instruction on HQE personnel administration.

To date, we have hired two HQEs; one in the Tactical Technology Office; one in the Information Exploitation Office. We have another offer pending and two more in negotiation.

33. Senator REED. Dr. Tether, how do these new authorities compare with respect to supporting the performance of DARPA's designated mission? Are there particular advantages to one over the other?

Dr. TETHER. The most valuable aspect of the section 1101 and HQE hiring programs is the ability to negotiate salary (and bonus) and move quickly with an offer of employment. Since receiving the hiring authority delegation and a block of allocations, the HQE program can meet DARPA's technical hiring needs as well as the Section 1101 program has done over the past 6 years. In fact, the HQE program is an enhanced version of the Section 1101 program in that, if necessary, we are able to offer more compensation than what is allowable under the 1101 authority (e.g., bonuses of up to 50,000, vs. 25,000 in the Section 1101 program; HQEs receive 8 hours of annual leave per pay period vs. 4 hours of annual leave for section 1101 first time appointments).

As long as DARPA is able to manage our HQE hiring in the same manner as we have managed Section 1101, it will be a more advantageous and flexible hiring authority.

HIGH PRODUCTIVITY COMPUTING SYSTEM PROGRAM

34. Senator REED. Dr. Tether, how much funding is being requested in the fiscal year 2006 budget for the High Productivity Computing System Program (HPCS)? What do you expect this funding will achieve?

Dr. TETHER. The fiscal year 2006 budget request for the HPCS program is $70.1 million. The requested fiscal year 2006 funding will complete the R&D phase (Phase II) of the HPCS program and start the full-scale development phase (Phase III). Based on the same successful rapid response model used for the transition from Phase I to II, a Phase III solicitation will be released, proposals reviewed, and vendor(s) selected.

At this budget level, we anticipate that one team will move forward into the full-scale development of HPCS Phase III effort.

35. Senator REED. Dr. Tether, how much additional funding is necessary in order to fund additional HPCS teams for the system development and demonstration (SDD) phase of the program?

Dr. TETHER. An additional team would not require additional funding in fiscal year 2006, but would require $50 million more in fiscal year 2007. This would result in a budget profile of $70.1 million in fiscal year 2006 and $125 million in fiscal year 2007. Fiscal year 2008 and fiscal year 2009 have yet to be finalized, but additional funds would be needed in both years.

We are also soliciting the Department of Energy and the National Security Agency to provide the additional required funding for the program to have an additional team since they are major beneficiaries of the technology.

36. Senator REED. Dr. Tether, why is it advantageous to fund multiple contractors during the SDD phase of the program?

Dr. TETHER. A number of recent reports, including the High-End Computing Revitalization Task Force report, have indicated the importance of revitalizing high-end computing to ensure a strong United States high performance computing (HPC) technology, development and product base. The number of government agencies already participating in the HPCS program (including the DOD, the National Security Agency, the National Reconnaissance Office, the Department of Energy, the National Aeronautics and Space Administration, and the National Science Foundation) attest to the importance of the program to national security and scientific leadership.

Each of the current Phase II vendors offer a unique high-end computing capability and commercial market emphasis. Based on the vital role of a world-class HPC capability, multiple awards for Phase III would greatly increase the industrial base capability to support our national security needs, ensure continued U.S. scientific leadership, and greatly enhance the long-term viability of high-end computing.

QUESTIONS SUBMITTED BY SENATOR BILL NELSON

NANOTECHNOLOGY

37. Senator BILL NELSON. Dr. Sega, Dr. Killion, Admiral Cohen, Mr. Engle, and Dr. Tether, investment in nano-related S&T research appears to have been significant over the last few years. Nanotechnology has tremendous intuitive appeal, gen-

erated considerable excitement, and attracted significant investment. Despite the investment, one does not hear much about nanotechnology moving very progressively from conceptual potential to technical promise. One cannot survey America's research universities these days and not find scientists with a nano-miracle ready to solve any number of materials, electronic, chemical, mechanical or bio-medical problem.

For example, Florida State University and Florida A&M University are in partnership with Armor Holding, Incorporated (manufacturer of the up-armored High Mobility Multipurpose Wheeled Vehicle (HMMWV)) in the development of a composite material and manufacturing technology that will provide new lightweight body armor to protect soldiers' arms and legs. The ultimate objective is to apply this manufacturing technique to an exceptionally strong and lightweight nano-material, also under development at Florida State and Florida A&M. You can imagine that scientists at these two great universities are working hard on this effort with a great sense of purpose and understanding of the urgency to find an extremities protection solution.

What in your view is the potential or promise of nanotechnology solutions to military technical challenges?

Dr. SEGA. Nanotechnology will impact military capabilities across a broad spectrum of application areas because the ability to control and exploit material structure at the nanometer scale will permit a wide range of new functionalities. Some specific areas for which nanotechnology offers the greatest potential for enhancing military capabilities include: chemical/biological defense, information technology, energy and energetics, multifunctional materials and devices, and health monitoring and sensing.

Dr. KILLION. Nanotechnology has the greatest potential to impact warfighter needs in the areas of chemical and biological defense, network-centric technologies, power and energy, light combat system survivability, soldier protection, and soldier health monitoring and treatment.

Admiral COHEN. There is significant excitement about the promise of nanotechnology for many applications around the world. The example cited is one where nanomaterials and composites are being examined as potential high strength, but lightweight, materials for body armor. Other examples of nanoscience-driven opportunities that have significant military application include:

1) nanoelectronics, nanophotonics, and nanomagnetics research as potential solutions in areas of network centric warfare, information warfare, uninhabited combat vehicles, automation and robotics for reduced manning, effective training via virtual reality, and rapid digital signal processing;

2) nanomaterials "by design" wherein today's computers are capable of designing and testing new materials before they are made resulting in potential, cost effective, solutions in areas of high performance and affordable materials, multifunctional and adaptive (i.e., smart) materials, energetic materials and materials for power generation and storage, nanoengineered functional materials, and materials requiring reduced maintenance;

3) nanobiotechnology for warfighter protection research as potential solutions for chemical and biological agent detection and destruction, and human performance issues such as health monitoring and prophylaxis.

The successful transition of these S&T nanoscience research efforts into field-tested nanotechnology products will have significant impact in the following areas:

1) information dominance wherein nanoscale phenomena foster lower power and/or less energy dissipation per process, better signal transduction via improved signal-to-noise, faster processing speeds due to shorter transit times, and higher function density;

2) enhanced platforms wherein nanoscale phenomena provide multifunctional and/or adaptive design flexibility inhibit conventional failure mechanisms in materials, and control the release of energy;

3) weapons and countermeasures wherein nanoscale phenomena provide controlled energy release fuels and explosives, new materials for high power lasers and missile seeker domes, and stealth;

4) detection, protection, and decontamination systems for weapons of mass destruction wherein nanoscale phenomena provide improved detector sensitivity, improved selectivity with miniaturized arrays, new capability via distributed autonomous systems, super absorbent material, and nanofibers for membranes and clothing; and

5) warfighter enhancement and protection wherein nanoscale phenomena provide more function per unit weight and/or volume, improved power generation and storage and/or lower power demand, and personal decision aids.

Mr. ENGLE. We believe nanotechnology is paving the way to new materials and device architectures that could form the foundation of future warfighting capabilities. Because nanotechnology involves manipulation of materials at the atomic level, we see applications across our portfolio of science. For this reason we are building scientific expertise in each of our applicable Technical Directorates. Some specific areas we are exploring include materials that can self-repair for use on aircraft surfaces, energetic materials for better control of kinetic weapons, and new materials that will allow us to build lighter weight sensors with significantly higher resolution.

Dr. TETHER. The real promise of nanotechnology occurs when working at the scale of nanometers provides a specific set of properties that can't be achieved any other way. There are a great number of areas in which nanotechnology offers promise for significant improvement in Defense capabilities. Accordingly, our budget request this year includes about $170 million for nanotechnology, which is the highest in the Department.

An example of fielded nanotechnology is the development of microwave and millimeterwave transistors where the current carrying channel is grown 10 nm thick with atomic layer precision and the modulating gate electrode is patterned at 100 nm long to detect and amplify signals above 20 GHz. Many of these nanoscale devices are flying today on space platforms.

This type of nanometer control of electronic, photonic, and MEMS components is expanding and expected to impact an increasingly large number for DOD systems:

- Ultradense giant magneto resistance memories were one of the first examples of the promise of nanotechnology. Today, these radiation hard, high speed, nonvolatile memories are being evaluated for missiles and space applications.
- Semiconductor optical devices require control of their material and device structure on the order of 10 or 20 nm. This has led to quantum cascade lasers which are useful for detecting chemical agents and the vertical cavity lasers now often used to move signals around inside military equipment, which rely on nanotechnology to create their mirror stacks.
- Silicon germanium electronics combined with nanoscale Complementary Metal Oxide Semiconductor (CMOS) is revolutionizing radio frequency (RF) electronics by allowing RF and mixed analog-digital electronics circuits for military systems to be fabricated at a lower cost in silicon fabs.
- We can now control the flatness on films deposited on 8 to 12 inch diameter silicon wafers down to nanometers. This allows the processing of very fast transistor circuits with clock frequencies in excess of few gigahertz, which is important for many signal processing functions.

The levels of investment over the last 5 years are setting the stage for a myriad of new capabilities that are about ready to be brought to fruition. New biological sensors, high density nano-wire based electronics, nano-scale photonic devices, nano-scale mechanical oscillators, and ultra-high strength fibers from carbon nanotubes to name just a few.

38. Senator BILL NELSON. Dr. Sega, Dr. Killion, Admiral Cohen, Mr. Engle, and Dr. Tether, in what areas would you say that nanotechnology has demonstrated promise and is very close to operationally testing a field application? If nothing is close to operational testing, why, given the levels of investment over the last 5 years, have we not prototyped a useful nano-solution to a militarily-relevant technical challenge?

Dr. SEGA. Nanotechnology is still emerging and at the early stages of development. In fact, many of the critical scientific breakthroughs needed to realize the potential of nanotechnology for military applications have only emerged within the past few years. Nonetheless, significant demonstrations of the unique potential of nanotechnology have occurred, and many of these results have been transferred to technology development, both to industry and within DOD laboratories. Some program accomplishments include the following:

- An aerosol-based sol-gel method (Aero-sol-gel) for preparing nanoporous iron-oxide nanoparticles with high internal surface area has been developed; a nano-sized oxidizer and fuel material offer the potential (high surface area) for applications that involve rapid energy release.
- A new experimental facility was developed for studying plasma synthesis and processing of aluminum nanoparticles for nanoenergetics applications via ARO-funded research at the University of Minnesota. Aluminum nanoparticles were synthesized using a plasma torch over a range of operat-

ing conditions. Particle size distributions, elemental composition and particle morphology were characterized.

• Recombinant virus protein-directed synthesis of semiconductor nanowires has been utilized to fabricate functional electronic circuits.

These are just a few demonstrations of the potential of nanotechnology for military applications that have been achieved by the military departments and DARPA.

Dr. KILLION. The U.S. Army has a broad portfolio of nanotechnology investment exploring a wide range of near and far term warfighter needs. Specific examples that have been fielded or are about to be fielded include:

a. A novel sensor called Fido, which is based on a unique nanoscale architecture developed at the Massachusetts Institute of Technology, is being produced by Nomadics, Inc. Fido has been demonstrated to detect ultra trace amounts of TNT, and recently received excellent preliminary feedback from field tests conducted by the Marine Corps at Yuma Proving Grounds and during operations in Iraq. The Army has initiated actions to mate Fido with an advanced unmanned ground vehicle capable of carrying multiple sensors to detect an array of threats. The plans include development of 10 systems for deployment to Iraq.

b. High surface area nanostructured materials have been demonstrated to yield both greater capacity for chemical agent decontamination and faster reactivity, removing over 99.6 percent of VX, GD (soman), and HD (mustard gas) from surfaces in under 90 seconds. This technology was fielded in 2004 by Marine Corps Air Station Supply at Cherry Point, NC, and the Research, Development, and Engineering Command (RDECOM), and has dual-use application for civilian first responders.

c. Nanocomposite thin film photovoltaics have been developed with the capability to provide lightweight, conformal and renewable power with power densities of greater than 40 W/lb. These materials are currently in advanced development. Field capable prototypes are expected during fiscal year 2006 and commercialization is imminent.

d. Nanotechnology enhanced barrier materials have been developed for CBRN applications and food and materiel packaging. Field testing of prototype materials for enhanced Meal Ready to Eat (MRE) packaging is expected by fiscal year 2006.

e. With joint support from the NIH and the Army, nanometerscale materials with an optical response tunable from viable to infrared wavelengths have been developed that enable a noninvasive approach to destroy tumors. Initial studies with this approach have demonstrated 100 percent success in mice.

Admiral COHEN. There are examples of nanotechnology that are undergoing field tests or that have already been fielded. Some examples include:

(1) Nanoelectronics - the commercial sector already manufactures semiconductor chips that have gate lengths of 90 nanometers or less. The dimensions of components in these devices will continue to shrink until they reach the physical limits of our current fabrication process in approximately 2014. Current nanoscience research activities are developing the fabrication and metrology tools needed to sustain the current semiconductor fabrication roadmap. Current and future nanoscience research activities are investigating/will investigate the next generation of electronic devices and architectures. The military also has significant investments in gallium arsenide and other III–V semiconductor materials and other electronic materials used for high-speed and/or low-power electronics and infrared sensing applications. Many of these devices also currently employ nanoscale components.

(2) Nanomaterials - the Navy is currently testing new nanoceramic composite coatings on mine countermeasure ships to solve a significant wear problem associated with its drive shaft. Nano-engineered aluminum particles (nano-aluminum) are being tested for fuel and explosives applications. Nanostructured materials such as silica and titania aerogels are being investigated for improved energy storage (batteries and ultra capacitors) and photovoltaics applications. Nanostructured materials (e.g., polymer, adsorbents, etc.,) are being investigated for membranes, clothing, and decontamination applications. Nanocrystalline diamond materials are being investigated as windows for high energy lasers and for electronics applications.

(3) Nanosensors - nanoscale components appear in a variety of physical, chemical, and biological sensors that are under development. These components include nanoparticles and quantum dots, nanotubes, nanowires,

nanomechanical resonators, etc. Several small companies are beginning to introduce products in this area.

Mr. ENGLE. There are nanotechnologies that are already operational. For example, infrared cameras that are enabled by nanotechnology to optimize the quantum efficiency of the PtSi/Si diodes have already been fielded on Air Force U–2 and B–52 platforms, thus providing navigation and night-time operational capabilities not previously available. Other promising nanotechnology efforts currently funded within the Air Force S&T program include:

- Ni-Coated Nanostrands: Addition of less than 1 percent Ni-coated nanostrands could provide electrically conductive airframe composite structures for lightning strike protection and protection from electrical discharge on aircraft refueling booms.
- Quantum Well Superlattice Lasers for Aircraft Self-Protection: Could provide new missile threat countermeasure protection against long-wavelength threats for large aircraft at a significant savings estimated at $300,000 per aircraft over current technology.
- Quantum Well Superlattices for Infrared Space Sensor Applications: Could provide faster and more accurate target detection and identification at 25 percent lower launch weight and 95 percent lower energy requirements.

Dr. TETHER. DARPA has been engaged in nanotechnology for many years, well before the national initiative began. In fact, many of the examples used to start that initiative came from work done at DARPA, and we are already beginning to see payoffs for DOD.

An example of fielded nanotechnology is the development of microwave and millimeter-wave transistors where the current carrying channel is grown 10 nm thick with atomic layer precision and the modulating gate electrode is patterned at 100 nm long to detect and amplify signals above 20 GHz. Many of these nanoscale devices are flying today on space platforms.

This type of nanometer control of electronic, photonic, and MEMS components is expanding and expected to impact an increasingly large number for DOD systems.

- Ultradense giant magneto resistance memories were one of the first examples of the promise of nanotechnology. Today, these radiation hard, high speed, non-volatile memories are being evaluated for missiles and space applications.
- Semiconductor optical devices require control of their material and device structure on the order of 10 or 20 nm. This has led to quantum cascade lasers which are useful for detecting chemical agents and the vertical cavity lasers now often used to move signals around inside military equipment, which rely on nanotechnology to create their mirror stacks
- Silcon germanium electronics combined with nanoscale CMOS is revolutionizing RF electronics by allowing RF and mixed analog-digital electronics circuits for military systems to be fabricated at a lower cost in silicon fabs.
- We can now control the flatness on films deposited on 8 to 12 inch diameter silicon wafers down to nanometers. This allows the processing of very fast transistor circuits with clock frequencies in excess of few gigahertz, which is important for many signal processing functions.

The levels of investment over the last 5 years are setting the stage for a myriad of new capabilities that are about ready to be brought to fruition. New biological sensors, high density nano-wire based electronics, nano-scale photonic devices, nanoscale mechanical oscillators, and ultra-high strength fibers from carbon nanotubes to name just a few.

39. Senator BILL NELSON. Dr. Sega, Dr. Killion, Admiral Cohen, Mr. Engle, and Dr. Tether, what are the barriers to the successful transition of nanotechnologies into operational systems?

Dr. SEGA. The primary barriers to successful transition of nanotechnologies, similar to those for any new technology, are manufacturing, reliability, and acceptance. Significant barriers to the future manufacturing of nanometer-sized structures include production quantities, quality control, and cost; as an example, carbon nanotube manufacturing efforts remain limited by these obstacles despite several years of commercial production. Demonstrating reliability and durability of nanotechnologies represents another significant barrier, particularly since the greatly enhanced feature densities characteristic of nanotechnology are expected to render new products and systems increasingly susceptible to degradation.

Dr. KILLION. The barriers to successful transition are generally identical to barriers encountered in transitioning any new technologies to programs of record and

program managers, including the ability to manufacture the materials in sufficient quantities, to process them cost-effectively and reliably, and to develop viable approaches for repair, rework, remanufacture, and disposal. Recognizing the need for a transition pathway, emphasis is being placed on effective coupling between the basic research programs and the SBIR, Small Business Technology Transfer (STTR) and Manufacturing Technology (MANTECH) programs to establish the unique infrastructure necessary to provide quality nanotechnology-based devices that are effective and producible in sufficient quantities. Additionally, reliability testing must be performed before a new material can be adopted, and additional barriers based on public perception of the safety of nanotechnology may be encountered and are being considered.

Admiral COHEN. One barrier is time. Despite our technological advancements it still seems to take 15 +/−5 years to transition from concept to initial product. Hence, although some of the initial nanoscience research can be traced back to the early 1980s most of the investment in nanoscience and nanotechnology is more recent. In some respects we should not yet expect to see significant transition to operational systems.

Another barrier is funding. This does not mean there is not a significant investment in nanoscience, but because it takes so long to transition from concept (science) to product (technology), a researcher must find several different sponsors along the way to support this effort. In addition, there is no automatic mechanism to transition nanoscience programs from 6.1 to 6.2 to 6.3, etc. In fact, while the majority of investment in nanoscience has been at the 6.1 basic research level, there is currently very little investment in the 6.2 or higher categories. .

Another barrier may be acceptance or reliability. While you may be aware of the integration and application of MEMS in commercial products such as sensors for automotive airbags, MEMS components existed for over 20 years before they were accepted for high volume applications such as airbag sensors.

Dr. TETHER. Current U.S. Army nanotechnology programs represent a balanced investment portfolio addressing both near-term and long-term warfighter needs to optimally identify breakthrough capabilities. There are no major unfunded requirements specific to nanotechnology.

Mr. ENGLE. As with any potentially revolutionary technology, it is difficult to mature nanotechnology to the point where system design engineers are comfortable including it in a system. Additionally, it is difficult to incorporate new technologies into system upgrades because of form, fit, and function requirements; often the new technologies result in a configuration that is quite different than the existing design. Until it can be proven that nanotechnology options are mature and affords greater benefits (i.e., cost, weight, strength, etc.) than existing technologies, our program offices will be cautious and approach this technology like any other new technology.

Dr. TETHER. Transitioning technology to operational use, particularly radical new technologies, always requires a great deal of work, but the barriers to successful transition of nanotechnology are no greater than that for other technologies. There aren't any special barriers for nanotechnology.

40. Senator BILL NELSON. Dr. Sega, Dr. Killion, Admiral Cohen, Mr. Engle, and Dr. Tether, what are your unfunded priority nanotechnology projects?

Dr. SEGA. The current DOD basic research investment, in view of the total National Nanotechnology Initiative (NNI), is adequate and represents a balanced investment portfolio addressing both near-term warfighter needs and long-term capabilities to identify breakthrough capabilities.

Dr. KILLION. Current U.S. Army nanotechnology programs represent a balanced investment portfolio addressing both near-term and long-term warfighter needs to optimally identify breakthrough capabilities. There are no major unfunded requirements specific to nanotechnology.

Admiral COHEN. Priority projects are already being funded under existing investments. The President's budget represents the best balance of resources to requirements. Were additional resources to become available, the Department would recommend funding higher priority items identified on the CNO's or CMC's Unfunded Requirements List. However, if additional funds were available, one new area with potential impact includes nanosensors for distributed autonomous systems.

Mr. ENGLE. Like many areas in the Air Force, we could wisely invest additional funds in nanotechnology efforts if available. The following nanotechnology efforts are included in the expanded Fiscal Year 2006 S&T Unfunded Priority List:

[In millions of dollars]

Nanotechnology Efforts	PE	Amount
Nanomaterials for Structures	61102F	1.0
Nanoenergetics	61102F	1.0
Nanoelectronics	61102F	3.0
Nanostructed Materials for Advanced Air Force Concepts	62102F	5.5
Nanocomposite Materials	62202F	3.5
Biological Interaction of Nanomaterials	62202F	3.2
Mobile Water Desalinization Using Carbon Nanotube Technology	62202F	2.5

Dr. TETHER. Our request this year includes about $170 million for nanotechnology, which is the highest in the Department. We have no unfunded nanotechnology requirements.

ELECTRIC-DRIVE

41. Senator BILL NELSON. Admiral Cohen, I have long believed that the Navy's most critical and promising transformational technology is the development of electric-drive propulsion systems for surface ships. The transformational implications are apparent, from increased combat capability to lower manning requirements and especially lower operating costs. It is not apparent, however, that the R&D necessary to make electric-drive a reality is keeping pace with plans for new classes of ships such as DD(X) or the Littoral Combat Ship. How is Navy R&D on electric-drive structured and resourced to ensure the availability of this capability for integration into new ship design and construction?

Admiral COHEN. The Navy continues to support the programs that will lead to electric drive in future warships. The T-AKE cargo ship will have a commercial-derivative electric drive system. The DD(X) will have an advanced electric drive and integrated power system. The Navy S&T community continues to invest in advanced electric drive technologies which will be available for introduction into future classes of warships including CG(X). One of the objectives of the ONR program is to significantly reduce the size and weight of electric propulsion, so that electric drive will be a viable option for small fast ships. Technologies being developed include superconducting motors that are torque dense and quiet, advanced controller technologies, and advanced power electronics that significantly reduce the volume, weight, and electrical harmonics associated with current state-of-the-art main motor controllers. The first full-scale superconducting motor is currently scheduled to be completed in 2006. Additionally, ONR is building an Advanced Electric Ship Demonstrator that will enable the waterborne demonstration of advanced electric propulsion concepts at roughly a quarter scale of a DD(X) sized platform.

42. Senator BILL NELSON. Admiral Cohen, what are your unfunded R&D priorities related to electric-drive that will accelerate the development of this technology?

Admiral COHEN. The President's Budget represents the best balance of resources to requirements. Were additional resources to become available, the Department would recommend funding higher priority items identified on the CNO's or CMC's Unfunded Requirements List. Although the ONR S&T program in electric drive is adequately funded, additional resources could accelerate work in advanced power conversion equipment. Assuming ONR achieves success in development of compact superconducting motor technologies, the next target for size and weight reduction is the motor drive, which converts power from the generator to the correct electrical frequency and voltage to power the propulsion motor. Additional funding could enable advanced electric systems topologies, improved motor drive power quality, higher performing thermal management components/systems, and increased motor drive power density. Investments are being made in each of these areas, but at a slower pace than the technology could support.

43. Senator BILL NELSON. Admiral Cohen, how are you leveraging other departments' investments in power technologies?

Admiral COHEN. Many investments outside of the Department of the Navy are being leveraged to accelerate the development of advanced electric drive and electric warship technologies. For example, the Office of the Secretary of Defense recently established a tri-service and DARPA Energy and Power Technology Initiative (EPTI), which provided both increased funding and additional oversight to energy and power investments within the Department. The EPTI "tiger team" meets regularly to share information and coordinate investment strategies. Navy personnel

also participate in the Interagency Advanced Power Group (IAPG), which includes not only the military services, but also the civilian R&D agencies. Some examples of areas in which the Navy leverages other service and agency investments include:

- DARPA's Wide Bandgap High Power Electronics program for advanced power switching devices.
- DOE and Air Force programs in superconducting wire and superconducting generator technologies.
- Army investments in capacitors and pulsed alternators to store energy for electric weapons.
- DOE investments in fuel cells.

LOW COST LAUNCH CAPABILITIES

44. Senator BILL NELSON. Dr. Sega, Mr. Engle, and Dr. Tether, in July, the DOD issued its space S&T strategy document. One of the goals of the new strategy is to develop low cost launch capabilities. Currently, there is no definition of "low cost." What is "low-cost launch?"

Dr. SEGA. The DOD Space S&T Strategy identifies near- and long-term goals for assured access to space as follows:

Within the next 5 years,

- Low-cost and reliable small payload launchers capable of placing a 500 Kg-class payload into low-earth orbit.

In the year 2020 or beyond,

- Survivable, low-cost, and reliable launch systems to enable on-demand launch of payloads to any orbit and altitude required.

For the near-term, we are focusing on technologies that will enable small launch vehicles (500Kg to Low-Earth-Orbit) costing less than $10 million a piece. The far-term strategy (by 2020 or beyond) focuses on science and technology developments that will enable low-cost launch for larger payloads.

Mr. ENGLE. In the short-term, as defined in the DOD Space S&T Strategy as the next 5 years, operational cost reductions or "low-cost launch" will most likely only apply to small launch. The Air Force goal for small launch is less than $10 million to place 1,000 pounds into a 100 nautical mile, 28.5 degrees east low-earth orbit. This goal excludes the cost of the launch range.

Dr. TETHER. Our primary effort for low cost launch at DARPA is Falcon, which we're executing in conjunction with the Air Force. Falcon's goals are to provide the flexibility to launch from 100 kg to 1,000 kg into low earth orbit. Falcon will be responsive, able to launch within 24 hours of authorization, and it will cost no more than $5 million per launch. The important feature of Falcon is that it will remove the launch-cost barrier for small satellites by making launch cost comparable to satellite cost. We think Falcon will significantly advance our capabilities in space by making small satellites an affordable and more attractive option.

45. Senator BILL NELSON. Dr. Sega, Mr. Engle, and Dr. Tether, how will you develop the metrics to know whether the short-term (within 5 years) and long-term (2020 and beyond) goals of "low-cost" are reached? For example, is the goal a certain dollar amount per pound launched, a percentage cost of a satellite, or a percentage reduction from today's launch costs?

Dr. SEGA. For the near-term we have established a nominal cost goal of less than $10 million per launch for small satellites (less than 500 kg) to low earth orbit. Concurrent with this cost goal, we are pursuing increased responsiveness to enable launch of smaller satellites in a matter of days to weeks following call up versus months to years for some currently available small spacecraft launch vehicles.

When completed our roadmap for a next generation large launch vehicle will identify the necessary S&T activities, demonstration milestones, and tactical level goals, such as launch costs, that were identified in the Space S&T Strategy. The metrics will be physics based for each system component and provide the technical foundation to achieve the system-level capability payoff goals. The roadmaps are not yet complete. Thus quantifiable cost performance metrics for next generation large launch systems are not yet available.

Mr. ENGLE. As previously mentioned, the short-term goal for "low-cost" launch is less than $10 million for a 1,000 pound payload. For 2020 and beyond, metrics will be developed based on a percentage of today's launch cost. The goal is to make launches three to six times cheaper than those using current systems. This metric includes recurring launch costs, which consist of consumables or expendable elements and costs to refurbish reusable elements.

Dr. TETHER. Considering launch cost as a percentage of satellite cost is, in my opinion, the most productive way to look at the problem, and it's the key to achieving low-cost access to space. When the cost of launching a satellite is several times the cost of the satellite itself, there's little incentive to invest in ways to reduce satellite costs, and more importantly, little incentive to make satellites small. On the other hand, if we can make launch costs comparable to or even less than satellite costs then there's considerable incentive for investment in less costly ways of doing things in space.

46. Senator BILL NELSON. Dr. Sega, Mr. Engle, and Dr. Tether, what programs are underway or planned to meet these goals?

Dr. SEGA. The Department has several ongoing S&T activities that support the Space S&T Strategy goals of low-cost launch systems. The Force Application and Launch from the Continental United States (FALCON) program is one specific example for small launch vehicles. Even though we have not completely finalized our roadmap for larger launch systems, we have verified that existing programs in propulsion, materials, aerodynamics and associated topics must be continued to provide the necessary foundational technologies.

Mr. ENGLE. In the near-term, the joint DARPA/Air Force Falcon program will develop and demonstrate a system capable of providing low-cost, responsive small lift of 1,000 pounds into a 100 nautical mile, 28.5 degrees east low earth orbit. For 2020, the Air Force is pursuing the Affordable Responsive Spacelift (ARES) initiative for payloads in the 10,000 to 40,000 pound-class. ARES is a hybrid system with a reusable first stage and an expendable second stage. In support of this program, the Air Force is pursuing technologies for rocket engines, avionics, structures, vehicle subsystems, and operations. For beyond 2020, the Air Force is pursuing technologies that would enable fully reusable systems with both rocket and/or airbreathing propulsion.

Dr. TETHER. Our primary effort at DARPA is Falcon, which we're executing in conjunction with the Air Force. Falcon's goals are to provide the flexibility to launch from 100 kg to 1,000 kg into low earth orbit. Falcon will be responsive, able to launch within 24 hours of authorization, and it will cost no more than $5 million per launch. The important feature of Falcon is that it will remove the launch-cost barrier for small satellites by making launch cost comparable to satellite cost. We think Falcon will significantly advance our capabilities in space by making small satellites an affordable and more attractive option.

SPACE SITUATIONAL AWARENESS

47. Senator BILL NELSON. Dr. Sega, Mr. Engle, and Dr. Tether, one of the short-term goals of the space S&T strategy document is to be able to "detect, identify, and characterize natural and man-made objects, threats and attacks." What are the metrics that will be used to measure these goals?

Dr. SEGA. The Space S&T Strategy outlines an implementation process centered around semiannual space S&T summits with participation from the S&T, Acquisition, Intel, and Warfighter communities. The latest summit activities have focused on developing S&T roadmaps for four operational vectors. When complete, these roadmaps will identify the necessary S&T activities, demonstration milestones, and tactical level goals, such as space situational awareness. Critical to this effort is the identification of technology metrics which will be physics based for each system component and provide the technical baseline to achieve the system-level capability payoff goals. It is anticipated that typical metrics such as smallest size object that can be tracked, ability to identify object types, determination of operational status of manmade objects will be employed and related to current capabilities.

Mr. ENGLE. Some key metrics that could be used to measure the Space S&T Strategy document goals are probability of detection, timeliness, accurate recognition, and knowledge integration and dissemination. These metrics can address a range of threats including hard-to-find objects, space weather events and their affect on space capabilities, and information management and decision support tools related to space situational awareness. In addition, these metrics address desired future capabilities of predicting space events and determining intent.

Dr. TETHER. DARPA currently has two ground-based space situational awareness (SSA) programs, Space Surveillance Telescope (SST) and Deep View. The SST program will produce a telescope capable of detecting very faint objects in geosynchronous orbit from the ground. SST sees all orbital objects as point sources; it doesn't image them. Its principal metrics are minimum detectable visual magnitude (which

is a function of the objects size, shape, and reflectivity), acquisition time, coverage rate, and revisit rate. These parameters are closely related.

The Deep View program is principally designed to characterize space objects in all orbits up to and including geosynchronous orbits. Deep View is an imaging radar, and its key performance metrics are minimum radar cross section that can be detected (a function of range), dwell time, and minimum resolvable feature size.

The actual values of these metrics are classified, but we would be pleased to provide them under separate cover if you wish.

48. Senator BILL NELSON. Dr. Sega, Mr. Engle, and Dr. Tether, what is the time frame that you want to achieve within which you can detect, identify, and characterize natural and man-made objects?

Dr. SEGA. To enable assured space situational awareness, as outlined in the 2004 DOD Space S&T Strategy, it will be necessary to develop and demonstrate enhanced capability technologies that will:

Within the next 5 years,

- Detect, identify, and characterize natural and man-made objects, threats and attacks.

In the year 2020 or beyond,

- Provide our warfighters complete space situational awareness under all possible circumstances or situations.

Mr. ENGLE. In the near term (i.e., approximately 5 years), the Air Force plans to develop technologies in numerous areas of SSA that should enable us to be able to detect and track small space objects in near-earth and deep space orbits. Our goal is to predict, with high precision, the location of high value assets at least 12 hours into the future. We also want to be able to characterize on-orbit anomalies, changes, and events within 2 days and to predict space weather events for at least 12 hours in to the future. In addition, we want to be able to determine key attributes of non-United States space forces within 2 weeks of deployment and to rapidly detect threats to United States space assets.

Dr. TETHER. DARPA has two programs underway to enhance SSA with ground-based sensors. The SST program is developing new focal plane technologies that enable very wide field-of-view, fast optical system to detect faint objects in the geosynchronous belt. The program is scheduled to end in 2008 with the operational testing of a fully capable telescope at the White Sands Missile Test Facility.

The Deep View program is upgrading a current SSA asset to operate as a high resolution, imaging radar. It will be used to characterize and support identification of space objects with much improved performance. It is scheduled for completion and capability with low-earth-orbit objects in 2008 and capability with geosynchronous objects in 2009.

49. Senator BILL NELSON. Dr. Sega, Mr. Engle, and Dr. Tether, what programs are underway or planned that will meet these goals?

Dr. SEGA. The Department has several ongoing S&T activities that support the Space S&T Strategy goals of assured space operations and space situational awareness. Specific efforts in progress include development and testing of onboard warning sensors for satellites and exploratory efforts to enhance ground-based space object tracking systems. Capability enhancements we hope to achieve from these and other programs in this topic area cannot be discussed in a public forum.

Mr. ENGLE. Air Force advanced technology development efforts, such as high accuracy tracking/orbit prediction, space environmental sensors and effects, and passive and active high-resolution imaging, support Air Force SSA goals. We are exploring the potential utility of multi-spectral and polarimetric sensing in various technology programs, and we continue to invest in technologies for ultra lightweight optics. These programs, including space experiments, emphasize new technologies for capabilities that support ground- and space-based applications.

Dr. TETHER. DARPA has two programs underway to enhance SSA with ground based sensors. The SST program is developing new focal plane technologies that enable very wide field-of-view, fast optical system to detect faint objects in the geosynchronous belt. The program is scheduled to end in 2008 with the operational testing of a fully capable telescope at the White Sands Missile Test Facility.

The Deep View program is upgrading a current SSA asset to operate as a high resolution, imaging radar. It will be used to characterize and support identification of space objects with much improved performance. It is scheduled for completion and capability with low-earth-orbit objects in 2008 and capability with geosynchronous objects in 2009.

ASSURED SPACE OPERATIONS

50. Senator BILL NELSON. Dr. Sega, Mr. Engle, and Dr. Tether, one of the major goals in the Space S&T Strategy document is "assured space operations." In the short- and long-term, how will this goal be implemented and what programs are underway or planned that will achieve this technology focus?

Dr. SEGA. Maintaining Assured Space Operations is a critical goal of our Space S&T Strategy. With participation of our S&T, Acquisition, Intel, and Warfighter communities we have focused on developing S&T roadmaps for operational vectors that should continue to ensure our freedom of action in space.

Some specific elements of assured space operations includes providing a responsive launch capability, maintaining full space situational awareness, and sustaining on-orbit operations of critical defense satellites despite possible hostile actions by others

Specific short-term and long-term goals include:

Within the next 5 years,

- Detect, identify, and characterize natural and manmade objects, threats, and attacks
- Minimize interruptions to operations
- Protection and countermeasures for enhanced survivability

In the year 2020 or beyond,

- Complete space situational awareness
- Uninterrupted operations
- Deny adversary's use of space

Mr. ENGLE. Short-term activities will focus primarily on increasing SSA capabilities (find, fix, track, identification, characterization, and information fusion) and passive onboard threat detection and protection. SSA technologies will enhance both ground- and space-based data collection, integration, and fusion. Affordable threat detection, identification, and protection solutions for various threats will be demonstrated and integrated with Space and Missile Command program roadmaps.

Long-term activities will focus primarily on providing a robust SSA and Defensive Counterspace Systems (DCS) capabilities. Technologies will focus on identification and characterization of hard-to-find objects, as well as space event prediction and intent determination. Space protection and countermeasures will be improved to ensure continued space operations, and off-board, active measures, as well as architectural system-of-system protection concepts will be assessed.

Programs already underway that focus on these technologies include the Integrated Space Technology Demonstration or XSS–11, the Maui Space Surveillance System, and numerous spacecraft and sensor protection efforts.

Dr. TETHER. Our approach to technologies for assured space operations considers five basic areas: space access and infrastructure, SSA, protection of U.S. space assets, denial of adversary use of space, and space-based engagement (surveillance, communications, and navigation in support of military operations on Earth).

Orbital Express will demonstrate the ability for autonomous refueling, upgrading, and life extension of on-orbit assets—providing greatly increased maneuverability and mission flexibility. The SST will demonstrate the optical ability to search geosynchronous altitudes for very faint objects and help determine their purpose and intent in a more timely manner. The Deep View program will use stronger radar techniques also to identify and characterize small objects at multiple altitudes.

Other projects are more long-term. Our Space Awareness program (SPAWN) will also investigate the ability to provide space awareness and even anomaly diagnostics and resolution from positions on orbit with our satellite systems. We are also pursuing a variety of microsatellite technologies that support multiple missions in the Microsatellite Demonstration Science and Technology Program (MiDSTEP).

QUESTIONS SUBMITTED BY SENATOR E. BENJAMIN NELSON

MISSILE DEFENSE AGENCY RESEARCH AND PROGRAMS

51. Senator BEN NELSON. Dr. Sega, how are your S&T programs coordinated with those of the Missile Defense Agency (MDA)? What investments are you making that will enhance our missile defense capabilities?

Dr. SEGA. The MDA is an active participant in all of our S&T review and coordination activities for those technical areas relevant to missile defense. This includes, for example, the S&T Comprehensive Review process. It is through the S&T Comprehensive review process that we ensure that investments are made to benefit all the national security requirements of all of the DOD components. The Comprehen-

sive Review incorporates both an Investment Strategy Review and Assessment (ISRA) and a Technology Area Review and Assessment (TARA). MDA also participates, where applicable, in preparation of our Basic Research Plan (BRP), the Defense Area Technology Plan (DTAP), and the Joint Warfighting S&T Plan (JWSTP).

52. Senator BEN NELSON. Dr. Sega, I understand that your office periodically evaluates the technical readiness of major defense systems. Have you done an evaluation of any MDA programs? What were the results of these technical evaluations?

Dr. SEGA. We have conducted technical assessments for the MDA's Ground-Based Midcourse Element and the software for the Initial Deployment Option (IDO). The results of these technical reviews were provided to the Component Acquisition Executive.

NETWORK-CENTRIC WARFARE RESEARCH

53. Senator BEN NELSON. Dr. Killion and Mr. Engle, your testimony highlights your investments in networking technology and information systems that will support future network-centric operations. What are the key technical barriers you think need to be addressed before we can fully realize the vision of truly joint, network-centric operations?

Dr. KILLION The key technology barriers include: making highly efficient use of the available frequency spectrum and bandwidth; developing highly efficient, compact broadband antennas; maintaining cross domain information security; and interfacing with non-network-centric software architectures and disparate data standards, formats and protocols. The Army currently has S&T efforts working on all of these challenges.

Mr. ENGLE. A major technical barrier to achieving the network-centric operations vision is the lack of fully joint, secure, and interoperable connectivity among people, applications, locations, and platforms. Another major barrier to achieving joint network-centric operations is interoperable networking across domains—air, space, ground, and cyber. In addition, network-centric operations requires the modernization of our legacy systems. These older systems must be upgraded and net-enabled to ensure cost-effective satisfaction of our continuing missions. Also, legacy system architectures should be converted to open system architectures to allow needed access to other systems and information assets. Developing secure links and networks capable of supporting the vast amounts of traffic necessary for full network-centric operations will be critical.

Another key area is the integration of network management, spectrum management, network and system topology (planning), and performance optimization to create a seamless information enterprise that will operate in a global Internet Protocol Version (IPv6) environment.

Finally, an additional major hurdle is to define and achieve end-to-end network performance, in the form of information assurance mechanisms, at low tactical echelons, while ensuring that throughput, network connectivity, and latency are optimized for mission effectiveness.

54. Senator BEN NELSON. Dr. Killion and Mr. Engle, what specific areas of research need to be invested in to develop the technologies we need to support networked forces?

Dr. KILLION The specific areas of research that are improving the ability to operate in a network-centric force include: multiband directional ground based and multibeam, multiband satellite antennas; dynamic network management for multiple, mobile ad-hoc networks; cross security domain solutions; and development of a common language capability across Army, Navy, and Air Force with automated language translation; and service-oriented architectures for enterprise software and network environments.

Mr. ENGLE. The Air Force is already investing in various technologies needed to support our networked forces, however, as with many areas in the Air Force, additional funds could be wisely invested if available. There are specific areas of research in both network-centric operations and network-centric infrastructure where investment is needed to support the networked forces. For network-centric operations, we need to develop technologies that will allow networked, executing forces at the engagement level to be fully informed of adversary locations/movement matched by friendly capabilities to achieve the desired effect across a spectrum of operations from urban warfare, to major theater of war, to humanitarian relief. For network-centric infrastructure, we need to develop technologies in two specific areas:

(1) Communications—Further research is needed in development of methods to improve the ability of "wireless on the move" communications to interface to the wired Global Information Grid in scenarios typical of military theaters of actions; and

(2) Systems Engineering and Architectures—Investments must be made in systems engineering to ensure that the architectures, designs, interfaces, and applications within the network-centric warfare concept will all work together to produce the objective.

QUESTIONS SUBMITTED BY SENATOR HILLARY RODHAM CLINTON

ROME IT RESEARCH

55. Senator CLINTON. Mr. Engle, your testimony highlights the work that is done by the Air Force Research Laboratory's (AFRL) Information Directorate in Rome, NY, on cyber operations and information systems on major defense platforms like the Joint Strike Fighter. In this budget, what investments are you making to continue to expand our leadership in areas of cyber operations?

Mr. ENGLE. The Air Force is investing and leveraging millions of dollars each year to provide cyber security for our operational networks. The AFRL's Information Directorate in Rome, New York, is the Air Force lead in cyber security technology development and demonstration. In the fiscal year 2006 President's budget, the Air Force focus is on investing in R&D in the area of cyber operations. The majority of this funding is for Information Assurance and Computer Network Defense projects. Specific areas in which we are currently investing and expanding a leadership role include self-healing networks, cyber forensics, wireless intrusion detection systems, cyber situational awareness, fusion and correlation of cyber events, and decision support. The Air Force investment in cyber operations heavily leverages investments made by DARPA and the Intelligence Community in these areas, maximizing efficiency and ensuring an expanded leadership role in the area of cyber operations.

56. Senator CLINTON. Mr. Engle, how do you work to ensure that advances in cyber security made at places like Rome are transitioned to the commercial sector, which is equally at risk from cyber attack by terrorists?

Mr. ENGLE. Much of the Air Force S&T investment in efforts that provide for cyber security for our operational networks has either a direct path to the field by way of commercial products and capabilities, or has immediate spin-off potential into the commercial world. The AFRL's Information Directorate in Rome, New York, is leading the Air Force in cyber security S&T, paving the way for a more secure and trusted Internet. Many of the technologies that have been developed and are planned to be developed in the future address the cyber security needs of the commercial sector. Some examples of this technology include secure and fault tolerant networks, cyber forensics, secure communications, wireless information assurance, and cyber security situational awareness.

Commercial network security companies, such as Symantec and Cloudshield, have employees who work in-house on a daily basis with Air Force cyber security engineers and scientists. These teams are developing technology, filling identified technology gaps, and providing a direct path for technology transfer to the commercial sector. The Information Directorate is also vigorously supporting small businesses to ensure that they have a foothold in the commercial market place. The SBIR program not only promotes commercialization, but also actually requires development of a commercialization plan.

In addition, there is a unique mechanism for technology transition based on the relationship between the Information Directorate and the National Institute of Justice's National Law Enforcement and Corrections Technology Center—Northeast (NLECTC–NE). The NLECTC–NE has developed a Cyber Science Laboratory (CSL) whose purpose is to take technology and transition it to the law enforcement community. The CSL has a solid connection with the United States Secret Service Electronic Crimes Task Force (ECTF) system. CSL's close relationship with the Information Directorate enables it to test, evaluate, and transition mature Air Force technologies and move those technologies to the ECTF and their member institutions.

DARPA INVESTMENT STRATEGY

57. Senator CLINTON. Dr. Tether, over the past 4 decades, DARPA has played a major role in making America the world leader in innovation, thorough, fundamen-

tal research investments that led to stealth, the Internet, modern integrated circuit design, and so forth. Recently, DARPA has characterized its mission as "bridging the gap between the Far Side and the Near Side," meaning investing in the space that lies between fundamental research and military products. I note that your request for basic research investment at DARPA is down $40 million with respect to 2005 appropriations, and even down $13 million below last year's original request, let alone down $45 million relative to the 2003 budget request. Is this trend consistent with the successful philosophy of the past few decades, or does it represent a shift?

Dr. TETHER. DARPA does not specifically invest in the space that lies between fundamental research and military products. By "bridging the gap," we look for ideas on the Far Side (e.g. from 6.1 or basic research) and fund them in order to accelerate them to the Near Side, where they can become a new military capability. Of course, during the transition, they do go through the space that lies between fundamental research and military products.

DARPA's basic research in fiscal year 2005 and fiscal year 2006 is about 4 or 5 percent of our budget, which is about the average level it has been for the last 15 or 20 years. We use our 6.1 funding to assure access to knowledge that comes from basic research in order to turn that new knowledge into new military capabilities. We are more in the business of multidisciplinary engineering, which, at the end of the day, is what determines how fast new knowledge can be turned into new products and our funding reflects this.

We strongly support the basic research sponsored by places like the National Science Foundation, the Office of Naval Research and the Department of Energy. We depend on it and value it and it is an asset to the Nation.

If there has been any shift at all in recent years, it's been towards more basic research at DARPA. From fiscal year 1999 to 2006 our request for 6.1 funding has doubled and grown almost one-third faster than DARPA's overall budget. Our proportion of the total DOD 6.1 funding has almost doubled too.

I believe that years from now, when DARPA's work in things like nanotechnology, cognitive computing, and neutrally controlled devices comes to fruition, it will have a huge impact, just like what we've done in the past.

58. Senator CLINTON. Dr. Tether, does this mean you will be reducing your investments in university-based research programs that may generate the revolutionary new technologies of tomorrow?

Dr. TETHER. Our basic research funding—the portion of our research budget that is the best fit with the university mission and the type of funding they favor—has more than doubled since 1999. Also since 1999, the percentage of our basic research funding going to universities increased to about 60 percent in fiscal year 2004, which is the norm for DOD. The bottom line is that since 1999 DARPA has increased its commitment to basic research and universities are getting a greater share of it.

But as I said in the answer to another question, we are more in the business of multidisciplinary engineering, which, at the end of the day, is what determines how fast new knowledge can be turned into new products.

LABORATORY PERSONNEL ISSUES

59. Senator CLINTON. Dr. Sega, Rome Labs is part of the AFRL system and as such is part of the laboratory personnel demonstration program. It is important that we obtain and retain top quality people if our laboratories are to be relevant and globally competitive. The great strength of these demo programs is their ability to be continuously modified so that local lab directors can experiment with new personnel authorities—which eventually may be adopted by the rest of the Department. Since Congress has determined that the lab demo programs will function independently of the NSPS until 2008, is the DOD still processing modifications and amendments to the lab demonstration programs or has the process closed down?

Dr. SEGA. No modifications or amendments to existing demonstrations have been processed recently. However, the Department will review any requests for demonstration project modifications or amendments consistent with the plan required by section 1107.

60. Senator CLINTON. Dr. Sega, do you feel that there is value in allowing local laboratory directors to continue to have control over their demonstration programs rather than being absorbed into a one-size-fits-all Department-wide system?

Dr. SEGA. The experience of the laboratory demonstration programs have had a positive influence on the development of the NSPS. NSPS should provide flexible and contemporary human resources with a system that enables the Department to meet and adjust, as necessary, to its mission requirements quickly and efficiently. When NSPS is implemented within the Department, local laboratory directors will find that it gives them the tools and controls they need for their personnel systems and processes. If that is the case, the Department may submit a legislative proposal to bring the NSPS-exempt laboratories into NSPS earlier than October 2008.

SMALL BUSINESS INNOVATION RESEARCH FUNDING

61. Senator CLINTON. Mr. Engle, the SBIR program is an integral part of the success we have in R&D. It has come to my attention that the Air Force has cut SBIR funding to some current contracts for fiscal year 2005. Can you explain why the Air Force has withheld this funding?

Mr. ENGLE. The Air Force put approximately 50 percent of the fiscal year 2005 SBIR funding on withhold as we conducted a review of the program to look for ways to improve both our current execution performance and the transition rate of technologies developed under SBIR Phase I and Phase II. We are continuing to analyze the results of this review to identify potential program improvements for fiscal year 2006 and beyond. However, based on our preliminary findings, the fiscal year 2005 SBIR funds were released for execution on March 8, 2005.

62. Senator CLINTON. Mr. Engle, what are the plans to resolve this issue and ensure the 2005 contracts get fulfilled?

Mr. ENGLE. The fiscal year 2005 SBIR funds were released for execution on March 8, 2005.

63. Senator CLINTON. Mr. Engle, are there systemic issues in how SBIR contracts are handled by the Air Force's technology development, contracting, and financial management organizations that need to be resolved in order to ensure that small businesses will not experience delays in receiving funding they are awarded in SBIR competitions?

Mr. ENGLE. The Air Force recently completed a review of its SBIR program and is continuing to analyze the results of this review to identify potential program improvements for fiscal year 2006 and beyond. Given the increasing size of the SBIR program, managing the program is becoming inherently difficult without additional authority to use a small portion of SBIR funding for program management. However, we are looking for ways to improve both our execution rate and transition of technologies, while strengthening the role of innovative small businesses and the technological capabilities of our Armed Forces.

[Whereupon, at 11:39 a.m., the subcommittee adjourned.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 2006

MONDAY, APRIL 11, 2005

U.S. SENATE,
SUBCOMMITTEE ON EMERGING THREATS
AND CAPABILITIES,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

CHEMICAL DEMILITARIZATION PROGRAM

The subcommittee met, pursuant to notice, at 2:03 p.m. in room SR–222, Russell Senate Office Building, Senator John Cornyn (chairman of the subcommittee) presiding.

Committee members present: Senators Cornyn and Reed.

Other Senators present: Senators Allard and Salazar.

Committee staff member present: Judith A. Ansley, staff director.

Majority staff members present: Elaine A. McCusker, professional staff member; and Lynn F. Rusten, professional staff member.

Minority staff members present: Richard W. Fieldhouse, professional staff member; and Arun A. Seraphin, professional staff member.

Staff assistants present: Benjamin L. Rubin and Nicholas W. West.

Committee members' assistants present: Russell J. Thomasson, assistant to Senator Cornyn; and Elizabeth King, assistant to Senator Reed.

OPENING STATEMENT OF SENATOR JOHN CORNYN, CHAIRMAN

Senator CORNYN. This Subcommittee on Emerging Threats and Capabilities hearing will now come to order. Gentlemen, thank you for being here with us today. We meet today to receive testimony on the Department of Defense's (DOD) fiscal year 2006 budget request for the Chemical Demilitarization Program. We welcome all of our witnesses: Michael Wynne, Under Secretary of Defense for Acquisition, Technology, and Logistics; Claude Bolton, Assistant Secretary of the Army for Acquisition, Logistics, and Technology; Dr. Dale Klein, Assistant to the Secretary of Defense for Nuclear and Chemical and Biological Defense Programs; and Ambassador Donald Mahley, Deputy Assistant Secretary of State for Arms Control.

The DOD Chemical Demilitarization Program is responsible for eliminating the U.S. chemical weapons stockpile, which originally

consisted of approximately 31,000 tons of lethal chemical agents and a wide variety of munitions located at Johnston Atoll in the Pacific and 8 sites in the continental United States (CONUS). Destruction of the stockpile began in 1990 and is supposed to be completed by April 29, 2007, in accordance with the Chemical Weapons Convention (CWC), to which the United States is a party.

Even taking into account the fact that the CWC does permit state parties to seek a 5-year extension of that deadline to April 29, 2012, this subcommittee is very concerned that as the Chemical Demilitarization Program is currently planned and budgeted it appears that the United States is not on track to complete destruction of our stockpile in accordance with our treaty deadlines.

To date, almost 36 percent of the total stockpile of lethal chemical agents has been destroyed, including the stockpiles at Johnston Atoll in the Pacific and Aberdeen Proving Ground, Maryland. The four baseline incineration sites at Tooele, Utah; Anniston, Alabama; Umatilla, Oregon; and Pine Bluff, Arkansas—I think this is a test to see if I can pronounce all those names; you will correct me, I am sure, if I am wrong—are all operational and are destroying their stocks of lethal chemical agents and munitions. The Army has recently informed us that within 30 days it plans to begin neutralizing the VX nerve agent stockpile at Newport, Indiana.

In addition to schedule delays, the cost of the program continues to increase at an alarming rate. Current worst case estimates of destroying the stockpile range from $26.8 billion to $37.3 billion.

The DOD has an obligation to destroy the U.S. chemical weapons stockpile in a manner that is safe for the general public, for the workers at the storage and demilitarization sites, and for the environment. DOD must also destroy the stockpile on a timetable consistent with the international legal obligations assumed by the United States when the U.S. Senate ratified the CWC in 1997. Finally, DOD has a responsibility to manage the Chemical Demilitarization Program efficiently and effectively so that the mission is accomplished at a reasonable cost.

Although DOD should be commended for the safe manner in which it is destroying the stockpile, DOD is not living up to its responsibilities with regard to cost and schedule. The subcommittee looks forward to understanding better some of the actions taken by Secretary Wynne to address these critical problems.

Before us today are individuals who bear great responsibility for the stewardship of this program and for the implementation of the CWC. We look forward to your testimony, in particular hearing how DOD plans to improve its management of this program and whether anything more in the way of fiscal resources or legislative authorities is needed to help the Department destroy the stockpile safely, on time, and at a reasonable cost.

We look forward to also hearing from Ambassador Mahley regarding the requirements of the CWC and the potential diplomatic ramifications of the problems that are evident in the U.S. Chemical Demilitarization Program.

Gentlemen, I thank each of you for your service and for appearing here today.

I note that, in addition to the ranking member, Senator Reed, and other members of the subcommittee, we will no doubt be joined

by the distinguished Senators from Colorado, who I know have a chemical storage site in their State and share a strong interest in this program.

I will now turn the floor over to Senator Reed for any opening remarks he cares to make.

STATEMENT OF SENATOR JACK REED

Senator REED. Thank you very much, Mr. Chairman, and let me join you in welcoming our witnesses here today. The Chemical Demilitarization Program is truly important and deserves national priority for at least two reasons. First, there is a vital need to eliminate the risk to the communities where our chemical weapons and agents are stored.

Second, we have an international treaty obligation under the CWC to destroy all our chemical weapons and production facilities. This is the law of the land. Once the United States ratifies and enters into a treaty, we commit ourselves as a Nation to meet all of our obligations under that treaty without exception or excuse. That means we must make every effort necessary to comply with the terms of the treaty. That is the same high standard to which we hold all other parties to any treaty.

The U.S. Chemical Demilitarization Program has made great progress in the last decade and most of our destruction facilities are now operating or about to do so. That is a tribute to the hard work of the Federal, State, and local officials and the contractor personnel who have made it possible to get these complex systems up and running. The DOD and the Army leadership represented here today deserve considerable credit for the successes we have had to date.

But there is also a serious issue before us. The Department restructured the Chemical Demilitarization Program last year, apparently for cost reasons, and this restructuring had the effect of jeopardizing our compliance with the CWC. By removing the majority of planned funding for the Pueblo, Colorado, and Blue Grass, Kentucky, sites and delaying planned construction at these two sites until 2011, the Department virtually guaranteed that the United States would not be able to meet the extended destruction deadline of April 2012.

One question that arises is whether DOD put our treaty obligations at risk in an attempt to save money. Additionally, did the Department consult and coordinate with all other relevant government agencies and offices before taking a step that would put us in noncompliance with a treaty obligation?

Although the costs for the Chemical Demilitarization Program have grown steadily, that trend is not unique to this program. Most DOD programs experience cost growth, sometimes dramatically so. With normal defense acquisition programs there is sometimes an option to slow the program down or reduce the planned procurement as a way to save money. However, that is not an option with a treaty obligation. There is no clause in the CWC that says if the cost of demilitarization increases by a certain amount we are free not to meet the destruction deadline.

We will hear today that the Department did not believe the previous plan could meet even the extended deadline of 2012. How-

ever, even so I fail to see how cutting funding from two of the planned demilitarization facilities and delaying the start of construction there until 2011 can do anything but kill our chances of complying with the treaty.

Fortunately, the Department has recently made modifications and is now allowing some redesign work and some neutral construction activities to proceed with fiscal year 2005 funds that had been previously withheld. The Department is also conducting a review of all options to see if there are other ways to meet the extended treaty deadline. Unfortunately, the previous decision to cut funding for the two sites has cost us precious time and there is no commensurate funding requested in the fiscal year 2006 budget request to continue the effort that is just getting started so late.

I hope there is no doubt at the end of this hearing that the United States is committed to meeting all its obligations under the CWC even if doing so costs more than predicted.

Thank you, Mr. Chairman.

Senator CORNYN. Thank you, Senator Reed, for your opening statement.

We will proceed to hear from the witnesses any opening statements that you may have, within reasonable limits, and then allow us to get to our questions. We will proceed through those rounds until either we run out of questions or we wear you out, whatever comes first.

The Honorable Michael W. Wynne, Under Secretary of Defense for Acquisition, Technology, and Logistics. Secretary Wynne, please proceed with any statement that you have, sir.

STATEMENT OF HON. MICHAEL W. WYNNE, UNDER SECRETARY OF DEFENSE FOR ACQUISITION, TECHNOLOGY, AND LOGISTICS; ACCOMPANIED BY DALE E. KLEIN, PH.D., ASSISTANT TO THE SECRETARY OF DEFENSE FOR NUCLEAR AND CHEMICAL AND BIOLOGICAL DEFENSE PROGRAMS

Mr. WYNNE. Thank you very much. Mr. Chairman, Senator Reed, Senator Salazar, distinguished members of the subcommittee: I thank you for the opportunity to appear before you today to discuss the status of the Chemical Demilitarization Program. Today I want to make three points concerning the Chemical Demilitarization Program:

First, if the Chemical Demilitarization Program had continued on its prior planned path the United States would not have met the Chemical Weapons Convention extended 100 percent destruction deadline of April 2012 no matter how much funding was appropriated for the U.S. Chemical Demilitarization Program. In November 2004, I chaired a Defense Acquisition Board to address the Chemical Demilitarization Program. At the Defense Acquisition Board I was presented with three options. None of the options presented allowed the United States to meet the extended 100 percent CWC destruction deadline of April 2012. In fact, all options required more funding than was planned and more time to complete chemical agent destruction than the treaty extension may have allowed. As a point of fact, the options appeared to me to endanger our opportunity to achieve even the 45 percent milestone. I felt this was unacceptable, given all the effort by communities and the

project management team to start destruction of almost 90 percent of the U.S. stockpile.

Second, given that no amount of money would meet the extended treaty deadline with the complex science, engineering and processes required by the then-current plan, I have taken aggressive steps to manage the life cycle cost and quality performance of the Chemical Demilitarization Program. At the same time, we are maintaining safety, meeting the 45 percent milestone, and holding out hope that there may be an alternative way of meeting the 100 percent extended deadline.

In December 2004, I gave two directions to the Chemical Demilitarization Program. First, I directed the program to prioritize funding to operating and constructing a facility to maximize our ability to meet the CWC extended 45 percent destruction deadline of December 2007. With the startup of Newport in less than 30 days, given the notification now before you, we will have commenced the destruction of about 90 percent of that stockpile.

Next, I directed the program manager for the assembled chemical weapons alternatives, which includes the last 10 percent of our stockpile, and the Army to develop potential alternatives that are safe, secure, timely, and cost effective. This 10 percent is divided between Blue Grass, Kentucky, which stores 2 percent of the stockpile, and Pueblo, Colorado, which stores 8 percent. At the time of my direction, Blue Grass and Pueblo were essentially greenfields, that is undeveloped land, and they remain that way today.

I requested the analysis because of the unacceptably high risk and cost of the Assembled Chemical Weapons Alternatives (ACWA) program and to maximize our ability to meet the CWC extended 100 percent destruction deadline. I expect to review these alternatives by the end of the third quarter of fiscal year 2005.

To highlight the importance of this issue, recent estimates project the life cycle costs of the program at where Senator Reed placed them, as high as $37 billion. These estimates have been corroborated in part by the Department's Cost Analysis Improvement Group (CAIG). While CAIG estimates do place pessimism into their projections, unfortunately their estimates have been a better forecast of the actual execution for this program and may end up to be low as compared to the actual cost to perform.

Understand, sir, that there is a high correlation between higher costs and longer schedule because it involves the complexity of the plants that we are talking about. I cite, for example, the continuing Environmental Protection Agency (EPA) concern over the hydrolysate from Newport. Changing the rules for environmental wastes is beyond our management capability and yet may cause me to have to not certify the current Nunn-McCurdy breach for Newport, which would then jeopardize funding for that site by law.

This brings me to the third point I wanted to make today. I have taken additional steps to put in place a plan of action to manage the escalating life cycle costs and timeline for this program. Implementing this plan will provide the United States with a safe, secure, timely, and cost-effective program to meet both the intent and the literal interpretation of the international obligation under the chemical weapons program, with some assistance from this committee, if that alternate method is required.

On March 23, I took steps to implement a path forward for the Pueblo and Blue Grass sites. I would note that Blue Grass never stopped designing and Pueblo never stopped designing, using residual funds from prior years. The question of whether or not they could start neutral construction was above and beyond the design capability, for which they have not yet achieved the required critical design review (CDR), nor have they come forward with an approved design which would allow them to start construction.

I directed the program manager for the ACWA program to do the following: First, identify changes to the existing design concept so that projects can be implemented with the recognition of cost as a major variable and set targets of an estimated cost of $1.5 billion for Pueblo and an estimated cost of $2 billion for Blue Grass in fiscal year 2002 constant dollars;

Next, to develop revised project milestones, cost targets, and appropriate incentives for cost, schedule, quality, and safety achievements at not only these two facilities, but perhaps back them up to the chemical destruction alternatives;

Last, provide a plan to preserve to the Government the option of competition for future phases of the project.

These efforts are intended to ensure the best value for the taxpayer and to meet the CWC obligations for the safe destruction of these chemical weapons.

The fiscal year 2006 budget submittal reflects my direction. I respectfully request your support for this program by fully funding the Chemical Demilitarization Program in the President's budget. The Department is fully committed to the safe, secure, timely, and cost-effective destruction of the chemical weapons stockpile, but we cannot start unless we know where we are going.

I welcome your comments on all aspects of our program's process. I thank you, Mr. Chairman, Senator Reed, and Senator Salazar for coming today and for the opportunity to testify. I am happy to answer your questions.

[The prepared statement of Mr. Wynne follows:]

PREPARED STATEMENT BY HON. MICHAEL WYNNE

Good afternoon, Mr. Chairman, Mr. Ranking Member, and distinguished subcommittee members. I am Michael Wynne, the Under Secretary of Defense for Acquisition, Technology, and Logistics (AT&L), and I thank you for the opportunity to appear before you today to discuss the status of the Chemical Demilitarization Program. While we have made progress in the destruction of stockpiled chemical weapons, the Department of Defense (DOD) recognizes that even greater progress in the very near future is required to keep the United States on track to meet its international obligations under the Chemical Weapons Convention (CWC). This is the first time I have testified before you regarding the Chemical Demilitarization Program.

Today, I want to make three points concerning the Chemical Demilitarization Program.

PROGRAM HISTORY AND STATUS

First, if the Chemical Demilitarization Program continues on its current path, the United States will not meet the CWC extended 100 percent destruction deadline of April 2012, no matter how much funding is appropriated for the U.S. Chemical Demilitarization Program. In July 2002, the Under Secretary of Defense for AT&L directed that the chemical weapon stockpile at Pueblo, Colorado, be destroyed by a neutralization facility followed by biotreatment, and in February 2003, the Department directed that the chemical weapon stockpile at Blue Grass, Kentucky, be destroyed by a neutralization facility followed by super critical water oxidation. Both

directions also established the life cycle cost. These costs were $1.5 billion for the Pueblo project and $2.0 billion for the Blue Grass project (in fiscal year 2002 constant dollars).

In 2004, it was brought to my attention that the Pueblo project was not within the baseline parameters and not designed according to the Under Secretary of Defense (AT&L) direction. Costs have increased to $2.6 billion, $1 billion over the life cycle cost certified to Congress on January 30, 2003. Based on the results of a preliminary assessment performed on the Pueblo project in May 2004, I requested a review be conducted regarding the Pueblo project by the DOD Inspector General (IG). Also, in June 2004, my staff requested an independent assessment by Mitretek Systems. The results of the DOD IG review and the Mitretek independent assessment showed a more cost-effective and manageable facility could be designed using the current neutralization process followed by biotreatment technology.

As a result of the Pueblo project issue and the growing costs at the operating and constructed chemical weapons destruction facilities, I chaired a Defense Acquisition Board (DAB) in November 2004. At the DAB, the Army and Program Manager (PM) for ACWA presented me with various options to address the program's funding and schedule. I was very concerned that none of the options presented to me resulted in the United States meeting the CWC extended 100 percent destruction deadline of April 2012. Further, all of the options showed significant increases in life cycle cost.

FUNDING PRIORITIES AND ALTERNATIVES DEVELOPMENT

Second, I have taken aggressive steps required for managing the escalating life cycle cost, schedule, and performance of the Chemical Demilitarization Program, without compromising safety. In December 2004, I prioritized the program's resources to operating and constructed facilities to maximize our ability to meet the CWC extended 45 percent destruction deadline of December 31, 2007. The current plans would develop and implement technically challenging designs for neutralization-based programs at Pueblo and Blue Grass. This has resulted in rapidly increasing cost estimates and schedules. Next, I directed the PM ACWA and Army to develop potential alternatives that are safe, secure, timely, and cost effective, and I expect to review them by the end of the third quarter of fiscal year 2005. These potential alternatives may include consolidation of chemical weapons, redefining our requirements in terms of performance, cost, and schedule, as well as seeking competition for future work. I must make it very clear that I did not exclude any alternatives, and I am fully aware that any plan to relocate chemical weapons will require statutory authority. However, I wanted to maximize our ability to meet the CWC extended 100 percent destruction deadline of April 2012 and reduce the unacceptably high operational risks and the escalating cost of the proposed designs. Through these directions, I am re-emphasizing that the Chemical Demilitarization Program remain within fiscal resources and that the program was never exempt from this requirement.

PATH FORWARD DEVELOPMENT

Third, I have begun the implementation of a path forward for the program to provide the United States with a safe, secure, timely, and cost-effective program to meet its international obligation under the CWC. As part of my renewed emphasis on controlling costs, on March 23, 2005, I directed the PM ACWA to do the following:

- Identify changes to the existing design concept so the projects can be implemented within an estimated cost of $1.5 billion for Pueblo and $2.0 billion for Blue Grass, in fiscal year 2002 constant dollars;
- Develop revised project milestones and cost targets and incentives; and
- Provide a plan for considering competition for future phases of the project.

I approved the limited release of fiscal year 2005 research, development, testing, and evaluation funds to accomplish this redesign effort, and I released fiscal year 2005 Military Construction funds ($40 million for Pueblo and $30 million for Blue Grass) to begin early construction for neutral site improvements for any alternative ultimately selected. I also requested the PM ACWA provide a cost of the redesign effort to right size the Pueblo and Blue Grass projects. These steps will enhance our ability to manage cost and schedule as the program moves forward to the goal of safely destroying our chemical weapons and meeting our treaty obligations.

CONCLUSION

In summary, I took steps to: 1) review the Chemical Demilitarization Program; 2) manage life cycle cost and evaluate alternatives; and 3) implement a path forward to manage cost and schedule. All of these efforts are intended to ensure the best value for the taxpayer and meet our CWC obligations. The fiscal year 2006 President's budget submittal reflects my direction, and I respectfully request your support for this program by fully funding it. The Department is fully committed to the safe, secure, timely, and cost-effective destruction of the chemical weapons stockpiles. I welcome your comments on all aspects of our program's progress, and I would be pleased to answer your questions. I thank you, Mr. Chairman, Mr. Ranking Member, and the other members of the subcommittee for the opportunity to testify today and your continued interest in and commitment to the Chemical Demilitarization Program.

Senator CORNYN. Thank you, Secretary Wynne.

Dr. Klein, we would be glad to hear from you.

Dr. KLEIN. Since my boss in the Office of the Secretary of Defense (OSD) made his opening statement, I am here to support and answer your questions. Thank you.

Senator CORNYN. Thank you very much.

Secretary Bolton.

STATEMENT OF HON. CLAUDE M. BOLTON, JR., ASSISTANT SECRETARY OF THE ARMY FOR ACQUISITION, LOGISTICS, AND TECHNOLOGY

Mr. BOLTON. Mr. Chairman, Senator Reed, distinguished members of the subcommittee: It is my pleasure to appear before you as Assistant Secretary of the Army for Acquisition, Logistics, and Technology and as the Army Acquisition Executive to discuss the status of the Chemical Demilitarization Program. I respectfully request that my written statement be entered into the record in its entirety.

Senator CORNYN. Without objection.

Mr. BOLTON. I am joined today by Mike Parker, the Director of the Chemical Materials Agency (CMA), and on behalf of Mr. Parker and the men and women who perform the safe and expeditious destruction of the chemical weapons for the Army, I want to thank the committee members and staff for your unwavering support of this important and difficult mission. Your candid appraisals of this endeavor guide our path and help us to achieve the tasks you have charged us to perform.

As the Army Acquisition Executive, I am responsible to the Secretary of the Army and to the Defense Acquisition Executive for all aspects of the Chemical Demilitarization Program except for the disposal efforts at Pueblo, Colorado, and Blue Grass, Kentucky. The Army's paramount objective is to destroy the stockpiles of chemical agent and munitions at disposal sites in Alabama, Arkansas, Indiana, Maryland, Oregon, and Utah, as well as the Nation's nonstockpile chemical warfare material, while ensuring the safety and protection of the workforce, the general public, and the environment.

I would like to outline three main points today. First, I will illustrate the excellent progress the Army has made over the past year. Second, I will highlight how we are conducting this mission safely. Third, I will describe some of the issues that affect the program's cost and schedule.

First I would like to point out that this is a remarkable time for the Army's Chemical Demilitarization Program. I am proud to report that over 36 percent of the total stockpile has been destroyed using chemical neutralization and incineration technologies. We have destroyed all of the agent drained from ton containers at our neutralization facility in Aberdeen, Maryland, making it the first facility within the CONUS to completely eliminate the risk of agent exposure to nearby communities. Our neutralization facility at Newport, Indiana, is expected to begin agent destruction operations next month. Our incineration facilities are also making tremendous progress. I am pleased to report that all of our incineration facilities are now operating. We have destroyed more than half of the Tooele, Utah, stockpile, which originally constituted over 40 percent of the total U.S. stockpile. Over one million munitions have been destroyed there, including all of the sarin-filled weapons and nearly all of the VX munitions, which together represent a 99-percent reduction in the risk to the community. The employees at our facility at Anniston, Alabama, have destroyed all of their sarin-filled rockets, which represents a 33-percent reduction in the risk to the surrounding community.

The workers at our facility at Umatilla, Oregon, also are doing their part to reduce the risks posed by continued storage. Since beginning operations in September 2004, they have safely eliminated over 10,000 sarin-filled rockets. Two weeks ago, the workers at our facility at Pine Bluff, Arkansas, began destroying munitions and reducing risks to their community. They have already destroyed over 100 sarin-filled rockets.

International treaty requires the complete destruction of our Nation's stockpile of chemical agent and munitions, but it also requires destruction of nonstockpile chemical warfare materiel. I am pleased to report that over 80 percent of our former production facilities have already been destroyed and we are on schedule to meet the April 2007 nonstockpile treaty deadline.

Focusing on my second point, I would like to emphasize that we are accomplishing all of the activities safely. The Army and its contractors have achieved exceptional safety records and by focusing our efforts and protecting the worker turning a valve during a plant operation we protect the general public and the environment as well. Our facilities have achieved an annual average reportable injury rate that, according to the Bureau of Labor Statistics, is somewhere between those of a credit union and a shoe store.

Our sites have logged millions and millions of hours without a lost time incident. Our facilities at Alabama, Arkansas, and Oregon have all recently received prestigious safety awards from State government offices in recognition of their extraordinary achievements. In addition, through the Chemical Stockpile Emergency Preparedness Program (CSEPP), the Army works closely with the Department of Homeland Security's Federal Emergency Management Agency (FEMA), and with State and local governments to review emergency preparedness requirements. As individual stockpile sites reduce risks to the communities through continued destruction, all 10 CSEPP sites have achieved full program benchmark compliance.

My third and final point is that a number of different issues impact the program's cost and schedule. No one envisioned the peace-

ful destruction of these weapons when they were manufactured over 50 years ago. However, achieving a mission of this scope and magnitude, one that holds the interests of so many important stakeholders, poses unique challenges. These challenges can be grouped generally into three categories: technical, external, and internal.

As an example of a new technical requirement, we recently identified the presence of mercury in portions of the Tooele mustard stockpile. The Tooele plant must be modified to remain compliant with regulations and prevent the release of mercury into the environment. We are currently investigating whether mercury contamination exists in the mustard of our other stockpile sites and the potential cost and schedule impact.

Challenges related to external requirements include State regulatory requirements, emergency response requirements, and litigations, among others. While new and changed requirements generally contribute to the increased safety and environmental protection, their implementation impacts cost and schedule.

With respect to internal challenges, operational events also have caused schedule delays and cost increases. Chemical warfare agents are by design deadly. To protect those who have the greatest contact with these weapons, our workers, we demand the safe operation of these plants. We work diligently to preclude chemical events through well-designed equipment and facilities, thoroughly vetted operational procedures, and comprehensive operator training.

We are focused on improving safe destruction operations through a continuous improvement approach that results from thoroughly examining operational events. We stop, take time to assess what went wrong, implement corrective actions, and proceed again with caution. I would prefer to stop operations, perhaps even for months, to ensure that we are being safe and environmentally protective rather than have any doubt about our ability to do the job safely.

I have visited seven sites since accepting the responsibility of this program and I look forward to visiting them all in due course. I am extremely impressed with the professionalism and dedication of the workforce and by the robustness of our facilities. I welcome and invite each of you to visit any of our disposal facilities and see for yourselves. I think you will be duly impressed.

In closing, Mr. Chairman, I ask for your continued support of this critical national program so that we may sustain our commitment to the communities surrounding the storage sites, the Nation, and to our international partners.

Thank you for the opportunity to discuss this important program with you and I look forward to your questions.

[The prepared statement of Mr. Bolton follows:]

PREPARED STATEMENT BY HON. CLAUDE M. BOLTON, JR.

Chairman Cornyn, Senator Reed, distinguished members of the subcommittee, it is my privilege to appear before you as the Assistant Secretary of the Army for Acquisition, Logistics, and Technology and as the Army Acquisition Executive to discuss the status of the Chemical Demilitarization Program. On behalf of the men and women who perform the safe and expeditious destruction of aging chemical agents and munitions for the Army, I want to thank the subcommittee members and staff

for your unwavering support of this important and difficult mission. Your candid appraisals of this important endeavor guide our path and help us to achieve the task you have charged us to perform. Your dedication to this mission is recognized and appreciated.

As the Army Acquisition Executive, I am responsible to the Secretary of the Army and to the Defense Acquisition Executive for all aspects of the Chemical Demilitarization Program, except for the demilitarization efforts at Pueblo, Colorado and Blue Grass, Kentucky. The Army's paramount objective is to destroy the stockpiles of chemical agent and munitions at the demilitarization sites in Alabama, Arkansas, Indiana, Maryland, Oregon, and Utah, as well as the Nation's non-stockpile chemical warfare materiel, while ensuring the safety and protection of the workforce, the general public, and the environment. The management attention that I personally give this program is commensurate with its tremendous importance to the American public, in terms of both ensuring safety and proceeding expeditiously with the destruction of these weapons in a cost-effective manner.

This is a remarkable time for the Army's Chemical Demilitarization Program. We are achieving a great deal and are doing so safely. Executing the mission, however, is not without its challenges.

I am proud to report that over 35 percent of the total stockpile is destroyed, and the bulk of the agent at our neutralization facility in Aberdeen, Maryland, has been destroyed. Aberdeen is the first facility within the continental United States to completely eliminate the risk of agent exposure to nearby communities. The bulk agent neutralization facility at Newport, Indiana is expected to begin agent destruction operations next month.

Our incineration facilities also are making tremendous progress. Our first incineration facility, on Johnston Atoll in the Pacific, safely completed destruction operations many years ago. We are in the process of closing out the Resource Conservation and Recovery Act permit for that site. We have destroyed more than half of the stockpile stored near Tooele, Utah. This site originally stored 44 percent of the original U.S. stockpile of chemical agents and munitions. In essence, the Tooele facility, alone, has now destroyed nearly one quarter of the entire U.S. stockpile, and more than is stored at any other single location. Over one million munitions have been destroyed at Tooele, including all of the sarin-filled weapons, and nearly all configurations of the VX munitions, which together represent a 99-percent reduction in risk to the surrounding communities. I am very proud of the Tooele workforce's accomplishments. The employees at our facility in Anniston, Alabama also have reason to be proud of their accomplishments. They have destroyed all of the sarin-filled rockets, which represents a 33-percent reduction in risk to their surrounding communities, and they continue to work safely and diligently to achieve their remaining schedule milestones. The employees at our facility at Umatilla, Oregon also are doing their part to reduce the risk posed by the continued storage of these aging weapons. Since beginning operations in September 2004, they have safely eliminated over 8,000 M55 sarin-filled rockets. I am very pleased to report that last week, the workers at our facility in Pine Bluff, Arkansas, began destroying agent, thereby reducing risk to their surrounding communities.

The Chemical Weapons Convention not only requires the complete destruction of our Nation's stockpile of agent and munitions, it provides for the destruction of our non-stockpile chemical warfare materiel as well. This component of the treaty requires the complete destruction of all of our former chemical weapons production facilities by April 2007, a deadline for which there is no extension provision. I am pleased to report that over 80 percent of our former production facilities have already been destroyed. The remaining two facilities, at Pine Bluff Arsenal and Newport Chemical Depot, are undergoing demolition and we are on schedule to meet our international treaty commitments. The non-stockpile program has also developed and deployed a number of innovative, safe, and efficient destruction technologies, such as the Explosive Destruction System (EDS), and the Single Chemical Agent Identification Set (CAIS) Access and Neutralization System (SCANS). These technologies effectively destroy chemical agent munitions and identification sets that contain agent, and they are completely mobile and proven to be safe. The EDS has safely processed nearly 300 rounds since entering into service in 1999, including the World War I chemical weapons recovered in nearby Spring Valley, Washington, DC, and we have used SCANS to destroy recovered CAIS vials and bottles with improved safety and cost effectiveness as compared to previous technology. The non-stockpile program also has developed useful chemical agent assessment technologies, such as the Mobile Munitions Assessment System, which helps operators identify the configuration and contents of recovered munitions. This capability greatly enhances the safety and efficiency of recovered munitions destruction operations.

In short, the Army has safely completed destruction of the stockpile at Johnston Atoll in the Pacific and drained all of the agent at Aberdeen, Maryland. Four sites are currently using incinerators to safely eliminate significant stockpiles. The last of the facilities under Army management is expected to begin destruction operations very soon and the destruction of our former production facilities and other non-stockpile chemical materiel is proceeding on schedule.

The most important fact is that we are accomplishing all of these activities safely. The Army and its contractors have achieved exceptional safety records, and by focusing our Safety Management System on protecting the worker who is turning a valve during a plant operation, we protect the general public and the environment as well. Overall, our facilities have achieved an average Annual Recordable Injury Rate of 1.39, which, according to the Bureau of Labor Statistics, is somewhere between those of credit unions and shoe stores. Our sites have logged millions of hours without a lost-time incident. As of February of this year, the Anniston facility logged more than 6.5 million man-hours, equating to 2 years, without a lost-time injury. In recognition, the Governor of Alabama and the Alabama Department of Industrial Relations presented our Anniston contractor with a prestigious safety award. The Pine Bluff facility received the Arkansas Department of Labor safety award last September in recognition of having logged 5 million man-hours without a lost time injury; their record continues and they have now worked more than 5.5 million man-hours without any lost time. Last month, our Umatilla contractor received the 2005 Oregon Governor's Occupational Safety and Health Employer Award for its "outstanding contributions to occupational safety and health."

We continue to strive for improved excellence in agent monitoring technology and practices. In an effort to conform to industry standards for worker and population protection, all of our facilities implemented new Airborne Exposure Limits (AELs) promulgated by the Centers for Disease Control and Prevention.

Compliance with environmental protection requirements is not negotiable. Our incineration facilities fully comply with the Environmental Protection Agency's Maximum Achievable Control Technology (MACT) requirements for emissions controls. We work daily to effectively implement the myriad requirements for the management of our solid and hazardous wastes. In addition, we work closely with our State and Federal environmental regulators and proactively take steps to stay ahead of the ever-changing regulatory environment under which we must operate.

The Army and the Federal Emergency Management Agency (FEMA) of the Department of Homeland Security (DHS) work closely with affected State and local governments to review emergency preparedness requirements as the individual weapons storage sites reduce risk to their communities through the destruction of their stockpiles. The Army and DHS FEMA share responsibility for the Chemical Stockpile Emergency Preparedness Program (CSEPP), which protects public health and safety by ensuring the emergency preparedness capabilities of Army installations and surrounding communities are ready to respond to an off-site chemical agent emergency. All 10 CSEPP States have achieved full program benchmark compliance. Capability Assessment and Readiness reports conducted by the States and annual program exercises consistently show that CSEPP States are better prepared to meet any emergencies than their non-CSEPP counterparts.

No one envisioned the peaceful destruction of these weapons when they were first manufactured. I am fond of saying that these chemical weapons are not fine wine; they do not improve with age. It is imperative that we continue to make significant strides toward destroying the Nation's stockpiles while still ensuring the safety of all involved. However, achieving a mission of this scope and magnitude, and one that holds the interest of so many important stakeholders, poses unique challenges. While we are focused on addressing these challenges, they will continue to cause significant growth in both cost and schedule as they have done in the past.

Our challenges can be grouped generally into three categories: technical, external, and internal. As examples of new technical requirements, our plants are aging beyond their expected service life, which will result in increased maintenance and refurbishment costs as well as schedule increases. As another example of a technical challenge, we recently identified the presence of mercury in portions of the Tooele, Utah, mustard stockpile. The Tooele plant must be modified to remain compliant with environmental regulations and prevent the release of mercury into the environment. We are currently investigating whether mercury contamination exists in the mustard at our other stockpile sites and the potential cost and schedule impacts of processing.

Challenges related to changing external requirements include the AELs and MACT requirements that I previously mentioned as well as State regulatory requirements, emergency response requirements, and litigation. While new requirements generally contribute to increased safety and environmental protection, their

implementation also impacts the program's cost and schedule. In our efforts to safely dispose of byproducts resulting from the destruction of VX in Indiana and the mustard in Maryland, the Army has pursued several technically and environmentally sound offsite disposal options. Attempts to resolve public concerns that have been expressed regarding the transport and treatment of secondary wastes have caused us to examine alternatives that are equally effective but potentially more expensive. Facility startups at Tooele and Anniston were delayed in response to community concerns, increased local emergency response requirements, and litigation.

With respect to internal challenges, operational events also have caused schedule delays and cost increases. Chemical warfare agents were designed to be deadly. To protect those who have the greatest contact with these weapons, our workers, we demand the safe operation of these plants. We work diligently to preclude, or at least minimize, the effect of these events through well-designed equipment and facilities, thoroughly vetted operational procedures, and comprehensive operator training. From this starting point, we are focused on improving safe destruction operations through a continuous improvement approach that results from thoroughly examining each event. We stop, take time to assess what went wrong, implement corrective actions, and proceed again with caution. I would prefer to stop operations—even for months—to ensure that our operations are safe and environmentally protective than to have any doubt about our ability to do this job safely. Our improving record on safety, about which I spoke earlier, demonstrates clearly that our continuous improvement program is working.

Finally, all stakeholders with an interest in this program play an important role. We are sensitive to the concerns of communities near the stockpile disposal facilities, and we work hard to effectively address their concerns while ensuring that we meet our program goals. We must be able to clearly articulate technically correct rationales for our decisions based on sound science while acknowledging citizen concerns in a way that recognizes personal and community perspectives about our program.

This is indeed a remarkable time for the Army's Chemical Demilitarization Program. As recited in my testimony here today we continue to accomplish the mission of safely destroying the stockpile. There have been, and will continue to be, challenges to overcome as we move forward. We look forward to working with Congress to achieve the mission it has laid out for us and to addressing the many challenges that affect this program. I have been to three sites, and I look forward to visiting them all in due course. I am extremely impressed with the professionalism, dedication, and ingenuity of our workforce and by the robustness of our facilities. I welcome each and every one of you to visit any of our disposal facilities and see them for yourselves; each is an impressive sight. I will continue to identify our requirements and then work to effectively use the resources that Congress provides to the program.

In closing, I ask for your continued support of this critical national program so that we may sustain our commitment to the communities surrounding the storage sites, to the Nation, and to our international partners. Thank you for the opportunity to discuss this important program with you. I look forward to answering any questions you may have.

Senator CORNYN. Thank you, Secretary Bolton.

Ambassador Mahley, we would be glad to hear from you.

STATEMENT OF HON. DONALD A. MAHLEY, DEPUTY ASSISTANT SECRETARY OF STATE, BUREAU OF ARMS CONTROL

Ambassador MAHLEY. Thank you, Mr. Chairman. First of all, I have a written statement that I would ask be entered into the record in its entirety.

Senator CORNYN. It will be, without objection.

Ambassador MAHLEY. Thank you, sir.

Second, I would like to summarize from that for my oral statement here this afternoon.

First of all, I am going to say things a little differently than what you have been hearing because I am going to talk about the treaty, the international obligations, and the history of this rather than the details of exactly what we are doing in a technical sense. One

of the things I want you to understand, and I think that you do understand, is that we started our Chemical Demilitarization Program well before there was a Chemical Weapons Convention. We started it back in 1985 with the current program. We did that, partly at the behest of the United States Congress, with an estimate at that point that said we should have been finished with it by 1994, which again would have been before the CWC even entered into force.

The fact that we are still here having this kind of a statement and inquiry today I think indicates that there have been indeed a number of difficulties that have come across with that program and a number of escalations from those initial estimates and the initial start that we made.

I mention all of this because I believe it is important to understand that the United States really has been committed to this kind of a destruction program even before we had an international treaty obligation to do so.

Now, what are we doing in the treaty itself? We heard the year 2012 mentioned a number of times today and indeed that is the ultimate deadline by which the treaty will require us to have our stocks destroyed. The initial deadline that we set in the treaty when we negotiated it was 2007, 10 years after entry into force.

I would point out that that was done with the full cognizance of everyone involved with giving us what we thought was at that point a safe margin from the then estimated program outputs that would have given us an opportunity to have complied with our international obligations.

The 2012 deadline constitutes a 5-year extension on what is actually written in the treaty for 10 years after entry into force. That is the maximum extension we can get, and so therefore there is no prospect that the treaty can be further modified in order to change that.

Having been involved in the negotiation of the CWC, let me make it clear. Those deadlines were inserted with the vigorous support of the United States. With the information then available to us and the program projections then being used, they offered what we judged to be a very safe margin, while not allowing other states to procrastinate indefinitely in their own destruction programs. That is why those limits are there.

I have been asked to address for this subcommittee specifically the implications for the United States with respect to that convention if we do not complete 100 percent destruction of our chemical weapons inventory by April 29, 2012. The most obvious but central point should this occur is that we will unequivocally become noncompliant with our international obligations. There is no automatic procedural or substantive impact of such noncompliance on our participation in the CWC or the Organization for the Prohibition of Chemical Weapons (OPCW). That is, we do not automatically lose our vote in either the executive council or the conference of states parties, we are not barred from selection to the executive council, and we are not subject to any additional inspections.

However, article 12 of the treaty lists a range of measures that can be taken by the conference in different stages of noncompliance. It provides that, "where a State party has been requested by

the executive council to take measures to redress a situation raising problems with regard to its compliance and where the State party fails to fulfill the request within the specified time, the conference may restrict or suspend the State party's rights and privileges under the convention until it undertakes the necessary action to conform with its obligations under the convention." So while I say there are no automatic penalties, that does not mean that the conference of states parties or the executive council cannot choose to impose penalties on a noncompliant state.

It also provides that in cases where serious damage to the object and purpose of the convention may result from activities prohibited by the convention, the convention, "may recommend collective measures to States parties in conformity with international law," and, "in cases of particular gravity bring the issue, including relevant information and conclusions, to the attention of the United Nations General Assembly and the United Nations Security Council."

Further, it does not appear that article 12 of the CWC was intended to restrict the rights of parties to the CWC to take additional actions allowed under the international law in response to a breach, as codified in the Vienna Convention on the Law of Treaties. A party specifically affected by a material breach may invoke it as a ground for suspending the operation of the treaty in whole or in part between itself and the defaulting states.

In other words, should a party believe that the United States' failure to destroy chemical weapons by 2012 constitutes a serious security breach between the United States and itself, it could then suspend operation of the CWC between the United States and that party. I.e., they would then feel free that they could then use chemical weapons if they had any on the United States under those circumstances.

Other parties may do the same if the treaty is of such a character that a material breach of its provisions radically changes the position of every party with respect to further performance of its obligations. I apologize for the relatively legalistic nature of that, but that is how we write treaties.

Given the way the United States operates by law and under the overall national policy objective of complying with its international legal obligations, it is obviously a highly undesirable circumstance if we do not adhere to those obligations. There is also great difficulty in pressing other countries to comply with the CWC if the United States is noncompliant.

The particular dilemma we face here, however, is that attempting to alter the CWC obligations in such a way as to avoid noncompliance is also fraught with real risks. If we were successful, we would then be establishing the very situation we strenuously tried to avoid during the negotiation of the convention. We would be making the destruction obligation essentially open-ended and thus gravely undermine the incentive for other possessors to continue to make chemical weapons destruction a priority in their own national planning.

For the record, under the current situation the only other possessor likely facing the situation of not being done by 2012 is Russia.

Indeed, it would be a major challenge for Russia to have even half of its declared stockpile destroyed by 2012.

If current assumptions hold and we indeed are noncompliant for not having completed our stockpile destruction, there will inevitably be some countries that will argue the United States has lost its right to offer opinions on the activities of other countries, at least with respect to chemical weapons. Frankly, that argument is made today, even before the deadline has been reached, on the basis that we have an inventory at all.

Responsible countries will not credit such arguments. I do not believe we will damage our international influence fatally if we have not completed our destruction by the deadline, so long as we are continuing to devote obvious and extensive effort and resources to the program and so continue to inform other parties of the nature of our progress. The Russian Federation could seize on any failure of the United States to complete the destruction by 2012 as an excuse to further submerge its own destruction program in competing budget priorities and to justify its own failure to meet the treaty deadline.

In response, we would of course need to emphasize that our performance, which far outstrips theirs both in effort expended and in results achieved, should not distract anyone from examining Russia's performance on its own merits.

In summary, Mr. Chairman, there are absolute requirements under the CWC for complete destruction of chemical weapons stockpiles by a date certain. It is not possible to excuse or alter those deadlines and the treaty was deliberately written to make them inflexible beyond the 5-year extension allowed in the existing text.

If the United States does not complete its destruction program by April 29, 2012, a situation that appears increasingly inevitable absent fundamental change, the United States will be in noncompliance with the CWC. While clearly undesirable, assuming continued priority is given to chemical weapons destruction by the DOD and by this subcommittee, such noncompliance should not be viewed by reasonable states as the United States trying to evade its legal obligations to eliminate chemical weapons or its commitment to the rule of law. There can be no assurance, of course, that those with particular political agendas might not seek to exploit the situation by making the situation an issue in the OPCW and elsewhere.

Thank you, Mr. Chairman, for your indulgence in this and I look forward to answering your questions.

[The prepared statement of Ambassador Mahley follows:]

PREPARED STATEMENT BY HON. DONALD A. MAHLEY

CHEMICAL WEAPONS DEMILITARIZATION

I am very pleased to have been invited here today to testify on the Chemical Weapons Convention (CWC) implications of the United States Chemical Weapons Demilitarization Program. You have already heard from my colleagues information on the current state of activity and the plans for future activity and budgeting. I will try to be brief and to outline mostly what the CWC requires, as well as my view on the implications for the United States role under that convention of the demilitarization activities you have had described today.

Before I do so, however, I would ask your indulgence to relate just a bit of history. I first became involved in the United States Chemical Weapons Demilitarization Program back in 1985 when, while serving on Active Duty with the United States Army, my responsibilities as a member of the National Security Council staff included chemical weapons. I make this note to remind all of us that the United States began destroying its chemical weapons stockpile long before there was a CWC. When the United States began production of binary chemical weapons—a process we terminated in 1991, again before there was a CWC—we recognized that as a corollary to the production of binary weapons as a newer and safer chemical deterrent, we should dispose of our existing stocks in a safe and ecologically sound manner.

One of the aspects of our long history of chemical weapons destruction is the gradual process of realizing just how difficult and technologically demanding such a program is. When the U.S. Army first started this program, it was very confident that it could be completed—for unitary stocks—by 1994, and would cost less than a billion dollars. The briefings you have heard from my Department of Defense (DOD) colleagues today is stark evidence of how much more complicated the process is than we recognized when we started down this path.

The CWC, the international treaty banning possession and use of chemical weapons, was negotiated over a lengthy period in the Conference on Disarmament in Geneva. Realistic activity toward completing a workable convention actually began in April of 1984, when George H.W. Bush, then Vice President of the United States, presented to the Conference a draft treaty that became the basis for negotiations and ultimately the foundation of the Convention. Negotiations on the Convention were completed by the Conference on Disarmament in September 1992, and the Convention was opened for signature in Paris on January 13, 1993. Lawrence Eagleburger, as Secretary of State, signed the treaty in Paris on behalf of the United States. The Convention entered into force both internationally and for the United States on April 29, 1997, following lengthy ratification proceedings in the Senate.

Article IV of the CWC requires all parties to the Convention to destroy completely their chemical weapons stockpiles. Paragraph 6 of Article IV states that such destruction ". . . shall finish not later than 10 years after entry into force of this Convention." Part IV(A) of the Verification Annex of the Convention provides additional details on the destruction of chemical weapons. Paragraph 13 of Part IV(A) specifies that ". . . the following processes may not be used: dumping in any body of water, land burial, or open-pit burning." Paragraph 24 provides that if a country is not able to complete destruction of its chemical weapons within 10 years of entry into force of the Convention, it may apply for extension of the deadline. However, "any extension shall be the minimum necessary, but in no case shall the deadline for a State Party to complete destruction of all chemical weapons be extended beyond 15 years after the entry into force of this Convention."

What all of that language combines to mean is that the United States, in order to comply with its obligations under the CWC, must complete destruction of its chemical weapons inventory by April 29, 2012. That date assumes the maximum possible extension under the Convention. Obtaining the extension should be feasible, especially considering the number of briefings we have provided to other parties at the OPCW and the demonstration—through money and effort—of our intentions to carry out destruction as rapidly as feasible. However, obtaining extensions beyond that date is not an available option under the provisions of the Convention.

Having been involved in the negotiation of the CWC, let me make it clear that those deadlines were inserted into the text with the vigorous support of the United States. With the information then available to us and the program projections then being used, the deadlines offered what we judged as a very safe margin while not allowing other states to procrastinate indefinitely in their own destruction programs.

I have been asked specifically to address the implications for the United States with respect to the CWC if we do not complete 100 percent destruction of our chemical weapons inventory by April 29, 2012. The most obvious but most central point, should this occur, is that we will unequivocally become noncompliant with our obligations. There is no automatic procedural or substantive impact of such non-compliance on our participation in the CWC and the OPCW. That is, we do not automatically lose our vote in either the Executive Council or the Conference of State Parties, we are not barred from selection to the Executive Council, and we are not subject to any additional inspections. However, Article XII lists a range of measures that can be taken by the Conference in different stages of non-compliance. It provides that "where a State Party has been requested by the Executive Council to take measures to redress a situation raising problems with regard to its compliance, and

where the State Party fails to fulfill the request within the specified time, the Conference may . . . restrict or suspend the State Party's rights and privileges under [the] Convention until it undertakes the necessary action to conform with its obligations under [the] Convention." It also provides that in cases where serious damage to the object and purpose of the Convention may result from activities prohibited under the Convention, the Conference "may recommend collective measures to States Parties in conformity with international law," and "in cases of particular gravity, bring the issue, including relevant information and conclusions, to the attention of the United Nations General Assembly and the United Nations Security Council."

Further, it does not appear that Article XII was intended to restrict the rights of Parties to the CWC to take the actions allowed under international law in response to a breach. As codified in the Vienna Convention on the Law of Treaties, a party specially affected by a material breach may "invoke it as a ground for suspending the operation of the treaty in whole or in part between itself and the defaulting State." Other parties may do the same if the treaty is of such a character that a material breach of its provisions radically changes the position of every party with respect to the further performance of its obligations.

Given that the United States operates by rule of law and under the overall national policy objective of complying with its international legal obligations, it obviously is a highly undesirable circumstance if we were not to adhere to those obligations. There is also great difficulty in pressing other countries to comply with the CWC if the United States is noncompliant. The particular dilemma we face here, however, is that attempting to alter the CWC obligations in such a way as to avoid noncompliance is fraught with real risk.

We could attempt to amend the Convention. I would strongly recommend against any such effort for two reasons.

First, if we were successful, we would then be establishing the very situation we strenuously tried to avoid during the negotiation of the Convention: we would be making the destruction obligation essentially open-ended, and thus gravely undermine the incentive for other possessors to continue to make chemical weapons destruction a priority in their own national planning. For the record, based on the current situation, the only other possessor likely facing the situation of not being done with destruction by 2012 is Russia. Indeed, it would be a major challenge for Russia to have even half its declared stockpile destroyed by 2012.

Second, in opening the Convention to amendment, we run the real risk of other countries adding their own favorite subjects to the amendment effort. Any and all such proposals would need to be taken seriously, because the CWC amendment procedures in effect give each State Party a veto, and thus the ability to hold any amendment hostage to their own proposals. Seeking to amend the destruction deadline potentially could undermine the very object and purpose of the Convention, since there is a real desire on the part of a number of countries to convert the document from being an arms control and security agreement to being a technology transfer and chemical industry assistance agreement.

If current assumptions hold and we are noncompliant for not having completed our stockpile destruction, there inevitably will be some countries that will argue that the United States has lost its right to offer opinions on the activities of other countries—at least with respect to chemical weapons. Frankly, this argument is made today even before the deadline has been reached, on the basis that we have an inventory at all. Responsible countries will not credit such arguments. I do not believe that we will damage our international influence fatally, if we have not completed our destruction by the deadline, so long as we are continuing to devote obvious and extensive effort and resources to the program and so inform the other parties.

The Russian Federation could seize on any failure of the United States to complete destruction by 2012 as an excuse to further submerge its own destruction program in competing budget priorities, and to justify its own failure to meet the treaty deadline. In response, we would need to emphasize that our performance which far outstrips theirs in both effort expended and results achieved, should not distract anyone from examining Russia's performance on its own merits.

In summary, Mr. Chairman, there are absolute requirements under the CWC for complete destruction of chemical weapons stockpiles by a date certain. It is not possible to excuse or alter those deadlines, and the treaty was deliberately written to make them inflexible beyond the 5-year extension allowed under the existing text. If the United States does not complete its destruction program by April 29, 2012—a situation that appears increasingly inevitable absent fundamental change—the United States will be in noncompliance with the CWC. While clearly undesirable, assuming continued priority is given to chemical weapons destruction by the DOD

and this subcommittee, such noncompliance should not be viewed by reasonable people as the United States trying to evade its legal obligations to eliminate chemical weapons or its commitment to the rule of law. There can be no assurance, of course, that those with a particular political agenda might not seek to exploit the situation, by making the matter an issue in the OPCW or elsewhere.

Thank you very much for your attention.

Senator CORNYN. Thank you very much, Ambassador Mahley. That was very informative.

We will now proceed with a round of questions. Let me start. The history of the Chemical Demilitarization Program has been marked by numerous restructurings and shifting oversight responsibilities between OSD, the Army, and within the Army itself. As the Government Accountability Office (GAO) noted last year, "The program's complex management structure, with multiple lines of authority within the Army and the separation of program components between the Army and the Department of Defense raises concerns about the roles and responsibilities of the different parts of the program."

Although technical surprises and new environmental regulations, as some of you have already said, have led to cost increases and schedule delays, I want to ensure that we have the program structured appropriately to minimize cost and schedule problems.

Let me just say at the outset, gentlemen, that I congratulate you for the good work that has been done so far. As I said in my opening statement, you have done it safely. I am impressed that the morbidity associated with this program is somewhere like that of a shoe store, I think you mentioned, Secretary Bolton. That is a great accomplishment, to have done this so safely.

But we do have a responsibility to the American people to make sure that our treaty obligations are complied with and also that their tax dollars are being spent as efficiently as possible. So I do have those concerns about both the management structure and the shifting of responsibilities, as the GAO noted.

Let me just ask each one of you to comment, if you will, starting with you, Secretary Wynne, and then Dr. Klein and Secretary Bolton. In your opinion, do we currently have the best management structure in place to run this program? If not, what changes would you recommend to the program's structure to make sure that we do?

Mr. WYNNE. We always quest to have the best organization. In this case what we have tried to do is to maximize the opportunity for the construction companies to know their counterparts and to maximize the experience base of the management team with those contractors. I think the way that the program is currently organized in a management structure, though it may seem a little bit awkward, both Secretary Bolton and myself have essentially ordained the same program manager to manage both of the CMA and the ACWA efforts to essentially consolidate that experience base into a single source.

The difficulty of Pueblo and Blue Grass has to do with each of their individual sites and I think the more difficult technologies associated with neutralization as applied to their specific compounds and weapons. That having been said, the same, if you will, stewards of the system are there for both. Bechtel is the contract manager for both Blue Grass and Pueblo right now. They have quite

a bit of experience dealing with our Army program manager and I think that does very well.

The breakout of the funding that you may have noticed myself doing in late last year was specifically to avoid having the Nunn-McCurdy statute force me to shut down the entirety of this effort as a result of overruns that you have mentioned. Breaking it down into three components, CMA, Newport, and then the ACWA facilities, gave me more management flexibility because I can see my way to certifying the four certification requirements of the Nunn-McCurdy break for the underway facilities. I have a hard time with Newport, though we have registered her for opening, and I do believe that it is, if you will, under control. But I do not know whether it is under control relative to the EPA regulations. Right now, the Army program manager has done an absolutely magnificent job of corralling, if you will, the various Federal, State, and local regulators on the parts of the program that are underway and in many cases making great progress.

The third part, which was the ACWA, does not really have to undergo a Nunn-McCurdy certification since I have asked that it be recompeted and/or restructured. But, I think it was in fact sailing towards that alternative and that is the reason that we broke it out.

So there is no best case scenario here that I can tell you, because best would probably have the program operating on budget and on schedule. However, under the circumstances I think this is the most effective program management alternative we could jointly come up with.

Senator CORNYN. Thank you.

Dr. Klein.

Dr. KLEIN. As you had indicated, this program is challenging. The way it is structured, OSD has the oversight responsibility for this program from the standpoint of people's attention to both cost and schedule. The Army is the executive agent. I think one of the things that would help us the most, as Mike Wynne indicated, is now to combine the ACWA and the CMA programs so that they are in linear form.

As Mike and Claude Bolton also indicated, Mike Parker is the head of both the CMA and the ACWA program and it would give us some efficiencies of scale if those were now combined.

Senator CORNYN. Thank you.

Secretary Bolton.

Mr. BOLTON. Yes, sir. I agree with my colleagues. I would go on to say that I am going into my fourth year in this position and I have been on this particular program with this responsibility a little over 2 years, and I must tell you, Mr. Chairman, that I resisted with some vigor being chosen to select this for this program, the reason being that when I judge a program I look for three things: one, do we understand the requirement and has it been codified; two, do we have the right processes in place to accomplish the task given; and three, do we have the right people, both on the Government and the contracting side.

As I stated in my opening comments, and Dale Klein also alluded to it, the requirements have changed almost from day one for this program, starting back in 1985, then into the 1990s, and certainly

into today, for a variety of reasons. Without control over that requirement, it is very difficult to control costs and schedule. With the processes we have developed, I think we have a pretty good handle on how to destroy these agents. We have shown that successfully and safely, and particularly with incineration, and we have learned a lot from Aberdeen in terms of neutralization. We will learn more when we get to start the Newport. So I think those lessons learned will lend themselves to a very good operation once Pueblo and Blue Grass are open.

We definitely have the right people. Mike Parker and his staff, as well as the contracting personnel, are truly world-class experts at what they do. They know how to get the job done.

In terms of the management structure, it is a bit convoluted and, as I said 2 years ago when we brought this over and talked to a few of the staffers, for where we were at that point in time it was the best organizational structure. We had made some changes. We will continue to improve that and, as Dale Klein has already indicated, from my point of view, if you want to manage all of this better you put all of the sites under one management structure rather than the two that we have right now.

But back to your basic question, the management structure is working well. There is room for improvement and we will do that in the future.

Senator CORNYN. Thank you.

My time has expired. Senator Reed.

Senator REED. Thank you very much, Mr. Chairman, and thank you, gentlemen, for your testimony today.

Secretary Wynne, I am trying to understand the logic of the various budget decisions that have been made. Last year you pulled back money and I think from your testimony you suggested that the reason was that, without regard to the money committed, the plan would not work. Now in the supplemental legislation you have 2005 money you are going to add back in right now. Does that indicate that the plan is now working, that you feel comfortable committing? If so, why do we not see anything in the 2006 budget which would be moving forward with a maximum and deliberate effort to meet the obligations of the treaty?

Mr. WYNNE. Thank you for the question, Senator. I did approve the release of an appropriated $40 million for Pueblo and $30 million for Blue Grass from the fiscal year 2005 military construction funding, basically to start site preparation for whatever alternatives are ultimately accomplished. The design work continues based on prior year fundings and has never been stopped. The design work from 2004 and 2003, frankly, our roll-forward, totals over I think $250 million of available funding and they still have not achieved a 67-percent design target, which would constitute the CDR at either site.

So there really is not a go-ahead available to me to essentially start major bulldozer activity at either site. That having been said, I think it is imperative if we do intend to meet the treaty obligation, which we do, to accomplish two things. First is we need to meet our 45-percent deadline. This means we need to incentivize our ongoing operations to meet the deadline. At Pine Bluff, for example, we only have one shift in operation because we cannot re-

cruit for Pine Bluff. Now, Pine Bluff is not in a location where you might say that people show up every day and are looking for work.

However, there is another side to this. We have a personnel reliability program that we put all the workforce through at each of these sites just as if they were guarding our nuclear weapons on a military installation. These are not inexpensive people and we are very selective with who we put through that program. So the backlog is there.

We need to afford the program manager some incentive money perhaps to pay bonuses for people to move to Pine Bluff so that we can fill out the planned three-shift operation. Otherwise it is going to take three times as long to essentially complete the Pine Bluff, which would by itself begin to endanger the 2012 treaty deadline.

So giving the program manager maximum flexibility to meet the 45 percent became an imperative. Basically, waiting for the design to complete, with or without any addition of 2006 funding, they have sufficient money left over from prior year funding essentially to move all the way through 2006 right now, even if we approved it as a result of this hearing and/or approved it as a result of the CDR.

So I do not feel bad at all about the use of the money. My intention is to study all the alternatives, to get the maximum capability to meet the 2012 deadline. We will be coming back to you, of course, if it is an alternative other than destruction onsite. But I would tell you, sir—and you probably know this as well—that if it comes to that or if we have to move some subset of it later in time, I think we should all hold that alternative open and never let it go until such time as we see that we can meet effectively, efficiently, and, as Secretary Bolton rightly said, safely beyond site destruction that we all are kind of questing after.

Senator REED. Just to follow up, Mr. Secretary. The 45 percent destruction, that deadline is 2007?

Mr. WYNNE. That deadline is 2007, sir.

Senator REED. 2007. So what you have done essentially is focus on the intermediate deadline of 2007 and try to use more appropriately and more efficiently the facilities we already have in place to destroy the material?

Mr. WYNNE. Yes, sir.

Senator REED. That still leaves the question, and you have just spoken about it, about the other facilities, Pueblo, et cetera. The question I would follow up with is—it seems to me that if we are moving forward at Pueblo other than just all these other facilities, we would have at least an idea of how much money we could deploy in the next budget cycle. There is nothing in the budget. I fear that another supplemental or another reprogramming will take place next year for funds for these facilities. It helps us a great deal to know for authorization purposes, not for appropriations purposes, to know how much money you could spend next year.

You have said you think you can get by with what you have now, but it puts us in a slight dilemma. We have to authorize these funds. Can you comment?

Mr. WYNNE. As I mentioned, Senator, I think I am given maximum flexibility for us to meet the requirements for the 86 percent of the stockpile that is already underway or completed. Newport ac-

counts for 4 percent of the stockpile and we have a request in that you might accelerate if you would like to. It is currently costing me $400,000 a day at Newport to not work because I already have a qualified staff there that I could open, and this 30-day notification cycle that we are going through really was left over from some of the early days of the facility. If there is anything I would ask of this committee, you might want to accelerate that approval cycle.

There is $400 million available to essentially begin both—any of the alternatives that would be considered at Pueblo and at Blue Grass should we ever take that alternative, and that includes the alternative of destruction in place. This should absolutely fill all the requirements that we can foresee for fiscal year 2005 and fiscal year 2006, so I do not see anything that I would be asking you to do at present.

That having been said, the Army has not given me the plan as yet and that will come in I think by the end of June. We will also be providing you the required strategic vision at that point as to what we see. We are all hoping that the contractors, some of whom have already been in, will in fact give us more alternatives that will actually meet the schedule and perhaps do it with some schedule incentives as opposed to square foot.

Senator REED. Just a final point. Mr. Chairman, you have been very kind.

From your remarks, it seems that you are not confident that you have in place yet the programs, the facilities, to begin significant funding to try to reach the 2012 deadline. Is that fair?

Mr. WYNNE. I would say that we are examining every alternative we can, which may by the way include onsite destruction, but we do not yet have an approved design that we can turn a shovel of dirt for the building. We are turning in fact or doing major site construction to prepare for either building a building and/or moving the stocks.

Senator REED. Thank you, Mr. Secretary.

Senator CORNYN. Thank you, Senator Reed.

We will go from side to side. Since Senator Reed was the last questioner, we will turn now to Senator Allard.

Senator ALLARD. Mr. Chairman, thank you. I have a prepared statement I would like to submit in the record and I ask unanimous consent.

Senator CORNYN. Without objection.

[The prepared statement of Senator Allard follows:]

PREPARED STATEMENT BY SENATOR WAYNE ALLARD

Thank you, Mr. Chairman, for providing me the opportunity to come and ask your witnesses a few questions. I recognize that it is highly unusual for those who are not members of the subcommittee to appear at a subcommittee hearing, but this matter before the subcommittee today is of considerable importance to my State of Colorado.

Mr. Chairman, I am deeply alarmed by the DOD's management of its Chemical Demilitarization Program. This program is significantly behind schedule and over budget. The program was supposed to have been completed before April 29, 2012, at a cost of approximately $2.1 billion. The program is now on a path to cost as much as $37 billion and be completed in 2030.

The DOD has consistently failed to provide sufficient funding for this program, forcing those who run to program to make programmatic decisions that pit sites against each other. The DOD has failed to provide adequate program management. It has repeatedly stopped design work and operations and then restarted, adding

enormous start-up and stop work costs and considerable schedule delays. The Department has failed to effectively communicate its intentions and plans to the States in which permitting is necessary and the local communities which must provide their support.

At the Pueblo Depot in Colorado, the Department accelerated the program in 2002. Then, in 2004, without communicating its intentions to Congress, the State of Colorado, or the Pueblo community, the Department unilaterally decided to cease all design work and put the program in care-taker status for the next 6 years. Two months ago, the DOD ordered a study on whether the stockpile in Pueblo should be relocated to an operational incineration site, potentially wasting tens of millions of dollars already spent on design work. A month later, the Department changed its mind again by ordering the preparatory construction and the redesign of the facility. The future of the program still remains uncertain because of the lack of funding in the Future Years Defense Plan.

Mr. Chairman, I am frustrated and the people of Colorado are frustrated. We cannot seem to get a straight answer from the Department. One day I was told by Department officials that the stockpile would not be relocated outside of Colorado. The very next day, the Department ordered the study of transportation options. The DOD has been inconsistent and unreliable regarding its intentions for this program.

I am also troubled by the DOD's apparent willingness to violate the CWC not destroying our country's chemical weapons stockpile by 2012. I believe the United States has an obligation to comply with it. Our Nation's reputation is at stake.

The most disappointing aspect of this matter is the fact that Congress has been more than willing to provide the funds and political support to get this program done on time. Last year alone, Congress added $50 million for the project at Pueblo. I am certain that if the DOD requested additional funding for the overall program, this Congress would be more than willing to support this request. Even those Members who do not have chemical weapons stockpile in their State recognize the importance of completing this program as soon as possible.

Again, I appreciate your willingness, Mr. Chairman, to provide me with the opportunity to question the witnesses here today.

Senator ALLARD. Also, my colleague Senator Mitch McConnell has a prepared statement he would like to submit in the record.

Senator CORNYN. Without objection.

[The prepared statement of Senator McConnell follows:]

PREPARED STATEMENT BY SENATOR MITCH MCCONNELL

Mr. Chairman, I thank the subcommittee for holding this hearing on an issue of prime importance to my constituents in Kentucky and me—the deadly chemical weapons that are currently stored at the Blue Grass Army Depot. In addition, I would like to thank Senator Allard for his leadership on this issue and for submitting this statement to the subcommittee on my behalf. He feels as strongly as I do that the dangerous substances located at the center of our respective states need to be disposed of safely and quickly.

Imagine how nervous you would be if large quantities of VX gas were stored in the committee room across the hall. Now you see how the residents of Madison County, Kentucky, feel.

VX gas and other dangerous chemical weapons have been stored at the Blue Grass Army Depot for years. Now it is time to destroy such substances. The administration has asked Congress for the money to do so, and we have more than complied. Congress has appropriated hundreds of millions of dollars so the DOD can safely destroy these materials. Yet the Department refuses to do so. The Department has offered all sorts of reasons for why—some of which even contradict each other—but the bottom line is that the Department refuses to spend the money we appropriated to dispose of the chemical weapons.

This Congress cannot and will not let them get away with it.

The Department's foot dragging on cleaning up the ACWA program sites is simply unacceptable. The best they claim they can do is place the Blue Grass and Pueblo sites on "caretaker" status—meaning that no cleanup action will be taken in the foreseeable future. The longer we sit on these dangerous substances, the longer the surrounding communities are at risk. The DOD needs to fulfill its obligations to clean up these sites now.

The Department claims that the ACWA sites must be downgraded to "caretaker" status because they are over budget due to cost overruns. Yet the Department's own schizophrenic decision making is what has led to these high costs. At Blue Grass, they plan to stop design work and operations and then restart them again later,

adding unnecessary start-up and stop work costs. They stingily parcel out appropriated monies in such small quantities that it is impossible to spend funds efficiently.

Perhaps we should expect no less. Dale Klein, the Assistant to the Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs, admitted in congressional testimony last week that "some of our budgeting processes are accurate but incorrect."

Let me repeat that. Mr. Klein, speaking on behalf of the DOD, said on the record, "some of our budgeting processes are accurate but incorrect." I will leave it to someone else to figure out exactly what that means, but it does not fill me with confidence in the Department's ability to resolve this issue.

Transporting chemical weapons across state lines is illegal. Yet the Department has ordered a study of how to do just that. Kentuckians don't want vials of nerve gas speeding down the interstate, Mr. Chairman. I suspect neither do the people of other States.

Most saddening of all is that by placing the ACWA sites on caretaker status, the Department is acknowledging that the weapons will not be disposed of until 2016 at the earliest. Yet the United States has signed the CWC, which establishes a deadline for elimination of these substances by 2012. The DOD should be working with all the speed it can muster to meet this deadline, not openly thumbing its nose at it.

In this age of terrorism, our decisionmaking processes for handling and disposing of such horrifying weapons must be focused and clear. The DOD's approach to the ACWA sites has been neither.

I thank this subcommittee for holding this hearing and for holding the DOD up to the strictest standard regarding its cleanup of the ACWA sites at the Blue Grass Army Depot and the Pueblo, Colorado Depot. Lives may depend on it.

Thank you.

Senator ALLARD. I am sorry about being late. We just got off the plane and the weather is not too favorable in Colorado right now, but we did get off.

Mr. WYNNE. Welcome, Senator Allard. I will tell you, I lived in Colorado and I remember well the late spring snow storms. I am glad you are here at all, sir.

Senator ALLARD. So you understand how you can have 70 degrees the day before and 2 feet of snow the next day.

Secretary Wynne, you had issued a memorandum to the Secretary of the Army on March 23, 2005, regarding the contracts for the Pueblo and then Blue Grass chemical stockpile disposal sites. As I understand it, the memo instructs the program manager for the ACWA program to identify changes to the existing design concept so that costs for Pueblo do not exceed $1.5 billion for Pueblo and then $2.0 billion for Blue Grass.

I note that the legal requirements of the certification statute require only that certification of alternative technologies be of comparable cost, safety, and projected duration to baseline incineration. The public law made no mention of certifying a life cycle cost estimate. The question is why did the DOD certify to Congress the $1.5 billion cost figure for Pueblo when it was not necessary to do it?

Mr. WYNNE. Sir, at the time I think that we—of course, we consulted with our legal authorities and I think at the time they thought that met the intent of the statute if it did not meet the letter of the statute.

Senator ALLARD. Would you not agree that this certification has put the Department in a box and made it nearly impossible for the work to be completed before the 2012 deadline?

Mr. WYNNE. Sir, I think when it was originally certified it was actually done with the idea, fully cognizant of the contractor who

gave us the estimate and fully cognizant of the program that made the thing, that they thought they had management margin relative to all of the technical difficulties that the neutralization concept would have given them. So we did not realize at the time what a bind it would have put us in.

But, we were sailing right towards a Nunn-McCurdy breach when we made those stipulations.

Senator ALLARD. It seems to me that if you look at what has been happening at the other sites, this was a totally unrealistic figure. I just have a hard time understanding why the Department holds to this life cycle cost when you look at some of the other costs which will—it is clear the project is going to cost more, particularly when you compare it to operational incineration sites, which currently have projected life cycle cost estimates that exceed $3 to $5 billion per site.

So this is new technology and I am trying to understand the logic of a $1.5 billion estimate when you are looking at the other sites and you have $3 to $5 billion to clean them up with incineration, which is a commonly-used technology in the cleanup.

Mr. WYNNE. Sir, I have not seen the analysis of doing incineration at Pueblo, for example, which would be the comparative estimate, because every site is different and every munition is different. Tooele, for example, has 50 percent of our stockpile there that they are trying to close. Johnston Island represents one that came open and now is shut down, so it has the only life cycle cost that we can sort of do a comparison to.

But the certification usually is relative to the same—a different technology on the same site, both, if you will, for Blue Grass and for Pueblo.

Senator ALLARD. But if you look at all the other sites, they are running $3 to $5 billion. Would this not have raised some concern when you had one that comes in half, maybe just a third of the cost of what was happening at the other sites?

Mr. WYNNE. I would have to take that one for the record, sir, as to how the evaluation was made at the time and the certification was made at the time. But I do know that the estimates were sound when they went through and the changes that have come about have been mostly technological.

[The information referred to follows:]

When the Department certified neutralization technology to Congress it was determined that this technology would meet the cost and schedule criteria of a conceptualized incinerator for the Pueblo and Blue Grass stockpiles. Based on the analysis for this requirement it is also now a fact that the incinerator concepts that would address the Pueblo and Blue Grass stockpiles are less expensive than current Assembled Chemical Weapons Alternatives neutralization designs.

Senator ALLARD. When can Congress expect to see a realistic life cycle cost estimate for Pueblo and Blue Grass?

Mr. WYNNE. I have asked the Army to complete their analysis of alternatives. We have actually heard from some, you might refer to them as optimistic, contractors, who say by the end of June we ought to have the estimate underway along with a revised design. I would say that until that occurs I cannot offer you any earlier date.

Senator ALLARD. Mr. Chairman, this is pretty important. I hope you can tolerate my going ahead here for a few more questions. I hope I am not duplicating anything that has been asked previously.

Secretary Wynne, I was troubled with your memorandum on March 23, 2005, that did not highlight the importance of schedule. In 1997, the United States Senate ratified the CWC, which obligates our Nation to destroy our chemical weapons stockpile by 2012. I opposed the ratification of the CWC. However, putting that aside, I firmly believe that our Nation has a moral obligation to comply with its treaty obligations.

According to the schedule provided to me on January 18, 2005, by Assistant Secretary Dale Klein, six of the eight U.S. chemical weapons sites will not make the treaty deadline. In fact, work at Pueblo is not scheduled to be completed until at least 2021. Why did you not highlight the importance of schedule in your memorandum?

Mr. WYNNE. When I asked for options in late 2004, none of the options met the treaty deadline no matter how much money we spent on the project. As an old estimator I realize that the increase in cost is almost a surrogate for an increase in schedule, and I recognize that we have to, therefore, put an incentive on cost. Everyone knows that we are trying to achieve the 2012 treaty deadline, so I did not think that it had to be reminded. But I did worry that we did not have a cost incentive and I correlate the two very closely.

So when the amount of money required for Pueblo went from $1.5 to $2.6 billion, I did not think it would result in a shorter schedule, but instead felt that actually we would have spent more money and yet not have made the treaty deadline, which would have meant that I would have essentially not effectively husbanded the taxpayers' resources.

Senator ALLARD. It sounds as though the DOD has decided unilaterally not to comply with the CWC. Is that true?

Mr. WYNNE. Hardly, sir. In fact, if you really wanted to comply with the CWC treaty, you would allow for some of the alternatives that we are exploring, such as transportation, because we can move to then incentivizing some of the sites that are currently operating to essentially accelerate their schedules and accommodate these extra munitions. Recall that we have already started 86 percent of the chemical stockpile. Four percent is underway at Newport, so the remaining stockpile that we are talking about here is 10 percent.

Senator ALLARD. But transportation is excluded by law. It says that you shall not——

Mr. WYNNE. I would agree, sir, that you would play a part in whether or not we achieve that deadline.

Senator ALLARD. How much of the U.S. stockpile do you expect to destroy by the 2012 deadline?

Mr. WYNNE. I would hope, sir, that with your permission and good alternatives from the Army, we will have achieved 100 percent.

Senator ALLARD. Now, Ambassador Mahley, on February 17 during a hearing in the Appropriations Committee I asked Secretary of State Condoleezza Rice what the ramifications would be if the

United States did not comply with the CWC. She unambiguously stated, "If the United States of America is not complying with its obligations, then it is going to be hard to force anyone else to comply. We have been very much a country of laws that insists on our own compliance and so we want to keep that record."

I could not agree more with her response. Will it be difficult to hold other nations to the treaty if we do not comply with the CWC?

Ambassador MAHLEY. Sir, the answer to that is that we will lose some of our moral status in doing so. Number one, that does not, in the fact that we are not complying with the treaty, remove the obligation for other countries to be compliant with the treaty. So the fact is that our not being in compliance does not remove their legal obligation.

What it does do is impede our ability to call them to task for that, because they will simply reply that we are indeed ourselves not being compliant. I would emphasize, however, that I do believe that reasonable states, not necessarily to include all the states in the world, but reasonable States will take a look at the amount of effort and the amount of progress that the United States has made on this deadline and will not hold that to be exactly the same kind of noncompliance as someone who has not paid any attention to this obligation whatever. That of course is a matter of political judgment and would have to wait until the actual event occurs.

Thank you.

Senator ALLARD. It just seems to me like it is going to be very difficult to insist that the other states comply when we are not complying. Have you submitted any recommendation to the President as far as complying, or has the State Department submitted any recommendation as far as this treaty is concerned?

Ambassador MAHLEY. Sir, we always submit to the President of the United States annual recommendations that the United States ought to be and remain in compliance with all of our international obligations. The fact is that the question of compliance that is in question here is not a current question of noncompliance, at which time it would be the Department of State's responsibility to recommend to the President of the United States how we would like to see the United States come back into compliance when we were not.

But looking at this as a future matter, then I think that the answer is no, we have not submitted a recommendation to look at this for 2012.

Senator ALLARD. So you have notified the President that you do not see how we can comply with this. Have you made a recommendation that the treaty deadline be extended or anything like that?

Ambassador MAHLEY. Sir, the treaty deadline cannot be extended because there is no flexibility in extending it, 2012 is actually an extension. The original deadline is 2007. It can be extended to 2012, but not beyond that. The only other alternative to extension would be something like trying to amend the convention, which has its own dangers.

Senator ALLARD. So will you have to renegotiate the treaty?

Ambassador MAHLEY. Sir, I would not intend to try to do that.

Senator ALLARD. Mr. Chairman, I have a number of other questions. What I would like to do is submit those for the record, unless you feel like you have enough time for me to ask another——

Senator CORNYN. I want to make sure we accommodate Senator Salazar. We are going to be able to do another round.

Senator ALLARD. That would be great.

Senator CORNYN. So at this time, I will recognize Senator Salazar.

STATEMENT OF HON. KEN SALAZAR, U.S. SENATOR FROM COLORADO

Senator SALAZAR. Thank you very much. Senator Cornyn and Senator Reed, let me just first, as the chairman and ranking member of the subcommittee, thank you for allowing both Senator Allard and myself to ask a few questions at your hearing. My thanks as well to Senator Warner and Senator Levin as the chairman and ranking member of the Armed Services Committee.

Let me just say to Secretary Wynne, Dr. Klein, Secretary Bolton, and Ambassador Mahley, this is a very important issue that we are dealing with here today in my State. I join my colleague Senator Allard in raising the concerns that he has raised with respect to the timeline that we are under concerning the Pueblo Army Depot.

Let me tell you why from my point of view it is so important. When you look at the Pueblo Army Depot and you realize that there are 780,000 munitions that are stored within 23,000 acres of the Pueblo Army Depot, it ought to be of great concern to you as well as to all of us. I have flown over that area probably 100 times during my life and you can see the places where the munitions are stored throughout this 23,000 acre site. To realize that these 780,000 munitions are stored within a very close proximity of the city of Pueblo and the city of Colorado Springs and the southern edges of Colorado Springs and Fort Carson ought to be of grave concern for all of us.

In the last month and a half or so there was a jet that actually crashed just on the perimeter of the Pueblo Army Depot. Had it just gone another mile and a half or so out to the east, it may have crashed into one of these munition storage places.

So when we think about our concern in terms of community safety, I have great concerns about the 100,000 inhabitants of the city of Pueblo. I have great concerns about the security of the half a million people who live in the Colorado Springs and Fort Carson areas. So it is important for us that we make sure that as we continue this dialogue, which I am sure that we are going to continue, at least with me for the next 6 years while I am the U.S. Senator, that we have the kind of understanding where we have some straight talk and honest answers coming from you as we move forward with respect to the particular timelines.

In my mind this is important for us to do, one, because of the community safety concerns that I outlined; second, the importance of compliance with our international obligations, which both Senator Reed and Senator Cornyn have so eloquently talked about; and third, because of the potential that these 780,000 munitions themselves could become targets of terrorism. As we deal with the

war on terror, how we ultimately neutralize these chemical weapons is something that is very important to all of us.

I will tell you that when we got involved in our communications with Dr. Klein and Secretary Wynne my concern was that we were seeing a position from you that was one of extreme waffling and indecision and lack of clarity about where it is that we were going. For a long time there in the months of January and February, the major issue that we were hearing back from the community was that there was a possibility that you were simply going to abandon all of the investment that had gone into the research and development of the ACWA neutralization process and instead look at transportation. So for a while there it seemed you were simply planning on transporting these chemical munitions to other places.

So it is in that context that I have several questions to ask of you. The first question, Under Secretary Wynne, to you is that as I read the letter that you sent to both Senator Allard and me on March 25 I implicitly see that letter as telling us that onsite water neutralization is still the preferred technology and what you want to pursue at the Pueblo Army Depot. It seems to say that you are not looking at other technologies at this point in time.

I would like your clarification of what you are looking at with respect to the technology that will be used to neutralize the chemicals at the Pueblo Army Depot, and whether my understanding is correct that we are still moving forward with the water neutralization process.

Mr. WYNNE. I have asked the Army, Senator, to be clear, to examine every alternative that would make the 2012 deadline. I have not left any alternative out. That includes some transportation. I would think that incineration in that part of Colorado, having lived in Colorado Springs and Denver for several years of my life, I look upon it as incineration may not be very good, but the scrubbers are getting better. They are not cheap. So therefore neutralization looks like it might be an option, but I am waiting for the alternatives to come forward from the Army.

We have had, interestingly enough, some contractors show up on our doorstep that have different innovative production methods, mostly surrounding the continuation of neutralization. They mostly want to take advantage of the research that has gone on. That led me to try to say, okay, then let us release the neutral funding that would in fact allow for site preparation work for either construction if we pass the CDR for a slightly modified design than they had before——

Senator SALAZAR. Let me, if I may, interrupt you for a second, Secretary Wynne. Your response is part of what causes me grave concern. I know these are the concerns that are shared by my colleague from Colorado, Senator Allard. We know that you are not going to be transporting these chemical munitions offsite. Both Senator Allard and I would fight that. We have legislation that we have introduced simply to affirm what is already the state of existing law.

When we talk about limited taxpayer dollars that are available to get this job done, which we ought to try to get done by 2012, we ought not be studying windmills that have no ability, ultimately, to deal with the problem that we are facing here. These

chemical munitions are not going to be transported: one, because it is in violation of Federal law; and two, because of community concerns with respect to public safety.

So when we have your Department studying transportation as one of the alternatives, it seems to me a nonsensical approach to ultimately getting to the end result that we want.

Second, with respect to incineration, that was a bridge that it seems to me we crossed a long time ago with respect to the Pueblo Army Depot. That was looked at and the conclusion that everyone came to as a group of stakeholders working together on a common agenda was that we were not going to go down the path of incineration, but instead we were going to move forward with the water neutralization technology.

So I think it is that change from you and from your Department that creates huge concerns among the people of Colorado and Senator Allard and myself in terms of whether we are really moving forward with a good faith effort to stay on the agreements and the understandings that we have with the local community with respect to a water neutralization effort.

Mr. WYNNE. Well, sir, it is a fine balance between how we go through the treaty obligations that we have and meeting the needs of the community. The needs of the community may not reflect national interests. In fact, I would say that I feel like I owe you at this national level every alternative that I bring forward to meet the treaty, and then I leave it to you, sir, to determine whether or not that alternative is an acceptable one for meeting the treaty or whether or not we should just hold the treaty in abeyance and meet community needs over and above national interests. I do not know the answer, but I feel as a steward of the taxpayer dollars I owe it to you.

As to whether or not this is a hazardous material, we transport hazardous materials through our major cities all the time. If I were to do the transportation in the winter out of Pueblo, Colorado, it is the most stable, hardened chemical you could transport in the winter. In the summer I might have a different thought here.

So I feel like I need to at least look at that alternative, so I might bring to you the range of alternatives. This may not be the preference that I have, but in fact if it became 2008 or 2010 and I had only a small stockpile left and I could meet the alternative, I would probably come back to you and say, we can meet the treaty if you would allow me to do this. You may say, as you are today—and I will adhere to the law, as you so state—that, no, that is not going to ever change, so we will hold the treaty in abeyance. Sir, that would be your choice.

Senator SALAZAR. My time has expired and I have several other questions that I will ask you on the next round. But, let me just punctuate this point home to you. It makes from my point of view no sense whatsoever for you to be spending significant sums of money in studying alternatives that we know are now illegal under United States law. I will proceed with my other questions when we come back around to the next round.

Senator CORNYN. Thank you, Senator Salazar.

Gentlemen, this is probably a good question for Secretary Bolton, Secretary Wynne, and Dr. Klein. You alluded to, Secretary Wynne,

the requirement in the National Defense Authorization Act of last year for the Under Secretary of Defense for Acquisition, Technology, and Logistics and the Secretary of the Army, who is responsible for executing the chemical agents and munitions destruction program, to jointly prepare a strategic plan for future activities of the Chemical Demilitarization Program.

My question is that when we asked about that earlier what I heard from you, Secretary Wynne and Secretary Bolton, sounded like a fairly coherent plan going forward, but yet you said that you would not have that strategic plan as required by the National Defense Authorization Act (NDAA) ready until, I thought you said, June. Would you clarify that or tell me if I misunderstood you?

Mr. WYNNE. Yes, sir, I can. In asking the Army to look at alternatives, I felt like I owed them as well, because we know that one plant is completed, five are underway and seemingly proceeding reasonably well, although I mentioned Pine Bluff could use, if you will, incentives to additionally staff.

Newport, I am very worried about. I would like to see us accelerate the opening of that. I feel like that 4 percent of material may get underway. It looks pretty good to me right now, and I would like to have everything I can in place by the time, which is approximately May 6, to allow me to certify that under the Nunn-McCurdy statute it is within our management ability to contain the costs.

But I felt like, that having been said, the strategic approach to the ACWA is an important part of the strategic vision. But my strategic vision, if you will, or goal at the end of the day is to achieve or maximize the achievement of all chemical weapons destruction by 2012. That could be easily submitted on the back of an envelope, but that is not what you are looking for.

I have listened very well to what Senator Salazar has said, as well as Senator Allard either personally in his office or here today, and I understand the constraints which we are operating under. I would only offer that these are the kinds of constraints and environmental regulations that have us essentially to where Ambassador Mahley says we thought we could achieve this by 1994, but it is now 2005 and we have yet to break honest ground at either Pueblo or Blue Grass on a definable design.

Senator CORNYN. I hear what you are saying and again it makes a lot of sense. My concern is that, given the checkered history of this program, both in terms of costs and in terms of who is responsible for what, much of which it sounds like you have striven to try to remedy, I do not understand why it is that it is going to take until June to come up with a strategic plan that Congress said they wanted in the NDAA.

It strikes me that it is imperative to have that in writing and produced to Congress so we can all understand. As you see, we are struggling to understand, and we can hopefully be of assistance to you and, if necessary, we will be actively encouraging you to accomplish that plan. But we need to have that in writing and, as you said, language on the back of an envelope will not suffice. We need something that is comprehensive, something so that everybody understands who is responsible for what and when, particularly given the history of this program.

Let me ask, Ambassador Mahley, in your view is there adequate coordination between the Departments of State and Defense to ensure that the Chemical Demilitarization Program is in sync with the U.S. treaty obligations and diplomatic strategy at the OPCW? Let me ask you also to consider when you answer that, what role does the National Security Council (NSC) play in ensuring coordination and resolution of any problems? Finally, do you have any suggestions for improving coordination in this area?

Ambassador MAHLEY. Thank you, Senator, for the question. Let me answer the first part of it, do I believe we are in synchronization. I think the answer to that is yes. The DOD continues to inform the Department of State and the NSC through the interagency process of what the state of play is with respect to the Chemical Demilitarization Program. We coordinate a number of briefings that we give to the OPCW on a regular basis to update them in terms of their proposal both to meet the 45-percent deadline and eventually to meet the 100-percent deadline.

Now, we have not briefed the 100-percent deadline at this point because we have just achieved the extension for the 45-percent deadline and we are now moving to meet that. We will be briefing on our prospects for the 100-percent deadline in 2006, which is just next year, when we go to The Hague to do this.

The National Security Council has devoted a number of resources to this and if I had any complaint about synchronization it would only be in the sense that, as you see the table in front of you here, you are probably looking at the United States officials who are most knowledgeable about this program. Getting the attention of some of the more senior members of the various branches of the executive branch is sometimes difficult. But that is our job and we undertake it on a regular basis.

So I think that I would not say there is anything that we would ask for intervention to try to increase that coordination. We are working on it. We have the Office of National Authority that works on it. So we are doing it in pretty good order.

Thank you.

Senator CORNYN. I would say, Ambassador Mahley, if you need any help getting the attention of the executive branch that we have four Senators, members of the subcommittee, the members of the full Armed Services Committee, and I think indeed the whole Senate that would be of assistance to you, if you will let us know whether you need that help or not. This is an important matter for all the reasons we have already discussed and as we all already know.

Senator Reed.

Senator REED. Thank you very much, Mr. Chairman.

Ambassador Mahley, first let me thank you for your very lucid opening statement and your response to questions.

Specifically, DOD decisions to cease investment in some of these facilities for the reasons that Secretary Wynne discussed, were those decisions reviewed by the NSC and confirmed by the National Security Council, or did DOD essentially make the decision by itself through its budget process?

Ambassador MAHLEY. Senator, I am hesitating just a little bit because I think that gets down to a question of what did you know

and when did you know it in the classic sense of that, and I am not——

Senator REED. Those are the best questions.

Ambassador MAHLEY. I am not real sure that I can answer that fulsomely for you. But let me express it this way. I do not recall that the DOD specifically briefed the interagency nor the NSC, although I am not in a position to answer that question authoritatively since they may know things that they do not share with me simply because of the press of business, if not for other national security reasons.

But I do not recall that we were specifically briefed about the acquisition memo before the acquisition memo itself was signed. I do recall, however, that DOD had indicated both the general state of play with respect to the Chemical Demilitarization Program and that we had had a number of interagency meetings, at which the NSC did indeed participate, about the various obstacles and problems that we were running into, both in terms of overall appropriations level and in terms of the technological barriers that are involved in that prior to the time that that acquisition memo was actually issued.

Senator REED. Thank you. Mr. Ambassador, just a final question. We are sitting here today and I do not think anyone is 100 percent confident that we are going to meet the deadline of 2012. If we do not and if we are unambiguously out of compliance with the CWC in 2012, would that be the first time that we have been out of compliance with an arms control treaty obligation?

Ambassador MAHLEY. It does not happen very often, which is why I am reviewing in my mind to see if I can think of any other examples in which that may have occurred. I think I would answer your question in the following way. There have been charges that the United States failed in compliance with arms control treaties at other times in the past.

There was an incident in 1994 when the Cuban Government accused us erroneously of having attacked them with biological weapons. There are various issues that the Russian Federation raises in almost every meeting of the implementation commissions with respect to the Strategic Arms Reduction Treaty and the Intermediate-Range Nuclear Forces Treaty in which they allege that, for very obscure but nonetheless very elaborate reasons, we are technically in noncompliance, all of which are rebuttable and which we have rebutted very strongly.

In my 25 years of working with the arms control arena, I do not recall any instance in which the United States has unambiguously been in noncompliance with our arms control obligations.

Senator REED. Thank you, Mr. Ambassador.

Secretary Wynne, we have heard about the tremendous challenges you are facing and I think it bears repeating that you have made substantial progress, all of you gentlemen, in dealing with a very difficult issue. I can recall when there was great difficulty in even thinking about starting some of the incineration in Anniston and Pine Bluff and we moved through that.

But I think what we have heard today is the need to develop alternatives that are compliant with the law as it exists today, not simply saying we can do 15 different things. We need to know the

cost of that. That I think is something that would be very useful for us.

In that vein, though, do you think there are other issues and items that would be appropriate to put in the authorization bill or to consider that would give you the flexibility of management or different tools that you could use effectively?

Mr. WYNNE. Well, first of all, Senator Reed, thank you very much for the opportunity to respond to that. Not yet have I given up on the extension of the treaty through 2012. In fact, what I did was I made every move to try to achieve the 45-percent deadline so that we could reserve to ourselves the methods and means of achieving the 2012 deadline and, if you will, offer our colleagues in the State Department the maximum opportunity for a positive briefing when it comes to The Hague in 2006.

Your second point, as to whether or not I should offer alternatives, is really very dependent upon the will of the people and the will of the Nation to either achieve the 2012 treaty obligation and/or comply with statutes that they themselves have put into place. Right now, as you say, we are constrained from implementing any other alternative but onsite destruction. I am hoping that in this go-round—as I mentioned, the contractors have already brought forward to me some other different innovative approaches relative to how you do things, lessons learned that we have even gotten now from the construction site at Newport, Indiana, from the way we did things at Aberdeen Proving Ground, that may in fact inform this process to allow us to do some incentivization.

I also think that the contractors need different kinds of incentivization. As I mentioned, they may have to give bonuses so that they achieve a full three-shift operation at Pine Bluff, which they do not have yet the ability to do. I think we should incentivize schedule when we finally have a decent cost.

I will note that the great struggle with every road construction department is finding out how to best incentivize contractors to achieve the road construction in minimum time. I think we can find those things as well.

I am pleased to be able to say that this experience that we have had with the contractors has already benefited us, in the sense that when the increase came as it did at Pueblo and I went to inform Senator Allard that, with all of the things going on in acquisition, I had to send in the Inspector General, I am pleased that he found that it was nothing more than essentially an interpretation of the contract on both sides than anything that could be ascribed any differently, and that the costs were in fact rationalized at both the $1.5 billion level and then at the $2.6 billion level, frankly, that we began to see the search for alternatives.

So that having been said, the experience we have gained maintained, if you will, the cost control that we had in place at Blue Grass and I think will ultimately reflect itself in the new design that we are bringing forward at Pueblo. But that is yet to be determined and I frankly have not seen the details of that proposal.

Senator REED. Thank you, Mr. Secretary.

Mr. Secretary, it seems that there is an assumption here that this program is just too expensive even to in any way restructure it, and either implicitly or explicitly we are saying that we will not

meet the treaty timelines because it is just too expensive. Some of the expenses you alluded to are because of technology, some are because of the proper incentivization of the contract. Some are because of constraints our law places upon the techniques that you can use.

But, I think we need to make that decision, whether this is too expensive. I think as a result I would urge once again that an alternative has to be developed and costed, if that is the right word, with the view of making the obligations by 2012 and delivering your best advice to us about how much that will cost. Then we can make decisions about whether or not that is the appropriate path.

Mr. WYNNE. Right, and all the options that were presented to me basically said that no amount of cost thrown at this problem will in fact guarantee us to meet the treaty. In fact, the more you spend the more uncertain it becomes that you will make the treaty obligation because you do not have enough people, you do not have enough product, you do not have enough outcomes.

Sir, I worry about making sure that it is a safe manner for destruction at the same time, because when you only incentivize schedule many times quality suffers. If quality suffers, safety cannot be far behind. So, I do worry very dramatically about that balance because the farthest thing from my mind would be ever to set either a community or a worker at any risk trying to achieve something that was nigh onto impossible, if you will, when we set them out to do it.

So that having been said, I fully recognize that we owe you a full set of alternatives and not just constrained alternatives to try to figure out how to best, if you will, manage this process that has been set in motion.

Senator REED. Thank you, Mr. Secretary.

Thank you, Mr. Chairman.

Senator CORNYN. Senator Allard.

Senator ALLARD. Mr. Chairman, thank you.

You expressed your concern about the cost of the project, Secretary Wynne. Are you concerned that these additional studies may do nothing more than just add to the cost of the project?

Mr. WYNNE. Actually, sir, the additional studies have in fact informed the process much better. There has been nothing that would stop, for example, the achievement of a CDR at Blue Grass. There has been no challenge to the design. We have still not had a CDR and we are still a greenfield site there.

Here at Pueblo, I think we have also been informed on the production site. Many times, sir, having lost sight of the objective, to redouble your efforts is just not the right answer. Sitting back and asking hard questions many times can save you schedule, can save you costs.

Senator ALLARD. You say, well, maybe because of technological changes. I will bet you there will be new technologies introduced in the next 10 years in this area. So when do we say let us move ahead with the project and quit studying new technology? It seems to me that at some point in time we have to draw the line and move forward with what we have in order to comply with the treaty, and I think this new technology argument can be extended out almost in perpetuity.

We have already had three studies on the Pueblo site, and finally the 104th Congress said no more that year, which I think expressed the will of the people. So when is the Department of the Army going to move forward with the will of the people and start getting going with this project?

Mr. WYNNE. I have asked the Army to come back to me within the third fiscal quarter, which is about the middle of June, with alternatives that are a balance of cost, schedule, and effective safety to maximize our opportunity to meet the treaty obligation.

Senator ALLARD. Now, Mr. Secretary, I understand the program manager has most of the funding he needs to carry over funds to conduct design and preparatory construction at Pueblo and Blue Grass during fiscal year 2006. However, I note that DOD's current budget for Pueblo and Blue Grass provides only $30 million for these sites in fiscal year 2007. This number is woefully inadequate. I do not think anybody can argue with that.

If the Department plans to move forward on these projects, is there going to be inadequate funding? Does DOD plan to provide sufficient funding for construction and final design work for the ACWA sites in its fiscal year 2007 budget?

Mr. WYNNE. Sir, to Senator Reed's point, I think we owe you the full measure of alternatives that would maximize the opportunity to achieve the site, and I think at that point the 2007 budget would be reevaluated.

Senator ALLARD. Will DOD attempt to keep Pueblo and Blue Grass in caretaker status for the next 5 years, as was briefed to me 2 months ago?

Mr. WYNNE. Sir, I think the answer is the same as I just gave. As a result of the studies, I think I am ready to sit down with the program manager. If he has a viable plan that will maximize our opportunity to meet the 2012 schedule, I am willing to support him on it.

Senator ALLARD. Secretary Wynne, many in Colorado believe that the dramatic cost overruns at operational incineration sites have led the Department to take money from Pueblo and Blue Grass to pay for these costs. I was skeptical until I obtained a copy of a DOD memo dated July 14, 2003, that suggests using funding for Pueblo and Blue Grass as "bill payers," to pay for other costs in the Chemical Demilitarization Program.

One estimate has the entire Chemical Demilitarization Program costing over $37 billion and completed by 2030. Why is the Department neglecting Pueblo and Blue Grass in favor of operational incineration sites?

Mr. WYNNE. Senator Allard, I probably would have allowed the program to continue as it was until the costs went from $1.5 billion to $2.6 billion, which is when it really hit my radar screen and I tried to take positive action to try to determine what alternatives were available to the Department to make the 2012 site. Before that, I did not take much else into account.

Senator ALLARD. Do you have similar concerns about the overruns in the incineration sites?

Mr. WYNNE. I do.

Senator ALLARD. Why are you not studying them like Pueblo and Blue Grass?

Mr. WYNNE. They are for the most part underway, operating, have met their regulatory requirements, and are not, if you will, greenfield sites, as are Blue Grass and Pueblo.

Senator ALLARD. Why has the Department refused to increase its budget request for the Chemical Demilitarization Program to cover the cost of the overruns both at the other sites as well as Pueblo and Blue Grass?

Mr. WYNNE. With all the roll-forward money that has gone unspent from 2003 and 2004, there was really no need to, in the 2006 budget, take a look in that direction. There is plenty of money available to complete the design and start the construction well through 2006. As you point out, and I think we have to meet the intent here, we have to take a look at what it means for us in 2007. I think, sir, that is the time that your question has a lot of relevance.

Senator ALLARD. How much money are we rolling forward? How much is in that that is unspent?

Mr. WYNNE. I think it is over $450 million right now.

Senator ALLARD. $450 million?

Mr. WYNNE. Yes, sir.

Senator ALLARD. Those are funds that are sitting there that are unobligated at this point in time, is that correct?

Mr. WYNNE. Yes, sir.

Senator ALLARD. What share of those are for Blue Grass and Pueblo?

Mr. WYNNE. I do not have that answer, sir.

Senator ALLARD. I am thinking somewhere around $300 million, if that is correct. Do you have any reason to dispute that?

Mr. WYNNE. I do not know the answer.

Senator ALLARD. I would ask that perhaps maybe you can get a chance to check that.

Mr. WYNNE. Yes, I sure can, absolutely.

Senator ALLARD. I would appreciate that very much.

[The information referred to follows:]

As of February 28, 2005, $267.6 million in Assembled Chemical Weapons Alternatives funds are available and not disbursed.

Mr. Chairman, to wrap this up, I want to thank you for your time and consideration. You have been most tolerant while Senator Salazar and myself pursue this. Senator Mitch McConnell is also very interested in what is happening here. I would also like to thank Senator Reed, who I have worked with on many issues before in the past.

This is an important issue for our country. I think it is an important policy issue. It is certainly not only important to Colorado, but I think the whole country. We have new technology here and we have to hold somebody accountable for moving forward at some point in time. So I do have to share with you a concern at the lack of moving forward. Frankly, when we get negotiating with our counterparts in other countries I do not think they can say that we are really moving ahead expeditiously when I see how much taxpayer dollars we seem to be spending here and do not seem to be showing much result. I am sort of disappointed in the program as a whole.

But I would also again extend my thanks to you, Mr. Chairman, and also the chairman of the full committee, Senator Warner, in working with both Senator Salazar and myself, and it has been a pleasure working with my colleague from Colorado on this important issue.

Thank you.

Senator CORNYN. Thank you, Senator Allard.

Senator Salazar.

Senator SALAZAR. Thank you, Senator Cornyn.

Let me follow up on a question from Senator Allard if I may, Secretary Wynne. My understanding is that for this fiscal year what you have requested is $40 million for the water neutralization efforts at the Pueblo chemical depot, but within the ACWA funding stream that there are about $400 million that have already been appropriated and are unexecuted, whether that is $350 million or $400 million, whatever that amount may be.

My question to you is, what assurance do we have that that money will continue to be set aside to be used for Blue Grass and for the Pueblo Army Depot, as opposed to being filtered off into other DOD projects under your jurisdiction?

Mr. WYNNE. One of the things that I did, sir, was create three program element codes, which between them would require some reprogramming amongst them. We tried to split out the funding. I will have to get you the actual look, but by doing that it actually helps you to focus in on what is associated with the ACWA, what is associated with Newport, and what is associated with the CMA program. I think I will try to get you what the laydown was, if you will, looking backwards, because once the program element codes are struck and approved, which they have already been submitted to you, there are some restrictions on just blatantly transferring money.

Senator SALAZAR. If you can get that information to me, Mr. Secretary, I would appreciate it very much.

Mr. WYNNE. I would be happy to.

[The information referred to follows:]

For fiscal year 2006 the funding for the Chemical Materials Agency (CMA) is $1,203.5 million, $143.0 million for CMA Newport, and $33.0 million allocated for Assembled Chemical Weapons Alternatives in the President's budget.

Senator SALAZAR. Let me ask one more question and then I will have one closing comment. With respect to the timeline for completing the work at the Pueblo Army Depot we would all hope that somehow we are going to be able to figure out a way of getting this done by 2012 because that is what we are required to do under our international obligations. But, based on the information that we have gleaned from the DOD, it seems that perhaps you are looking more like a 2020 timeline and that for right now at least you have Pueblo and Blue Grass both in their greenfield status. I know you are working on getting a more established timeline back from your personnel by the end of June.

Am I misreading the timeline here at all that there are some people saying that it may be 2020 before we actually start the construction effort in Pueblo?

Mr. WYNNE. One of the things I am hoping to do with the release of the site preparation funds is to actually do some site preparation

in parallel to the actual down-select and obligation of a construction contract, to try to speed things up. So I think actually, Senator, we should not allow, if you will, the nay-sayers to push us so far on schedule that we even start to accept a 2020 date.

I am hoping that by the time we get to 2010 we will know pretty precisely what needs to be done in order to either meet our deadline and/or take another decision. That is kind of my goal. I spoke briefly with Ambassador Mahley and he indicated that we need to be very close to the end to have a cogent story for anybody relative to exceeding the treaty deadline. Sir, the most cogent story I know of is to be completed.

Senator SALAZAR. I think because the timeline is so important for us and you will have new information in June, I would request, Secretary Wynne, a meeting with you and Dr. Klein and whoever else needs to be a part of that meeting at the end of June, and I would request that that meeting be with Senator Allard and myself as well as other members of the Colorado congressional delegation, Representative Hefly and Representative John Salazar, who are very interested as well in what happens with respect to the Pueblo Army Depot. So if you will agree to have that meeting with us, I think it would be a very important one to have. I will work on trying to get that scheduled.

Let me just make a closing comment here. For me, as a Senator from Colorado, when I look at these 780,000 munitions at the Pueblo Army Depot I think it is important that we have a definite timeline in which we are moving forward. Our questions to you are hard questions and they have been hard questions, and I do appreciate the work that you and your colleagues have done in trying to clean up the chemical weapons arsenal that we had in this country. There has been significant progress made. There is still a lot more progress to be made.

When I see the remnants of what we have there at the Pueblo Army Depot, essentially with nothing having happened on the ground since we have been working on this issue, in the context of the world that we are in today I believe that it still presents a huge target for terrorism in our country and therefore it is a matter of national security that we move forward in as effective a way as we possibly can to make sure that we are taking care of the mustard gas there at the Pueblo Army Depot.

Second, it creates huge community and public safety concerns for both Colorado Springs and the Pueblo communities. You know there are huge populations there.

Third, I do think that Ambassador Mahley's comment about the importance of us as a Nation being able to speak with a sense of moral authority requires us to make sure that we are doing everything to fulfill our international obligations, and certainly the April 2012 deadline that we have under the CWC is something that I know you are very concerned about and something that we as a Nation are all very concerned about.

Let me thank you for your very candid responses here today, and I very much look forward to our continuing work together.

Chairman Cornyn and Ranking Member Reed, I appreciate very much your leadership in this subcommittee and also for indulging

both Senator Allard and myself with the opportunity to ask questions today. Thank you very much.

Senator CORNYN. Thank you for joining us, Senator Salazar.

Secretary Wynne, before we adjourn, you have alluded to something you think we might be able to do to be of assistance to you at the chemical weapons destruction facility at Newport, Indiana. I believe you indicated there is a 30-day notice provision.

Mr. WYNNE. Yes, sir.

Senator CORNYN. But you are standing by, paying the bills for people to go to work even though they are unable to go to work, until you receive some sort of response from Congress.

Mr. WYNNE. I think a 30-day expiration, sir, or you can tell us that the notice has been sufficient and we may go forward.

Senator CORNYN. We will certainly work with the staff, Chairman Warner, and Ranking Member Levin to try to give you a quick response, because if there is some way we can expedite that and get that facility up and running and save the taxpayers some money in the process, I am all for it.

Mr. WYNNE. We would appreciate that, sir.

Senator CORNYN. Well, thank you very much.

We will keep the record open for let us say a week. That ought to be enough time for members if they have additional questions they would like to submit in writing, and we would appreciate your prompt response to those. But, we will leave that open until, let us say, the close of business 1 week from today to submit to you.

Thank you again for your participation and your service to our country and for answering I know some tough questions about a very important issue.

This hearing is adjourned.

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR JACK REED

CHEMICAL WEAPONS CONVENTION COMPLIANCE

1. Senator REED. Dr. Klein, in your capacity as the Assistant to the Secretary of Defense for Nuclear, Chemical, and Biological matters, you represent the policy component of the Department of Defense (DOD). Can you tell the committee if the DOD is committed to ensuring that the United States meets all its obligations under the Chemical Weapons Convention (CWC), including the obligation to destroy all our chemical weapons by the deadline established in the treaty?

Dr. KLEIN. The Department is committed to the safe, secure, cost effective, and timely destruction of all U.S. chemical weapons. The Department is currently analyzing alternatives that will maximize the opportunity to meet the extended 100 percent CWC destruction deadline.

2. Senator REED. Dr. Klein, is that commitment dependent on a cost limit, or is the Department committed to ensuring U.S. compliance with the CWC's obligations even if doing so costs more than suggested by a cost estimate from 2002?

Dr. KLEIN. The Department has not established an absolute cost limit for the Chemical Demilitarization Program. However, the Department is taking steps to make sure the program balances cost, schedule, and performance objectives while at the same time, maximizing the opportunity to meet the CWC extended 100-percent destruction deadline.

COST CONSTRAINTS

3. Senator REED. Secretary Wynne, the decision to restructure the chemical demilitarization program, and to move funding from the Assembled Chemical Weapons Alternative (ACWA) program to the operating sites, was made for cost reasons. I

believe all the operating facilities have cost more than their initial estimates. If it is not possible to build, operate, and close the two ACWA sites for the previously estimated cost, does that mean the United States will not meet its treaty obligations under the CWC?

Mr. WYNNE. No, the Department is currently analyzing alternatives that are safe, secure, timely, and cost-effective, which will maximize the opportunity to meet the extended 100-percent CWC destruction deadline. Our objective is to select one or a combination of these alternatives that will enable the U.S. to destroy the chemical weapons at Pueblo, Colorado and Blue Grass, Kentucky, within the cost estimates originally certified to Congress.

4. Senator REED. Secretary Wynne, would the Department be willing to spend more than the previous estimate, if necessary, to ensure our compliance with the CWC?

Mr. WYNNE. The Department will provide the necessary resources to maximize the opportunity to meet the extended 100-percent CWC destruction deadline in a safe, secure, timely, and cost-effective manner.

NEW PLAN FOR COMPLIANCE

5. Senator REED. Secretary Wynne, your testimony was that implementing your new plan "will provide the United States with a safe, secure, timely, and cost-effective program to meet both the intent and the literal interpretation of its international obligation under the Chemical Weapons Convention, with some assistance from this committee if required." Exactly how would your plan permit the United States to meet its treaty deadline, and exactly what kind of assistance you are considering from this committee?

Mr. WYNNE. The Department is currently analyzing alternatives that will maximize the opportunity to meet the extended 100-percent CWC destruction deadline. The Department has not yet identified specific assistance that would be required but in general the Department will be requesting assistance from local and state officials with application of environmental regulations and issuing of permits. An example of this would be off-site disposal of uncontaminated dunage and secondary waste.

"CERTIFIED" COST ESTIMATES

6. Senator REED. Secretary Wynne, your prepared statement indicates that the Pueblo and Blue Grass project decisions in 2002 and 2003 established life cycle costs for each site. You say the Pueblo life cycle cost estimates were "certified" to Congress in January 2003. Many DOD programs experience cost growth, and the Department often requests increased funding to accommodate these increases. Are you suggesting that no DOD programs are permitted to cost more than such "certified" estimates?

Mr. WYNNE. No, the Department is not suggesting that no program can exceed "certified" estimates. However, the recent estimate for the design of the Pueblo, Colorado, project had increased by approximately $1 billion, an unacceptably high level. Therefore, I felt it was necessary, while the Pueblo and Blue Grass, Kentucky, programs were still in their design phases, to determine whether there are alternatives that will destroy these chemical weapons stockpiles in a safe, secure, timely, and cost-effective manner.

7. Senator REED. Secretary Wynne, why are the ACWA cost estimates being treated as a cost cap, when there is no legislative cost cap imposed on the program?

Mr. WYNNE. The ACWA Program costs estimates are not being treated as a cost cap. However, the Department is required to manage the cost of this program in the same manner required of managing costs of all Major Defense Acquisition Programs.

COST ESTIMATES AND ACWA

8. Senator REED. Secretary Wynne, you have indicated a serious concern with the increasing cost estimates for the chemical demilitarization program, which could be $37 billion or higher. What percentage and amount of that overall cost estimate is directly attributable to the Chemical Materials Agency sites, and how much directly to the two ACWA sites?

Mr. WYNNE. On April 8, 2005, the Department submitted the December 2004 Selected Acquisition Reports (SARs) to Congress for the Chemical Demilitarization (Chem Demil)-Chemical Materials Agency (CMA) Program, the Chem Demil-CMA Newport Program, and the Chem Demil-ACWA Program. Based on the program funding summary for each program SAR, the total life-cycle cost estimate (LCCE) for the entire Chemical Demilitarization Program is $32.703 billion. For the Chem Demil-CMA and the Chem Demil-CMA Newport programs, the LCCE is $27.815 billion, which is approximately 85 percent of the entire program LCCE. For the Chem Demil-ACWA, the LCCE is $4.888 billion, which is approximately 15 percent of the entire program LCCE. These cost percentages are consistent with the stockpile percentages of 90 percent and 10 percent, respectively.

POSSIBLE NEWPORT FUNDING TERMINATION

9. Senator REED. Secretary Wynne, the DOD recently sent a notification that it intends to begin neutralization of bulk chemical agent at Newport, Indiana, within 30 days. Your statement included a reference to the possibility that you would have to cease funding for Newport, depending on the Environmental Protection Agency's concerns about the post-neutralization waste treatment. Can you explain why this might happen, and what steps the Department has taken to avoid a requirement to stop the funding for Newport?

Mr. WYNNE. If the Environmental Protection Agency decides the Newport facility's waste should not be disposed at the DuPont facility in Deepwater, New Jersey, the current cost estimate of operating the Newport facility would require re-evaluation based on other treatment and disposal methods. If revised estimates are determined to exceed the approved Acquisition Program Baseline by 25 percent or more, then the Under Secretary of Defense (Acquisition, Technology, and Logistics) will have to make certifications to Congress pursuant to Section 2433, Title 10, U.S. Code. If the Under Secretary is unable to make timely certifications to Congress, statutory limitations on obligating funds for that program will be triggered.

ESTIMATE OF LIKELY CWC NONCOMPLIANCE

10. Senator REED. Secretary Wynne, you have stated that you were presented with options that indicated that on the previous path we would not be able to meet our CWC extended destruction deadline. Please explain the basis for the analysis of each option that reached that conclusion.

Mr. WYNNE. The Department conducted a standard program review of the Chemical Demilitarization Program. This type of review is used for all defense acquisition programs. The results of the program review revealed significant increases in the life cycle cost estimate. This prompted the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD(AT&L)) to convene a Defense Acquisition Board in November 2004 to further analyze the program. Each mission area under the Chemical Demilitarization Program, which includes the U.S. Army Chemical Materials Agency and the ACWA Program, was instructed to provide path forward options that were within fiscal guidance and fiscally unconstrained. The Department Cost Analysis and Improvement Group (CAIG) had conducted a risk analysis of both cost and schedule, and had accorded high risk to all options presented with regard to meeting the Chemical Weapons Convention extended 100 percent destruction deadline. Consequently, the USD(AT&L) directed the program manager to analyze all alternatives that would destroy the chemical weapons in a safe, secure, timely, and cost-effective manner, while maximizing the opportunity to meet the Chemical Weapons Convention extended 100 percent destruction deadline.

11. Senator REED. Secretary Wynne, did you share those results with the State Department, the National Security Council, the Office of Management and Budget, or any other agencies before finalizing the fiscal year 2006 budget request for chemical demilitarization?

Mr. WYNNE. Yes. The Department of Defense briefed the Office of Management and Budget, State Department, and National Security Council prior to the fiscal year 2006 President's budget submission on the current path of the Chemical Demilitarization Program and discussed the issues related to noncompliance with our international treaty obligations. The Office of Management and Budget staff also attended the Department's meetings that reviewed the options presented during the budget and program review process.

CONSULTATION PRIOR TO BUDGET DECISION

12. Senator REED. Secretary Wynne, your decision to reduce funding for Pueblo and Blue Grass, and to delay construction until 2011 at those two sites, seems to have the effect of ensuring that the U.S. will not meet its CWC destruction deadline. Did the Department consult fully with all relevant agencies of the executive branch before making such a budget decision, making clear the likely effect on our ability to meet our treaty obligations?

Mr. WYNNE. Yes. The Department's discussions with the relevant agencies of the executive branch included the development of alternatives to maximize our opportunity to achieve the extended 45-percent CWC destruction milestone of December 2007, as well as the extended 100-percent CWC destruction deadline of April 2012.

13. Senator REED. Ambassador Mahley, was the State Department fully consulted before a budget decision was made on reducing funding for Pueblo and Blue Grass?

Ambassador MAHLEY. DOD regularly consults with us on the progress of the chemical weapons destruction program and the implications for U.S. ability to meet its obligations under the Chemical Weapons Convention. In general, DOD does not consult State on specific acquisition decisions with respect to the destruction program. Therefore, State was not consulted about the acquisition decision on funding for Pueblo and Blue Grass.

[Whereupon, at 3:54 p.m., the subcommittee adjourned.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEAR 2006

FRIDAY, APRIL 22, 2005

U.S. SENATE,
SUBCOMMITTEE ON EMERGING THREATS
AND CAPABILITIES,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

U.S. SPECIAL OPERATIONS COMMAND

The subcommittee met, pursuant to notice, at 9:37 a.m. in room SR–222, Russell Senate Office Building, Senator John Cornyn (chairman of the subcommittee) presiding.

Committee members present: Senators Cornyn and Reed.

Majority staff members present: Charles W. Alsup, professional staff member; Elaine A. McCusker, professional staff member; and Lynn F. Rusten, professional staff member.

Minority staff members present: Evelyn N. Farkas, professional staff member; Richard W. Fieldhouse, professional staff member; and Arun A. Seraphin, professional staff member.

Staff assistants present: Alison E. Brill and Nicholas W. West.

Committee members' assistants present: Russell J. Thomasson, assistant to Senator Cornyn; Elizabeth King, assistant to Senator Reed; and William K. Sutey, assistant to Senator Bill Nelson.

OPENING STATEMENT OF SENATOR JOHN CORNYN, CHAIRMAN

Senator CORNYN. Good morning. I am going to convene this meeting of the Emerging Threats and Capabilities Subcommittee to receive testimony on the roles and missions of the U.S. Special Operations Command (SOCOM) in review of President Bush's defense budget request for fiscal year 2006 and for the Future Years Defense Program.

Senator Reed and I would like to welcome our distinguished witnesses: Assistant Secretary of Defense for Special Operations and Low Intensity Conflict, Thomas W. O'Connell; and Commander of USSOCOM, General Doug Brown, U.S. Army. Welcome to both of you. We appreciate your service.

Clearly, the events of September 11 have forever changed our sense of security and the manner in which we organize and equip our Armed Forces to defend our Nation and the threats of the 21st century. Four years ago, SOCOM was principally focused on sup-

porting regional combatant commanders with Special Operations Forces (SOF) and was heavily engaged in regional security cooperation initiatives. Today SOCOM has much expanded responsibilities and is a key player in the global war on terror, with forces deployed on operational missions at the four corners of the globe.

Such complex organizational changes are not accomplished without hard work, a little trial and error, and dedicated leaders such as those we have before us today. A principal purpose of this hearing is to hear your reports on the progress that you are making in reorienting SOCOM to combat terrorism abroad and the challenges ahead in meeting the many and complex responsibilities associated with special operations, low intensity conflict, high tempo of operations (OPTEMPO), and future threats.

As we meet this morning, thousands of our special operators are engaged in military operations at home and abroad in the ongoing global war on terror. These brave men and women and their families deserve our continued support and they will get it. The subcommittee's commitment is to ensure that these troops remain the best equipped, best trained, best led, and most capable SOF in the world. In doing so, we must understand the challenges they face today and those they will face tomorrow. The insights of our witnesses today are an indispensable part of this process.

We have a number of important issues to discuss with our witnesses this morning. Secretary O'Connell and General Brown, SOF have been at the forefront of our military operations. The operational demands on SOCOM have been very high. The ability of SOCOM to sustain this high OPTEMPO is of great importance. The subcommittee wants to ensure that you have the people, the capabilities, and the resources to accomplish your many missions and prepare for the future. We look forward to your assessment.

While much attention has been focused on operations in Iraq and Afghanistan, we cannot lose sight of other challenges facing SOCOM. The Horn of Africa and other areas in sub-Saharan Africa, Latin America, and Southeast Asia are unsettled and potential havens for terrorists. Narcotrafficking and terrorism in the Andean Ridge and Central Asia are on the rise. The demand for U.S. SOF to respond to short-notice contingencies, conduct extended combat operations, and help train the Armed Forces of allied nations has never been higher. The subcommittee looks forward to your views on these issues as well.

As you prepare SOCOM to undertake expanded responsibilities, prudent steps are required to ensure the success of potential operations. The operational preparation of the environment concept is one such step. While I am supportive of the concept in principle, it has produced some concern that we want to explore today. We would like to receive an update from both our witnesses on the resolution of these concerns by other agencies about the program.

SOCOM has enjoyed great success in identifying emerging operational needs of its deployed teams and rapidly developing and fielding new capabilities for SOF. Major acquisitions programs, however, like the Advanced Sea/Air/Land (SEAL) Delivery System (ASDS) have proven to be more challenging. I had the chance, as General Brown and I discussed when he visited with me in my office recently, to visit the operational ASDS site last month and was

much impressed by the capability of the system and certainly the enthusiasm of the SEAL operators. But I am concerned, as I expressed then and I will repeat now, by the schedule slippage and the cost growth of the program. We look forward to General Brown's assessment of this program and the steps he has taken to improve oversight and management of this important program.

Our witnesses today represent the men and women of SOCOM, who quietly fight terrorism on distant battlefields, defending our homeland from threats of the 21st century. We applaud and honor their service and again thank our witnesses for their service and their presence before the subcommittee today.

I will now turn the floor over to Senator Reed, the ranking member.

STATEMENT OF SENATOR JACK REED

Senator REED. Thank you very much, Mr. Chairman, and let me join you in welcoming Assistant Secretary Tom O'Connell, who is not only a distinguished Army veteran, but a distinguished Rhode Islander. Thank you, Tom, and General Doug Brown, who leads with great distinction SOCOM, and also Command Chief Master Sergeant Bob Martens. A lot of our most capable special operators are senior noncommissioned officers and their role is absolutely critical to the military, and we thank you and your colleagues for your service.

We have called this hearing so that we can become better informed about how the SOCOM is organizing, training, and equipping to conduct its statutory missions, as well as to execute its new role leading the Department's global war on terrorism efforts. I do not need to go down the list of special operations achievements for our witnesses, my colleagues, and our observers. It has been an extraordinarily effective force in the last several years, as it has been throughout our history, and we thank you for the valor, the courage, and skill of the people that you lead, General Brown and Secretary O'Connell.

As General Brown outlined in his prepared testimony, the command has established a new Joint Interagency Operations and Intelligence Center to allow it to better execute its counterterrorism mission. The command is also increasing its manpower in critical areas, such as civil affairs (CA) and psychological operations (PSYOP), and it is working with the Marine Corps to increase cooperation and perhaps paving the way for the creation of a Marine Corps component for SOCOM.

The Major Force Program 11 (MFP–11) acquisition authority and the rapid procurement process provided by combat mission needs statements from the field continue to serve the immediate needs of the special operators. Nonetheless, the OPTEMPO remains the highest in the history of the SOF.

In addition, SOF operations are predominantly focused in and around Iraq and Afghanistan. Indeed, starting next fiscal year, for the first time in 6 years we will not have any SOF training the military in Colombia. So I wonder whether we are increasing the right categories of SOF by the right amount. Understanding that it takes time to create special operators, the time to start is now,

and the question I have for the witnesses is whether the capacity the command has planned to build will meet future requirements.

Also, many of the current special operations assignments are direct action missions and they are being conducted at the cost of the critical foreign training missions that serve the long-term war against terrorism and other U.S. national security objectives by providing SOF with familiarity and access. SOCOM has had to turn down a higher percentage of State Department requests for joint and combined training exercises since 2003 than it had even in the 2 previous years. These missions are critical in the long-term war against terrorism and other U.S. national security objectives. I would like to know what plans the Department of Defense (DOD) or command has to ensure that the special operations involvement in such training missions does not continue to decrease substantially.

I would also like to hear about any dedicated long-term futures planning within the command, noting that the budget request contains many legacy items. How do the DOD and SOCOM see the future and how is the command posturing research and development and procurement activities to meet future challenges? Is there a SOCOM transformation plan, in essence?

Finally, SOCOM's execution of its war on terrorism mission has led to concern about the nature of its operations, with some press accounts pointing to increased clandestine efforts that blur the lines between operational and intelligence functions. I would like to hear more about what SOF are doing and how these efforts differ from intelligence activities.

Let me conclude as I began, by commending you, General Brown, Secretary O'Connell, and the extraordinary soldiers, airmen, sailors, and marines that you lead. Thank you very much.

General BROWN. Thank you.

Senator CORNYN. Secretary O'Connell, we would be pleased to hear your opening statement and then we will turn to General Brown.

STATEMENT OF HON. THOMAS W. O'CONNELL, ASSISTANT SECRETARY OF DEFENSE FOR SPECIAL OPERATIONS AND LOW INTENSITY CONFLICT

Mr. O'CONNELL. Thank you, Mr. Chairman and Senator Reed. Thank you for the opportunity to appear before the subcommittee and comment on the status and progress of our Nation's SOF. Thank you both for your opening statements and we will endeavor to either get you the answers to your questions or provide them for the record.

With your permission, sir, I will keep my opening statement short. I have submitted a lengthier statement for the record.

Sir, the nature of the SOCOM is vastly different from just a few short years ago. Not only are they at war, they are playing a pivotal and crucial role, and in almost every aspect of the global war on terrorism they are playing a leading role. Whether participating in the direct action missions against the most vicious and dangerous of our adversaries, conducting CA missions designed to build the peace as well as infrastructure, conducting effective PSYOP activities in support of conventional troops, flying dan-

gerous heliborne and fixed-wing insertions in some of the most inhospitable terrain in the world, attacking Taliban formations and remnants in Afghanistan with our Ranger forces, or training foreign SOF all over the world to build foreign capacity, and in the case of the Green Berets of the Seventh Special Forces Group helping the Government and Armed Forces of Colombia overcome the scourge of narcoterrorists, the men and women of the United States SOCOM deserve a great deal of credit and praise, none more so than perhaps two of their leaders that have been acknowledged here today: General Doug Brown and Chief Master Sergeant Bob Martens.

Leadership is an intangible. Experience, integrity, vision, and savvy are the hallmarks of great leaders. Two of them for the SOCOM sit before you today.

A few months ago, sir, I had the opportunity to visit our SEAL Command in Coronado, California, the Naval Special Warfare Command. I came away both humbled and awed. Their contributions to the global war on terrorism and our Nation's defense have been nothing short of remarkable. That is a common thread among our SOF. Rangers, CA, PSYOP, Green Beret, Army Special Operations, Aviation Forces, Air Force Special Tactics Teams, our great Air Force Special Operations Command aviators—flying AC–130 gunships, Combat Talons, Pave Low helicopters, our pararescue personnel, and weathermen—Navy SEALs, and Special Boat Units, all contribute daily under the umbrella of "quiet professionals."

I cannot give enough credit to General Brown. He is the right man at the right time at the right place to lead our SOF. Let me also recognize the great SOF wives, led by Doug's wife Penny Brown. They have set the standard for family support and fostering a compassionate, caring environment among the SOF ranks.

One of the SOF truths, humans are more important than hardware, has been particularly evident in SOCOM's efforts to equip the man, rather than man the equipment. Their efforts to press the envelope with systems such as the CV–22 and the ASDS, which Senator Cornyn just mentioned, reflect this paradigm.

General Brown and his subordinate SOCOM staff and component commanders have worked tirelessly to develop a force structure that can optimize leading edge technology. I believe General Brown has carefully crafted a coherent plan for future growth of SOF. His plan is to increase SOF personnel by about 2,300 over the next 4 years, to include increases in both Special Forces and SEALs, reflecting an understanding of current needs as well as recruiting and training base limitations.

The support of this subcommittee, the full committee of the whole, and the entire Congress has been essential to the success of our SOF elements. General Brown will discuss the key to success in four words—joint, combined, coalition, and interagency—and I echo his evaluation.

Secretary Rumsfeld has charged his DOD leadership with developing forces that can meet the demands of our national military strategy as well as meeting the parameters of the Quadrennial Defense Review and other elements of guidance. I am confident that as these deliberations proceed we will determine that our SOF are

uniquely positioned to meet the challenges of the global war on terrorism.

As we look forward to the future challenges we face, we must recognize the tremendous support that members and staff of this subcommittee have provided. We welcome your critical inquiries. We welcome your counsel.

Sir, this position provides me with the opportunity and deep honor to interact with America's finest. It is indeed a humbling experience. With your support, we can do great things, and I welcome your questions. Thank you, sir.

[The prepared statement of Mr. O'Connell follows:]

PREPARED STATEMENT BY HON. THOMAS W. O'CONNELL

Mr. Chairman, and members of the subcommittee, I thank you for the opportunity to testify about special operations and the global war on terrorism, as well as those aspects of our current Special Operations Forces (SOF) posture that contribute significantly to our national capabilities to confront our adversaries.

I exercise civilian oversight of special operations activities of the Department of Defense (DOD). I attempt to ensure that SOF are appropriately employed and that senior policymakers understand their capabilities as well as their limitations. Not only am I an advocate and a defender of the U.S. Special Operations Command (SOCOM) and SOF, I am also dedicated to ensuring our SOF continues to be the best trained, best equipped, most flexible, and most effective fighting force available to our country. Representatives from the Office of Special Operations and Low-Intensity Conflict (SOLIC) spend a significant amount of time at SOCOM headquarters to assist with developing the SOF program and budget. I participate in the SOCOM Board of Director's meetings, the Command's executive resource body. This effort produces a SOF program and budget that stresses force readiness and sustainability, provides sufficient force structure to meet the demands of the geographic combatant commanders and the Commander, USSOCOM in his role as a supported commander in the global war on terrorism. I'd like to recognize my Director of Resources, Tim Morgan, whose work on Major Force Program-11 (MFP–11) issues has been superb.

We sponsor the Combating Terror Technology Support Program, through which I maintain executive direction and proponency along with the Department of State for the Technical Support Working Group (TSWG), which addresses the Nation's interagency combating terrorism requirements. We will continue to serve the technology needs of the warfighter in addressing the emerging threats. As Secretary Rumsfeld stated repeatedly, to address any of a myriad of threats we shall be facing, it will be necessary to shorten the decision cycle for force definition, equipping, and deployment. The Quadrennial Defense Review's recently published Terms of Reference is a reflection of that philosophy. Through its numerous requirements-driven successes and by continuing to reflect partnered cooperation across its subgroups and among Federal agencies, the Combating Terror Technology Support Program has shown it can meet that expectation. We also continue to seek solutions from many allies and coalition partners. On that point, we have achieved numerous successes. The Deputy Secretary of Defense has been instrumental in leading an Improvised Explosive Device Integrated Process Team. Under the executive leadership of the Army, we have been able to apply SOF/SOLIC assistance to the fight against the leading killer of U.S. forces in Iraq.

The United States is at a critical moment in the war on terrorism. We have realized initial successes and achieved a degree of momentum that together support a general assessment that we are making progress in winning this war. But sustaining that momentum and continuing the successes against terrorists and their supporters now and into the future is just as critical. We must ride the crest of successes of the Afghan and Iraqi elections to a new level of democratic processes in the region.

For the past 3 years, we have examined how the attacks of September 11 have changed how we define "defense," and how, as a consequence, the war on terrorism is fundamentally a different type of war than any we've fought before. We used to respond to the threat of global terrorism in terms of transnational criminal activity. While SOF were certainly a part of the equation, the SOF posture 4 years ago is one we would hardly recognize today.

Indeed, that is true of the entire military and the entire concept of national defense. Four years ago, we were geared to defend against a state projecting force across great distances, and we built extensive capabilities to provide us early warning and tools to deter aggression. But the potential destructiveness of an attack of the type we suffered on September 11 means that we are no longer afforded an opportunity to determine an "appropriate response," nor make a clear determination of when decisive action is too little or too late. For reasons we all understand, SOF have become a critical military tool in taking the war to the terrorists before it can be fought on our own soil or that of our allies. MFP–11 has been instrumental in allowing SOCOM to chart a steady path toward matching changing requirements against available resources.

I repeat my assessment of last year: SOF are uniquely qualified for that mission. Because of those qualifications and the demands of the war on terrorism, the SOCOM has been structuring and shaping SOF in different ways. While SOF were originally conceived to be used as forces for supporting or leveraging larger conventional forces in battle, or for undertaking discrete, limited strategic missions, the new reality has given SOF a prominent, front-line, essential role in the defense of our Nation. This change was the impetus for the shift of SOCOM from not only a supporting command but also a supported combatant command in the global war on terror. Our current Unified Command Plan reflects a paradigm shift in strategic thought.

This means SOF will continue to support regional commanders, while also at times being supported by other combatant commands. SOF are still the first in and last out in many contingency operations around the globe. SOF must be ready to act at any time, in all environments, overtly or clandestinely; alone or in concert with U.S. and foreign forces. General Brown's creation of the Center for Special Operations will pay significant dividends as we move forward to operating with the new National Counterterrorism Center.

Before I discuss further what has changed and what our new national security imperatives require of SOF, I want to note explicitly that one of the most important factors and essential considerations for us has not changed: the importance of the special operator. In terms of missions performed and in the qualities of the individuals who undertake those missions, the special operator is truly unique and requires a different type of mindset on our end in terms of planning and support. Our starting point has always been and must continue to be what we call the "SOF Truths," which are essentially statements of the fundamentals: "Quality is better than quantity. Special Operations Forces cannot be mass produced. Competent Special Operations Forces cannot be created after a crisis occurs. Humans are more important than hardware." General Brown and his subordinate commanders have made sure that these truths have not been eroded.

These truths have been reaffirmed by the superb performance of our SOF in Afghanistan, Iraq, Colombia, the Philippines, and many other countries around the world. I am keenly aware of how very much the dedication and commitment of our special operations professionals are appreciated by every member of the political leadership. I would like to cite the work of Under Secretaries Dr. David Chu and Ms. Tina Jonas. They fully supported the initiatives of SOCOM to address retention issues by fostering bonuses that will help with retention of key special operators at critical career decision points.

General Brown's testimony will reflect the importance we at both the DOD and SOCOM attach to a Joint, Combined, Coalition, and Interagency working environment. Perhaps more so than any other combatant command, SOCOM has led the way in breaking bureaucratic barriers and fostering interagency cooperation, particularly with the Central Intelligence Agency. I echo his comments.

About a year ago, I had the high honor of visiting some of our SOF in Iraq. These forces make us proud—and should cause potential adversaries to pause before seeking to harm the United States. The commitment of SOF to pursuing terrorists to all corners of the globe is embedded in their mindset. The experience gained in defeating the Taliban and disrupting al Qaeda in Afghanistan, destroying the brutal regime in Iraq, and aiding friends and partners in other corners of the globe, such as Colombia and the Philippines, has matured our warfighters to a keen edge. Our challenge is to maintain that edge, and it will require careful assistance from policymakers.

I also saw that the nature and importance of the new demands on SOF are apparent to the operators in the field, and they are clearly doing more with the additional manpower, funding, and materiel you've given them to meet the new challenges to our national security. This level of support is required to meet the challenges of the war on terrorism. The change from a regional, reactive posture to a global, proactive posture could not be achieved nor sustained with the levels of funding, materiel, and

forces that we had before September 11. I believe General Brown has charted a steady course of growth for the foreseeable future.

The fiscal year 2006 President's budget submission for SOCOM is $6.7 billion, an increase of a modest 3 percent. This funding request will continue the modernization and transformation effort started in fiscal year 2004. It will enable SOCOM to: 1) transform SOF capabilities to better locate and track individual terrorists across the globe and conduct small surgical operations with minimal risk to the employed force; 2) maintain sustained operations in areas where terrorist networks are operating; 3) continue to invest in critical "low-density/high-demand" aviation assets that provide SOF with the mobility necessary to deploy quickly and to execute their missions quickly; 4) continue to invest in key command, control, and communications infrastructure; and 5) support the personnel USSOCOM has added to continue worldwide deployments and 24-hour-a-day operations, particularly in the Center for Special Operations and the Theater Special Operations Commands.

This increase is essential to sustaining the necessary operations and to ensuring we can meet the Secretary's transformation requirements. We are grateful for Congress' continued interest and support in sustaining the necessary funding for the mission. I would also like to thank this committee and Congress for enacting special authorities (section 1208 of the National Defense Authorization Act for Fiscal Year 2005) that will permit our SOF to recruit and train surrogate forces in areas that offer exceptional opportunities for success in the global war on terrorism. In addition, thank you for your support on the supplemental that will go to conference shortly.

I would like to conclude by highlighting the implications the posture, programming, and policy for SOF in the war on terrorism have for all aspects of our Nation's defense. SOF have always been the innovators for the larger military, and the SOF mindset has been the incubator of innovation. That is especially true today. With the shift from SOF being postured for reactive, regional contingencies to being a global, proactive, and preemptive force, we are witnessing a key process of evolution in SOF that may also signal a need for additional necessary changes in our larger military. Our new Unified Command Plan reflects this evolution. As a key innovative force, SOF's direction can be a critical tool to inspire the evolution of the larger military and support the transformation of our national defense as a whole in coming years. As a Nation, we must identify and address those "ungoverned spaces", and build capacity to deal with those who would harm our country. Most of all, we must realize that we are not in a "battle of ideas," we are in a "test of wills."

Finally, a personal note: Whenever possible, I endeavor to attend funerals of SOF personnel at Arlington National Cemetery. It is indeed a high honor to represent the DOD. When I look into the eyes of widows, children, parents, and other relatives of our fallen heroes, I understand that there is no "quit" in their demeanor. We must honor their service and sacrifice. They are an inspiration to all who witness their courage and spirit. Your support is critical to the success of our SOF. I thank you for your careful scrutiny of our program and budget. Together, we can help move our SOF into a position of prominence that will continue to press the fight against America's enemies. Thank you. I welcome your questions.

Senator CORNYN. Thank you very much, Secretary O'Connell. General Brown, we will be glad to hear from you.

STATEMENT OF GEN BRYAN D. BROWN, USA, COMMANDER, U.S. SPECIAL OPERATIONS COMMAND

General BROWN. Mr. Chairman, Senator Reed: It is an honor to appear before the subcommittee today to report on our SOF. It is a privilege to be here with the Assistant Secretary of Defense for Special Operations and Low Intensity Conflict. I enjoy a tremendous working relationship with Mr. O'Connell as we aggressively fight the global war on terrorism.

The threat we face today in the global war on terrorism is an adversary without borders or boundaries, using asymmetrical methods to attack our vulnerabilities. Defeating this enemy requires the full range of our Nation's capabilities. SOF are uniquely trained and equipped to support our Nation and our coalition's efforts. Operating in this complex environment is what SOF do best.

After September 11, SOCOM's role changed from being traditionally a force provider to being the DOD lead for the global war on terrorism. Our new mission includes planning, synchronizing, and executing direct combat missions against terrorist organizations around the world and executing those missions as a supported commander when directed. Concurrently, we continue to provide our critical role of force provider to all our SOF and supporting commands to the geographic combatant commanders.

In addition to being a small, flexible, joint force, SOF have specialized skills, equipment, and tactics. We are regionally focused, politically and culturally sensitive, and many of us possess language skills.

We are working closely with the geographic combatant commanders to determine in which areas SOF should focus to achieve maximum effects. Our highly skilled direct action capability has resulted in the capture or killing of terrorists as we defend this Nation far forward, specifically in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF).

However, our capabilities are much more important than just direct action. Through careful engagement, SOCOM is also accomplishing our core task of foreign internal defense to help countries become more capable, our CA operations to eliminate the root causes of terrorism, and our PSYOPs to communicate the truth to those who would be deciding whether or not to join al Qaeda or other terrorist organizations.

As I mentioned earlier, we are a small force, but to meet the challenges of the global war on terrorism we are increasing our special operations manpower. We are adding force structure in SOF, CA, PSYOPs, our Air Force and our Army Special Operations Aviation Forces, and Navy Special Warfare. We are also providing additional staff to our theater special operations commands in the geographic combatant commanders' areas of responsibility (AORs).

In the next 4 years we will increase our numbers by over 2,300 personnel. That includes two additional SEAL team equivalents and approximately 500 Special Forces. In order to create more special operators, we have aggressively increased the number of training instructors and support personnel to enable us to increase our training capacity without lowering the standards. Additionally, with the help of the Service, the Office of the Secretary of Defense (OSD), and Congress, we have instituted retention initiatives that include targeted bonuses for specific operational specialties that are showing a decrease in strength and educational benefits for members of our command.

The key to SOCOM's success is our well-trained, well-equipped, highly capable special operators. Our number one SOF truth is that humans are more important than hardware. As such, our number one resource priority is our SOF warrior. We are emphasizing training, education, and equipment systems that will ensure our SOF warriors have the technical and tactical skill, regional expertise, language proficiency, and specialized equipment necessary to win this war.

In support of our SOF warriors, our title 10 acquisition authority is absolutely critical in enabling SOCOM to rapidly respond to battlefield requirements. Through our Special Operations Acquisition

Executive and Acquisition Center, we are able to quickly team operators and acquisition authorities to evaluate requirements, procure the right equipment, and respond rapidly across the spectrum of our operations. This is a pearl at SOCOM and it is a key enabler to the speed required to be capable of performing our missions.

SOCOM is the right command for the mission. However, we understand we are only part of the equation. The nature of this war and the challenges it poses require a robust, interdependent working relationship with the DOD and interagencies, to fully harness our Nation's instruments of power in this fight.

This is a long-term conflict and it is worldwide. It does not end with al Qaeda. There are multiple terrorist groups operating in several countries whose leadership, membership, and modes of operation will continue to change as the strategic environment changes. When we eliminate a seam, they will search for another. The enemy is patient, tenacious, and dedicated in this fight and we must be the same. SOCOM is preparing for the long term.

This Sunday marks the 25th anniversary of Operation Eagle Claw, the mission that resulted in Congress creating SOCOM. I want to thank you and the Members of Congress that created us in 1987 and continue to give us incredible support as we work together with our interagency and our coalition partners to secure our Nation and our global allies. The support of this subcommittee and the support of the Secretary of Defense help ensure SOF will become even more capable in the future.

I am ready for your questions, sir.

[The prepared statement of General Brown follows:]

PREPARED STATEMENT BY GEN BRYAN D. BROWN, USA

Mr. Chairman and distinguished members of the subcommittee, it is an honor and privilege to report to you on the state of the United States Special Operations Command (SOCOM). Today's United States Special Operations Forces (SOF) are the most capable in the world. They have performed magnificently on the battlefields of Iraq and Afghanistan, and in their support of geographic combatant commander activities around the world.

The Secretary of Defense expanded SOCOM's role in 2003 to include leading the Department of Defenses' (DOD) global war on terrorism planning effort, and commanding specifically designated global war on terrorism operations. In this role as the lead command for the global war on terrorism, SOCOM has matured into a warfighting command that is leading the planning and synchronization of DOD activities in support of the global war on terrorism. Today at SOCOM, our priorities are the global war on terrorism, the readiness of our forces, and building SOF's future capabilities to be even more capable to meet the demands of the changing strategic environment.

STRATEGIC ENVIRONMENT

Terrorist networks are globally dispersed and compartmentalized into remote, smaller networks or groups that limit direct access to their leadership, communications, and infrastructure. They recognize no borders and no boundaries, use the local populace for plain-sight concealment, and employ terror, torture, and indiscriminate killing as standard tactics, techniques, and procedures. Without respect for international law, they adapt their methods and conduct operations that incorporate technology across the spectrum from low tech to high tech. This creates a significant challenge for SOCOM and directs the Command along three lines. First, as the supported Commander, SOCOM must synchronize DOD efforts, coordinate and collaborate in interdepartmental and interagency efforts, facilitate the flow of information and intelligence, and foster cooperation with partner nations to shape the global war on terrorism. This will require the elimination of seams and sanctuaries. Second, SOCOM must focus SOF on the global war on terrorism by increasing emphasis on organizing, training, and equipping the force to accomplish our

main effort of attacking terrorist networks and enabling partner nations to do so in concert with us. We will provide assistance to other government agencies in our effort to persuade or coerce nation states that support terrorist networks, diminish the underlying conditions that cause terrorism, and counter core motivations that result in terrorist networks. Finally, we must continue to flawlessly integrate with conventional forces in traditional warfare.

SOCOM CENTER FOR SPECIAL OPERATIONS

When SOCOM was established by Congress in 1987, its primary role was to support the geographic combatant commanders by providing them with trained and equipped special operations personnel. Now SOCOM's focus has been rebalanced to emphasize the global war on terrorism—we are at war. The Center for Special Operations (CSO), a directorate within SOCOM headquarters, was created to optimize SOCOM's warfighting efforts, by breaking down traditional barriers that exist between plans, operations, and intelligence functions. By consolidating these efforts under a single director, SOCOM has improved its speed, agility, and flexibility—keys to success in today's global environment. The CSO has embedded interagency liaison teams that streamline interagency coordination, communication, and processes, further enhancing operations, intelligence and planning fusion. The CSO is in effect SOCOM's Joint Interagency Coordination Group. Responsibilities in the CSO include reviewing global strategies, developing courses of action, and formulating plans and recommendations for operational force employment by the Commander, SOCOM.

A dynamic component of the CSO is our Special Operations Joint Interagency Collaboration Center (SOJICC). A state of the art facility fusing operations and intelligence, the SOJICC integrates DOD and interagency information and databases to exploit the full potential of this information to support special operations planning and course of action development. SOJICC was developed in response to operational priorities and has been used extensively in supporting unique special operations requirements in Operation Enduring Freedom (OEF) and Operational Iraqi Freedom (OIF) and developing short turn-around products in support of SOF in all of the combatant commands.

GLOBAL WAR ON TERRORISM

Success in Operations

SOCOM's number one priority is the global war on terrorism. Defeating the terrorist threat requires the full range of Special Operations capabilities. SOCOM's special operators, carefully selected, highly trained, and well equipped, continue to be "the worst nightmare of America's worst enemies" as President Bush stated in June 2004. Employing the tactics, techniques and procedures most appropriate to a given situation, our forces act across the spectrum of operations from Civil Affairs (CA), to Unconventional Warfare (UW), to Direct Action.

Our interagency, conventional, and coalition relationships have never been stronger than in today's global operations. This joint, coalition, interagency team has brought freedom to millions in Afghanistan and Iraq. Yet plenty of work remains to defeat the insurgents that continue a violent struggle against democracy. SOF, deployed in support of the geographic combatant commanders, have been involved in every phase of this global effort. As we transition to the post-election environment in both Afghanistan and Iraq, joint, combined, and interagency efforts will be more critical than ever to win the peace, as we continue on the path to a more stable and secure world.

Iraq

SOF operations, in support of United States Central Command (CENTCOM), remain focused on defeating anti-coalition militia elements and denying them freedom of movement and action throughout Central and Northern Iraq. SOF have been very successful at finding, fixing, and finishing the enemy, and one of the keys to our success has been the ability to fuse intelligence with operations resulting in actions that not only capture or kill the enemy, but also generate additional information for further operations.

In close coordination with Iraqi and Coalition Forces, U.S. SOF played a critical role in virtually every major operation in Iraq during 2004, particularly the defeat of the insurgent offensives in April and August, the liberation of Fallujah in November, and coalition victories in Najaf, Samarra, and Ramadi. In these and other operations, SOF conducted numerous offensive actions resulting in a significant number of detainees. In addition to their combat effectiveness, SOF personnel have shown extraordinary maturity, cultural awareness, and good judgment. SOF, in coordina-

tion with conventional forces, continue to execute an aggressive offensive strategy against terrorists, but do so in a way to minimize the negative impact on Iraqi citizens.

A very visible and successful Special Operation Foreign Internal Defense mission has been our work with Iraqi security forces. Trained by Green Berets, the 36th Commando Battalion and the Iraqi Counterterrorism Battalion are now capable of providing ongoing security against insurgents. I have visited both units. They have fought valiantly in such difficult cities as Fallujah, Najaf, and Samarra alongside U.S. Special Forces. They are good, and are getting better.

Applying lessons learned from earlier successes against the Taliban in Afghanistan, SOF ground forces in Iraq have worked closely with conventional airpower to eliminate terrorists. SOF aviation has also been highly effective, destroying a large number of enemy targets with minimal collateral damage and providing rapid responses to time-sensitive information. SOF have rescued hostages and assisted local law enforcement agencies in capturing terrorists who murdered western hostages. In the waters of the Persian Gulf, SOF have conducted maritime interdiction operations to disrupt terrorist movement and operations. SOF are committed to helping the Iraqis, in support of CENTCOM's strategy, to establish a secure and peaceful future. SOF have played major roles alongside their conventional and coalition partners in supporting the road to Iraqi self-government and lasting security. Although much work remains, the very successful recent election is a striking example of the success of our efforts in global war on terrorism. The commander of the Multi-National Force in Iraq, GEN George W. Casey, Jr, described SOF achievements in Iraq as "Herculean."

Afghanistan

SOF continue to make vital contributions to the war on terrorism as well as stability operations. Major strategic events enabled by SOF include Afghanistan's first ever national election in October and the December inauguration of its first elected President. SOF operations focused on supporting these two historic events and were critical to these strategic victories. In precisely targeted offensive operations, SOF killed and captured hundreds of terrorists and insurgents. These operations have been crucial to securing cities near the critical area along the border with Pakistan and in former Taliban strongholds. SOF manned dozens of small camps in areas frequented by insurgents and terrorists, inhibiting enemy operations and enhancing the security of the Afghan population. The enemy has repeatedly attacked these small camps, but SOF, conventional, and Coalition Forces have defeated all enemy offensives and inflicted heavy enemy casualties.

Throughout Afghanistan, SOF conducted UW. A SOF core task, UW is operations conducted by, through, and with surrogate forces. The Services are using the term "Unconventional Warfare" frequently; however, accomplishing missions in a new or unconventional manner is not the same as UW. UW is a capability unique to SOF and will continue to be an important skill in future operations.

As in Iraq, major coalition goals included building up Afghan forces and having those forces conduct effective military operations, thereby increasing the legitimacy and popular support of the government. SOF emphasized combined operations, with the Afghan National Army taking the lead role throughout the country to accomplish these goals.

Coalition Forces, including SOF, assist in the counternarcotics effort in Afghanistan by reporting, confiscating, or destroying drugs and drug equipment encountered in the course of normal operations, sharing intelligence, and training Afghan security forces in these efforts. The adverse effect of the narcotics problem on Afghanistan's security, stability and society is significant and requires a multi-faceted and long term effort. The Afghan Government, aided by the international community, must work to create viable economic alternatives for growers and manufacturers.

Other Regions of the World

In addition to supporting the Commander, CENTCOM, SOF prosecuted global war on terrorism missions around the globe. In support of Commander, United States European Command, U.S. SOF joined our North Atlantic Treaty Organization SOF allies to form a response force in support of the 2004 Olympics in Athens, Greece, a high value potential target for international terrorists. This response force was fully integrated into the Olympic Games' security task force and helped ensure that terrorists did not disrupt the games.

SOF also worked with security forces from several African nations to enhance their counter-terrorist capabilities, conducting 2-month training periods with indigenous forces focused on logistics, communications, and weapons skills. The effort was

designed to eliminate sparsely-populated border regions as potential terrorist safe-havens before terrorists arrived in force. In the Balkans, CA, Psychological Operations (PSYOP) and other special operators supported operations in Bosnia, bolstering civil institutions to help maintain peace in that country.

In addition to short-term operations, SOF long-term activities help develop the strategic environment by contributing directly to deterrence efforts. U.S. SOF participated in over fifty Joint Combined Exercise Training events globally with host-nation forces. In the Pacific theater, SOF supported the Commander, United States Pacific Command (USPACOM) by providing assistance to allied nations seeking to stem narcoterrorism, as well as remove mines laid during four decades of regional conflicts. SOF continues to support OEF-Philippines, and during 2004, Joint Special Operations Task Force-Philippines deployed teams to provide operational planning and special skills training to Filipino Armed Forces personnel. U.S. SOF worked with Filipino military forces and other units throughout the country to prevent the disruption of national elections. Meanwhile, U.S. Navy SOF personnel worked with their counterparts to conduct expanded maritime interdiction operations around the archipelago. PSYOP soldiers sought to garner support of the local population.

The tsunami of December 2004 brought horrific destruction around the rim of the Indian Ocean, and SOF, in support of PACOM, responded immediately to provide humanitarian assistance to those struck by this devastating natural disaster. Through the use of specialized skills and equipment, SOF supported the U.S. and international relief efforts. SOF soldiers, airmen, and sailors provided their expertise in diverse areas such as airfield management, airlift, and delivering and distributing medical care and supplies in conjunction with the U.S. Air Force, Army, Navy, Marine Corps, and civilian organizations.

In South America, SOF efforts support the Commander, United States Southern Command through operations helping the Government of Colombia in its fight against terrorists, narcotics trafficking groups, and insurgents. SOF support included counter-narcoterrorist training deployments, training assistance to Colombian SOF, help with establishing a special operations command and control (C2) organization, longstanding CA and PSYOP activities and assistance fusing intelligence with operational planning. U.S. SOF also helped with the search for American citizens held hostage by terrorists. By the end of 2004, the Colombian military and police forces had made notable progress in the fight against narcoterrorists.

READINESS

Force readiness is a SOF priority and is crucial to mission success. SOCOM's number one readiness issue is our people, followed closely by our equipment and training.

People

SOCOM, while scheduled to grow in fiscal year 2005, remains less than 2 percent of our Nation's military force. Our operators are high-caliber professionals with intelligence, stamina, problem-solving skills, mental toughness, flexibility, determination, integrity, and extraordinary strength of character and will. Additionally, they are experts with their weapons, and many are language trained. Our small number of carefully selected, incredibly dedicated, capable, mature, well-trained, and well-led people are key to our quality force. However, we must have the total force—the correct mix of Active, Reserve, and National Guard personnel to meet the challenge. Last year I reported that SOF were deployed globally at the highest sustained operations tempo in their history. That is still true today, with over 6,100 special operators supporting the geographic combatant commanders.

To accomplish SOF missions, highly specialized skill sets are required, including cultural and regional awareness and expertise, and skill in employing both low and high-tech equipment and solutions. To achieve the required level of proficiency and guarantee SOF relevance, recruitment, training, accession and retention, development of the force must be closely managed. With the support of the Office of the Secretary of Defense and Congress, SOCOM was able to secure a comprehensive SOCOM retention package aimed at specific SOF operational specialists throughout their careers.

I believe our current operations tempo is manageable, but stressed in certain critical specialties—namely our SEALS, Special Forces, Air Force Special Operations Command Combat Controllers, Pararescuemen, and Special Operations Weather personnel. CA and PSYOP forces will be discussed shortly. SOCOM began our growth by investing in our schoolhouses through additional instructors to increase throughput for creating special operators while maintaining our standards. Coupled with retaining experienced SOF personnel, this will improve our capability to meet the demand on our force.

However, adding SOF is not a near-term fix, as SOF cannot be mass-produced, nor created after emergencies occur. Our recruiting is good, and our schools are full, but because of our rigorous selection and training process for SOF operators, it takes between 12 and 24 months, depending on specialty, to graduate an initially-qualified SOF operator. In fiscal year 2006, SOCOM will grow by 1,405 members to an end-strength of 52,846. We are adding personnel to our Active-Duty SEAL teams, increasing active Special Forces Group strength, and adding personnel at the 16th Special Operations Wing to support forward deployed and rotational requirements. We have also added one MH–47 aviation battalion based on the west coast and oriented towards the Pacific. With great support from the Secretary of Defense, we have significantly increased the authorized manning levels of SOF over the past 2 years, but areas of concern remain our PSYOP and CA forces.

Civil Affairs and Psychological Operations

CA and PSYOP were essential in facilitating the elections in both Afghanistan and Iraq and will continue to play critical roles in the stabilization and reconstruction of both countries. CA and PSYOP also had a vital role in combat operations and consolidation activities in Afghanistan and Iraq. Whether encouraging enemy fighters to surrender, directing civilians away from battle zones, or separating terrorists from their base of support, tactical PSYOP multiplied the effectiveness of combat operations and saved many lives.

Dissemination of truthful information to foreign audiences in support of U.S. policy and national objectives is a vital part of SOF's effort to secure peace. Culturally-oriented PSYOP units with selected language skills are supporting commanders and other U.S. Government agencies in operations ranging from humanitarian assistance to weapons collection. PSYOP forces have an aggressive program of providing handbills to children explaining the threat of unexploded ordinance and minefields. Additionally, through leaflets and broadcasts, PSYOP forces disseminate information to raise awareness about the Rewards for Justice Program. SOF then facilitate linking individuals possessing information with the appropriate agencies. PSYOP forces use nonviolent means in often violent environments to convince adversary, neutral, and friendly nations and forces to take action favorable to the U.S. and its allies. These forces, along with SOF CA units, are force multipliers. Three quarters of our PSYOP personnel are in our Reserve component.

CA forces are key to our long-term success in the global war on terrorism. CA specialists can quickly and systematically identify critical infrastructure requirements needed by local citizens. They can also locate civil resources to support military operations, help minimize civilian interference with operations, support national assistance activities, and establish and maintain liaison dialogue with civilian aid agencies, commercial and private organizations. CA forces are currently working with local governments of Iraq and Afghanistan and international humanitarian organizations to rebuild infrastructure and restore stability. They facilitate, plan, and coordinate repairing wells, providing food to hungry children, bringing medical care to families, and are hard at work helping rebuild school systems to counter radical thought through education. CA forces become advocates for their plans to synchronize indigenous populations and aggressively seek funding for regional projects. Over 90 percent of our CA personnel are in our Reserve component.

This level of effort, however, doesn't come without a price. While we believe people are more important than hardware and closely monitor our deployment schedules, Army Reserve CA and PSYOP units have been mobilized for up to 24 months under the partial mobilization authority. This in turn has made us more reliant on the few Active-Duty CA and PSYOP units to meet operational requirements. Future rotations for OIF/OEF will be constrained by the number of personnel in these specialties available. To improve these areas we have added four PSYOP companies (Reserve), two PSYOP companies (Active), two CA battalions (Reserve), and two CA companies (Active). While the use of Provisional Battalions created for the war effort is a concept we are exploring, compressed CA specialty training is not the best solution to this problem. We owe it to the geographic combatant commanders to send fully qualified CA and PSYOP personnel to the battlefield.

BUILDING FUTURE SPECIAL OPERATIONS FORCES

The command's main goal for the future is to identify and develop the capabilities SOF will need to remain the decisive piece of a joint, coalition, and interagency team while maintaining the readiness required to shape and respond to the world today. SOCOM is committed to producing next generation SOF capabilities that will provide competitive advantages over future adversaries. Future SOF will be positioned to respond rapidly to time sensitive targets in the global war on terrorism, provide strategic responsiveness as an early entry force, possess state of the art bat-

tlefield command, control, communications, computers, intelligence, surveillance, and reconnaissance (C^4ISR) and continue to increase cultural, regional, and linguistic expertise. SOF must construct systems and capabilities to have access around the world to locations of our choosing and have dominant C^4ISR.

Long-term success in the global war on terrorism depends largely upon our ability to rapidly employ a sustainable mix of capabilities with little warning—requiring agile, adaptive, and responsive warriors. We are transforming our force quickly to provide better on-the-ground capability to operate in the different "gray areas" around the world where conventional forces are traditionally uncomfortable. This will require a change in our thinking, not just our force structure. We continue to transform our headquarters to incorporate these changes. Our organization includes a standing Joint Task Force (JTF), capable of providing a spectrum of command and control options from providing a handful of liaison officers to an existing JTF to deploying a complete JTF. Moreover, SOCOM is organized for interagency transparency, a key element for success.

SOCOM is pursuing a holistic approach to our training, doctrine, organizational structure, and technology. We will blend the authorities, functions, and activities of a supported combatant command with our current Service-like authorities, functions, and activities necessary to develop, maintain, and enhance integrated joint SOF forces and capabilities. SOCOM will cut across current national, regional, and geographic boundaries by networking key counterterrorism and counterinsurgency command and control nodes to create a Global Counter Terrorist Network (GCTN) employing a tailored mix of assigned, attached, and supporting joint forces and capabilities.

Budget and Acquisition

The SOCOM fiscal year 2006 President's budget request is $6.7 billion, 3 percent more than the fiscal year 2005 appropriated amounts. This request includes military pay and allowances to ensure that now, and in the future, the President, the Secretary of Defense, SOCOM, the combatant commanders, and country teams have SOF capable of defeating terrorist organizations worldwide. Our Operations and Maintenance budget request grows $85 million, to $2.2 billion, which also includes a $22 million increase for training, as well as funds associated with sustaining SOF-specific weapons systems. Quick action on SOCOM's Fiscal Year 2005 Supplemental Request is the issue on which I need immediate support.

At the heart of SOCOM's strength is the commander's acquisition authority, which is similar to that of the Military Departments. It is one of the things that makes SOCOM special and makes our operators more capable, more quickly. Among the responsibilities assigned to SOCOM under Title 10, Section 167, is developing and acquiring "special operations-peculiar" equipment. SOF-peculiar equipment is based on technologies that enable our operators to become faster, stealthier, more precise, lethal, survivable, and sustainable. It will also enable PSYOPs forces to broadcast themes into denied areas, and provide CA specialists with SOF specific training and communications equipment. With exceptional support from Congress, the Secretary of Defense, the Services, and our industry partners, these authorities have been instrumental in equipping today's world-class SOF team to perform a broad range of SOF missions. We are aggressively eliminating those systems that do not support the global war on terrorism and directing those resources for more appropriate programs. Our Flagship Programs, the Advanced Seal Delivery System and the CV–22 Osprey continue to be a very important part of SOF's future. We will add, in the near future, two new flagship programs, our SOF Warrior Systems and our SOF training centers.

Our research and development (R&D) activities are focusing on discovering and exploiting technologies in the following areas:

Intelligence

SOCOM's primary concern remains actionable tactical intelligence. The "find" piece of find, fix, and finish is an intelligence based problem set. In other words, we have to find out who the bad guys are, where they are, and have the right forces in the right place at the right time to capture them. SOCOM is working to harness capabilities, like signals intelligence, imagery intelligence, and unattended sensors that channel the proper intelligence information to our analysts and operators so we can capture terrorists regardless of where they are on the globe. This persistent intelligence, surveillance, and reconnaisance (ISR) concept is a combination of continuous analysis, human intelligence, and SOF focused ISR systems that will dwell on a target for as long as the mission requires—the unblinking eye. We have made progress aggressively pursuing unmanned aerial vehicles, persistent intelligence systems and denied area access technology. We must continue to improve these ca-

pabilities, especially our ability to find and track targets in all weather conditions. SOCOM's number one technological shortfall is in our ability to persistently and remotely locate, track, and target a human.

A Global Network

SOF-led collaboration and synchronization across command lines will play a dramatically larger role. SOCOM will use the GCTN to position SOF around the world, in synchronized, simultaneous, and custom-tailored operations against designated terrorist organizations, their allies and sponsors. The GCTN will synchronize global ISR to gain persistent close-in visibility, coordinate interagency and capable partner nation efforts, and integrate command and control. These operations will be coordinated by SOCOM and geographic combatant commanders through their Theater Special Operations Commands which will serve as the focal points for joint SOF missions conducted within their regions. Key to this effort will be high bandwidth and reachback communications.

Additionally, SOF must facilitate the development of indigenous capabilities to fight against terrorists and rogue regimes. Robust UW capabilities greatly expand the set of options available to policy makers. SOF must also maintain and improve capabilities to support conventional forces. The concept of a GCTN is designed to position SOF in key locations to collect, fuse, analyze, and disseminate intelligence. Developing greater situational awareness in priority countries and regions will enhance SOF effectiveness in combating terrorist networks.

Develop the Special Operations Warrior

SOF can anticipate continued global employment in the near future. They will have to operate simultaneously in more than one geographic combatant commander's area of responsibility against elements of the same global enemy to eliminate seams and be responsive. For SOF the challenge is immense: how to train for the enormous and demanding range of functional skills necessary to meet SOCOM's core tasks while adapting intellectually to the global demands of this war against an enemy who holds no territory. SOCOM will meet these requirements through continued adaptation and growth of our education and training capabilities, to include advanced training systems. Additionally, in a globally networked operating environment, SOF must be survivable, sustainable, lethal, maneuverable, and possess superior situational awareness. These are SOCOM's R&D focus areas to support the SOF warrior.

CONCLUSION

The struggle against global terrorism is different from any other war in our history. We will not triumph solely or even primarily through military might. We must fight terrorist networks and their supporters using every instrument of national power of the United States. Progress will come through the persistent accumulation of successes—some seen, some unseen. Our goal will be reached when Americans and other civilized people around the world can lead their lives free of fear from terrorist attacks.

SOF will continue to play a lead role in this war by bringing terrorists, their supporters, and their state facilitators to justice, or by bringing justice to them. But winning this war will require new capabilities, sustainable increases in capacity, and significant improvements in the global reach and speed of SOF forces. To meet the demands of the new environment, we must ensure that our capabilities are well-tuned to meet emerging needs. U.S. special operators have been the cornerstone of our military operations since the beginning of the global war on terrorism. From Tampa to Tikrit to Toibalawe all of SOCOM is in high gear, a tempo we expect to maintain for a long time.

Our efforts will remain focused on our mission. Our success will come from the finest trained and prepared warriors in the world who are in the right place at the right time against the right adversary. SOF play a key role in America's and the world's defeat of terrorism. In an environment of asymmetric threats, we are this Nation's asymmetric force. With energy, focus, skill, and determination, we will take the fight to the enemy and win. Your continued support of our soldiers, sailors, airmen, marines, and DOD civilians is the foundation of our success.

Senator CORNYN. Thank you, General Brown and Secretary O'Connell. Your written statements will be made part of the record, without objection. We thank you for summarizing those for us.

We are going to go to a closed session by no later than 10:45 in order to probe a little further in that classified setting. I would just

ask you as we pose questions to you in the open setting, if there are areas that you think are appropriately addressed or perhaps in greater detail in the closed setting, if you will just advise us and we will follow up later in closed setting.

Mr. O'CONNELL. Yes, sir.

General BROWN. Yes, sir.

Senator CORNYN. Thank you very much.

General Brown, in 2003 the Secretary of Defense designated you as the lead combatant commander for the global war on terrorism and increased your responsibility to plan and conduct operations under circumstances as a supported combatant commander. Could you summarize what changes you have made in SOCOM's organization to enable you to plan, conduct, and sustain such operations?

General BROWN. Yes, sir, Mr. Chairman. First of all, at the staff level, we were organized into centers. We are not organized in line and block diagrams like traditional military organizations are. We were oriented on train, organize, and equip, which was basically our function. We did very few other types of missions. We reorganized the staff immediately and we built a Center for Special Operations, and I am happy to say that we have been approved for an additional three-star general who is going through confirmation right now that, when approved, will command our Center for Special Operations.

It is about a 450-man staff. We did that with very little plus-up in our headquarters, but that is our operational center and it combines our plans, operations, and intelligence into one integrated operation at Tampa, Florida. They will soon, in November of this year, move into a new building.

That was a huge reorganization challenge for us. We did it without appreciable growth. But we also did it by adding over 100 partners from other agencies that now work down at SOCOM headquarters to help us take on this mission. So I will still have a deputy, who will be a three-star, and that is Admiral Eric Olson, and then we will have another three-star that will run simply this synchronization of the global war on terror, and he will run the Center for Special Operations.

If you would have gone down to visit us about 3 years ago, you would have seen a command center that basically answered the phone and directed phone calls. Today we have a full-up operations center. It is online 24 hours a day monitoring situations around the world. Additionally, we have built a Special Operations Joint Interagency Collaboration Center, which is a very powerful capability, in our intelligence center. So we have stood up the ability to actually command and control.

One last thing real quick that we have done is we have stood up a Joint Task Force (JTF). We have a deployable capability. Should we be called on to do a major supported commander-type mission, we can deploy this JTF. For the first time in SOCOM's headquarters, last week it was deployed to the field at Avon Park, Florida, set up and operated for 5 to 7 days out of tents with deployable equipment, and it did very well on an exercise operating with two of the geographic combatant commanders supporting our exercise.

Those are just some of the organizational changes that we have made down there, Mr. Chairman.

Senator CORNYN. General Brown, to the extent you can discuss this in open session, under what circumstances would this authority that has been conferred on you as a supported combatant commander be used?

General BROWN. The first circumstance is that we do have a current requirement for synchronizing the global war on terrorism. So we are doing that portion of the planning and ensuring that the seams between the geographic combatant commanders and other combatant commanders are covered, and that we are lashing all of those plans together and making sure that the DOD has one integrated plan to go forward. So we are actually operating at that level right now.

Additionally, should there become a requirement for us to be a supported commander, I believe it would be a very specific, SOF-unique mission where we could go in and assist the geographic combatant commander. It may be one that is at the seam of two or three geographic commanders' areas and, just to keep the coordination requirement to a minimum, we would just put us in charge of it and it would be directed against the global war on terrorism.

Senator CORNYN. Thank you.

I would like to hear both of you comment on this question, and then I will turn the floor over to Senator Reed. The concept of Operational Preparation of the Environment (OPE) was developed to better enable SOCOM to be prepared to execute operations against terrorist targets if and when actionable intelligence becomes available. Several newspaper articles in December 2004 and early 2005 suggested that the DOD program was not well received by other government departments.

In general terms, please describe the purpose of the OPE program, and please describe what steps you have taken to reassure other government departments about the intent of this program and to improve coordination.

Mr. O'CONNELL. Thank you, Senator Cornyn. OPE is a term that evolved from two terms that were used previously, and perhaps we or the Department did not pick the best choice of words when it came to describing the activities of the teams, particularly to other members of the interagency.

We have always had in special operations—and I can go back to as early as 1980, when we had elements called regional survey teams that were out operating in embassies, and their attempt was to look at the types of threats that Americans might face, let us say, in a Guatemala, to survey the embassy, to look at routes to the airport for potential evacuation, areas of weakness in protecting ambassadors, how to best coordinate with the security forces and the embassy security forces in a particular embassy. Even back then, the concept of a regional survey team was not well understood.

When September 11 took place, the Department, I think, very quickly assessed the fact that they did not know where the next attack might come. As the rest of the government reacted by standing up certain activities, the U.S. SOCOM and the Department looked at areas where they felt that increased military cooperation, particularly of a SOF-type nature, might be required. I will not mention the specific areas. We can in closed session.

But the first two names we used were "operational preparation of the battlefield" and "pre-crisis activities," which tried to describe what teams might do on the ground. One of the first concerns was a head-scratch from, let us say, some people in the State Department saying: What battlefield or what crisis? As we were planning ahead, we did not necessarily say that there would be a battle here in this particular place or time.

But we have evolved, and I think both of the gentlemen would agree that almost every embassy situation is different. Each chief of mission and each chief of station from the Central Intelligence Agency (CIA) has a different perspective and different experience and different relationship with the military. They also see military requirements as being different from country to country. In each case, we will try to build that relationship between the chief of mission and the chief of station, so that it most effectively represents the needs of, first of all, the theater commander, the combatant commander, and also General Brown if he were required to conduct an operation in that area.

I would be happy to go into the specifics of some of the activities of the teams in closed session, sir.

Senator CORNYN. Thank you.

General Brown, let me just ask you to follow up on that question and response from Secretary O'Connell. Has SOCOM conducted or does it intend to conduct military activities in any country overseas without the knowledge of the chief of mission in any instance?

General BROWN. Absolutely not, Senator.

Senator CORNYN. I appreciate your clarifying that. Of course, as we have discussed previously, there have been some newspaper stories that have suggested otherwise.

What is your opinion on the level of coordination and cooperation among different agencies in this initiative?

General BROWN. First of all, Senator, OPE is about speed. It is about how fast can you move into an area and perform whatever task you have been given, and that is where OPE was developed. We work very hard on coordinating every activity with every one of the interagencies. I work very closely with the CIA on coordinating anything we are doing, and we work very closely with the State Department. Before any team of any kind, to include joint/combined exercises for training or any other special operations team deploys, they deploy with the full knowledge and approval of the embassy. They get a country clearance, just like any other deployment of a conventional force, and they get country clearance from the geographic combatant commanders.

So I am very comfortable we are working very hard and that we have never ever deployed into a country, quite frankly, in my history in special operations, without the full knowledge of the ambassador or the country team that we are going into that country.

I will be glad to discuss further the actual tactics, techniques, and procedures of OPE in a closed session.

Senator CORNYN. Thank you very much.

Senator Reed.

Senator REED. Thank you, Mr. Chairman. Let me just follow up on this line of questioning that you have raised, because it is an important line of questioning.

These teams that will be operating, you have acknowledged, General Brown, that they do so in your view with the full disclosure to the ambassador and to the chief of station. If they were to be discovered and detained, would they maintain themselves as military personnel?

General BROWN. Sir, it would probably be better if I answered those questions in closed hearing, if that would be okay.

Senator REED. That would be fine, General, if that is your judgment. I appreciate that.

There is always the question of notification of some of these operations pursuant to the law. There is a much more robust and historically better developed sort of policy with respect to CIA operations. Are you developing policies or should we think about policies to notify Congress about these operations if they are particularly sensitive?

General BROWN. Senator, we report everything that we are doing up to the Joint Chiefs of Staff and the OSD so that they can be appropriately reported.

Senator REED. My question then would be, at that level of reporting to us, is there a need to look at that level of reporting?

General BROWN. I believe what I have been told is—and Mr. O'Connell may have more detail on this—that the Secretary was over yesterday and met with the leadership of the House and the Senate to ensure that all of the reporting would be worked out as appropriate.

Senator REED. Mr. O'Connell, do you want to add a point?

Mr. O'CONNELL. Yes, sir. As General Brown mentioned, the Secretary did host a meeting with congressional leadership yesterday specifically over reporting procedures, to which committee, and I think the discussion—and I do not want to reveal the specific details or violate the confidence of the Members that were present—but, led by the Under Secretary of Defense for Intelligence, Dr. Cambone, Secretary Rumsfeld, Senate leadership, and House leadership looked at the types of structures that exist within Congress today and their specific oversight responsibilities.

Some of our activities are intelligence-related. Some of them are title 10 versus title 50 activities, and the reporting mechanisms are different. Sometimes they straddle both sides of a particular operational issue. The Secretary did give several examples yesterday, both historical and theoretical, where he felt that there were difficulties on both the executive branch and perhaps the legislative branch, as to how we stay in sync.

Several proposals were raised yesterday, some by the legislative leadership, some by the Secretary, and the promise was to continue to work these out. But the key thing is that everyone wants to do the right thing, to do the efficient thing, and to make sure that we are not jeopardizing speed or secrecy. So I think there was general agreement and comity in the room yesterday when that was discussed. But I would defer any specifics to the Secretary.

Senator REED. Surely. But I think what you have suggested is this is fertile ground for further work, analysis, and perhaps, if not legislation, then certain understandings between the executive branch and Congress about reporting.

Mr. O'CONNELL. Yes, sir.

Senator REED. General Brown, your OPTEMPO is extraordinarily high. You have suggested that you are going to increase your forces by about 5,000 personnel. I understand that that is going to take place over the next several years, beginning in the 2008 budget to 2011. Could you outline those plans? More specifically, it seems to me that the demands on you might call for a more immediate and even more robust increase in special operators. Also, recognizing the fact that training special operators is something that takes years, it is not something where in 3 or 4 weeks or 3 or 4 months you have an accomplished special operator—the field skills, the cultural sensitivities, just the maturity takes a while. So again, I think that suggests to me that beginning now rather than waiting until 2008 might be more appropriate.

Could you comment?

General BROWN. Senator, you are exactly right, and we are working real hard at that. Over the last 3 years—and I will be glad to get the exact figures for the record—we have added, over 1,000 CA and I believe about 300 to 400 PSYOP personnel, and those today are two of our stress areas, specifically CA, which is our most stressed area.

So we are already taking actions. We are about to grow two SEAL team equivalents and that is happening in 2006 and 2007. So we are growing some special operations. But the way we took this on was to grow our schools, to make sure that our schools were capable of the throughput that we needed and immediately put the resources necessary to grow the school so we could then start growing the force.

We cannot grow the Green Beret force until we get it full for the first time. Last year, at the end of 2004, I believe it ended the year about 89 percent full of Green Berets. We have a great plan for the future. General Phil Kensinger down at the Army Special Operations Command is doing a great job of focusing it. We have actually started teaching the same course in less weeks and with a higher standard requirement for graduation in language skills than ever in the history of special operations.

So all these things come together. We have the biggest classes going through that we have ever had in the history of special operations. We think we will get into the mid-1990s in our fill rates of Green Berets this year. Hopefully we will be on a glide slope that will allow us to continue this growth into the future as we continue to add another 500 or more Green Berets that will be necessary in the future.

It does take time. We started right away. We are in better shape than we have ever been in the history of the Green Berets. But quite frankly, we still have a lot of work to do on it.

[The information referred to follows:]

As you correctly stated "training special operators is something that takes years," with this in mind, we began in fiscal year 2004 ramping up our production of Army Special Forces soldiers and Navy SEALs. Special Forces throughput in fiscal year 2004 was increased from 450 to 550 at the U.S. Army Special Warfare Center and School. To further increase the number of SOF, in fiscal year 2006 we will add instructors and support personnel to both our Army and Navy training centers. Currently, the SOCOM is programmed to add 1,405 spaces in fiscal year 2006, 465 spaces in fiscal year 2007, and 1,675 spaces in fiscal year 2008. These increases will primarily support institutional training, operational, and support units which will improve readiness and mission effectiveness. To relieve the stress caused by

OPTEMPO in OIF and OEF, and increase our operational capabilities, SOCOM will add more CA, PSYOP, Special Forces, Army Rangers, Special Operations Aviation (rotary and fixed wing), and maritime forces.

Senator REED. Thank you, General Brown.

Let me ask one more question, then I will yield back to the chairman, and I presume we will go back and forth until 10:45. Thank you, Mr. Chairman.

Secretary Rumsfeld is in the process of promulgating a new directive on post-conflict and stability operations. You will play a key role in that. What changes do you see that you have to make to play this role in the new emerging strategy of post-stability operations? There are some specific issues that will come up and I would like your comments.

First, you mentioned CA. I think it is critical to have CA. We have discovered that shortages have plagued us over the last several months in Iraq and Afghanistan. I think it is important. On a recent trip to Iraq, I was struck by the difficulty of getting State Department, U.S. Agency for International Development (USAID), and other civilians who are in the CA business in the field, which leaves military forces, and properly so in many cases because of the security considerations, the only show in town.

So this CA function has to be critical. There is an issue of whether CA should be in SOCOM or should be migrated back to the Army, Marine Corps, or Navy. That is an issue.

Then there is another issue, too, which is whether or not we have to start training our conventional units and give them more special operations capabilities, if you will, since the missions are blending so significantly when you do stability and counterinsurgency operations.

So both Mr. O'Connell and General Brown, if you would comment on that range of issues.

Mr. O'CONNELL. Senator Reed, fair question and a very complex question, as I think you understand. Subsequent to the end of hostilities or the conventional phase, let us say, of the Iraqi conflict, there was much attention paid by the Department to how we were structured for post-conflict activities, and the Defense Science Board did a summer study on this which the Secretary chartered and received extensive briefings on. Other studies were done by the Institute for Defense Analysis.

They generally pointed to the same issues in terms of transition to and from war: Were we properly structured to do the types of planning that are required? Second, subsequent to an event, how were we postured and resourced to handle stability operations?

From those discussions came a series of initiatives which are under way today. One, a Department initiative which was adopted as a presidential initiative, the Global Peace Ops initiative, was adopted last year at the G–8 meeting, whereby we are going to be permitted to transfer money to the State Department to allow them to start looking at developing a significant peacekeeping capability, but one that does not deteriorate, as many have historically, over time, to put in places where we can increase partner capacity and reduce the strain on U.S. forces.

I think during the last year there were three or four instances—Liberia, Haiti—where we rushed conventional forces in, far more

capability than we actually needed on the ground, and perhaps we would have been much better working with partner nations and putting in basic infantry-trained peacekeepers.

With respect to your question of whether CA belong within the SOCOM, my personal view is that there is room in many forces for CA activities. The Marine Corps have some of their own. General Schoomaker is now looking, in consultations with the Secretary and General Brown, as to what portion of our CA forces might be permanently assigned to new Army units of action and which elements of CA should remain in SOCOM.

It is my personal view that CA can certainly be a combat multiplier. They can assist both the conventional and SOF on the ground, and the type of training that is given within the special operations school system in many cases for our Green Beret forces and our CA, much of the training is common. Could it be placed elsewhere? If the Secretary decides that it would be more effective elsewhere, that may happen.

But I would strongly urge the Department in any reorganization to retain a substantial, particularly Active Duty, CA capability within the SOCOM.

Senator REED. General Brown, your comments?

General BROWN. Sir, I think you are exactly right again. We will play a big piece in the stability operation. Specifically, that will fall on the shoulders of our CA. It is absolutely critical that at the appropriate time in the transition of the battle that the State Department, USAID, and all the other government agencies that play a part arrive on the battlefield at the right time and start carrying their portion of the reconstruction.

Additionally, you have to accommodate those private volunteers and nongovernmental organizations because they do bring a great deal of capability to the battlefield. So it is a very complex environment at that time, that transition in phase four. But it is extremely important.

The problem with CA is very complex because, quite frankly, we have a new appreciation for it, I think, in all of the DOD, but we have always had 27 battalions in the Reserve component. We have only had one battalion in the active force. So we went through those battalions fairly quickly and, quite frankly, that is our biggest stressed area now because we have deployed all of them. Over 90 percent of them have already been used on the battlefield and as we go into the next phases in rotations it is getting more and more difficult for us to find CA forces. We are working very closely with the Army to try and plus up our CA strength within the next year so that we can go ahead and get those folks now so that we can train them to standard and get them on the battlefield for the next rotations.

There are good things happening in CA. We have now worked with General Hagee and all the Marine Corps CA units, of which there are two going to three. The CA groups, their small battalions, will now go through the Army CA training at Fort Bragg, North Carolina, where we own the school. That is a good thing. That CA guy walking on the battlefield now will have a standard level of training, whether he is a marine or an Army CA soldier.

We are working closely with the Marine Corps—and, by the way, always have in the CA arena in every area, but specifically in CA. As we did routine deployments into Bosnia and Kosovo with our CA forces, the Marines were often part of that and took some of those rotations off of it.

I believe there are more tasks that the conventional forces can do with a special operations capability, and I think you are seeing that, especially in the Army under General Pete Schoomaker, who has some background in special operations, is working that pretty hard.

You will see that at our national training centers in the Army and our centers for training as you go out and see that they are putting a lot of energy into how military commanders work with civilian populations on the battlefield, a traditional CA function, but now they are more involved with it, and bring in the CA to help with it.

So I think there are a lot of good things going on with CA. We are into discussions of whether they should be in SOCOM or in the Army or a mixture of both of them. It is a key part of what we do on the battlefield in special operations, but the preponderance of the CA force is in direct support of a conventional military unit such as an Army division or an Army corps or a Marine Corps division, because the Army CA also support those divisions.

So I think the answer is—and I have met with General Schoomaker on it several times—to make sure we are doing what is best for CA and what is best for how we can perform the mission. Those are the things that we are working through right now. But I think there is a place in special operations for CA and we need to make sure that we have at least a portion of it.

Senator REED. Thank you.

Mr. Chairman.

Senator CORNYN. General Brown, SOCOM has long had a reputation for being able to rapidly respond to operational needs of their teams by being able to quickly identify requirements, develop the concept, find sources of supply, and rapidly field new capabilities to teams. I would like for you just for our edification to mention maybe a couple of successes that you think you have had in that area. Then I would like you to comment on the less positive story, at least from my perspective, when it comes to the complex acquisition programs like the ASDS. Then perhaps we can get Secretary O'Connell's comments about how we are going to deal with those more complex acquisition programs to make sure that they are clear in concept and design and well managed and hopefully kept within reasonable expense boundaries.

General BROWN. Thank you, Mr. Chairman. We do have a reputation, and I think it is more than a reputation. We actually execute acquisition very rapidly. We are very good at our MFP–11 for commercial off-the-shelf applications that apply to SOF. As we go into the battlefield with our combat mission needs statement, which you mentioned earlier, it is a very powerful process where somebody on the battlefield from any one of our Services that has a combat mission need can get that immediately to my headquarters and we have to make a decision, by our own policy, within 48 hours.

So it turns very quickly. Then we go after it if it is a valid requirement and we have to do whatever it takes, which is oftentimes reprogramming money or doing whatever we have to do to make this happen, because it is a combat mission need.

We have had great successes on it and I have a long list of them, everything from our Multiband Inter-Team Radio, which started out as just a very small acquisition program. As soon as the troops got on the battlefield and saw the need for the radio we rapidly—with the help of Congress, I might add—added a bunch of radios, and it has been one of the big success stories even though it is just a small radio. The successes include everything from weapons capabilities to sights to—unmanned aerial vehicles (UAVs) are a perfect example, hand-held UAVs, small, deployable UAVs. We basically had none when OEF started and now all the teams out there have them, and that is through our rapid acquisition process.

So I think that is a big success story. We have to be very careful not to add any bureaucracy or let it grow down at our headquarters, and we certainly want to keep that.

The ASDS has been a long process, as you got to see it out in Hawaii. It is an extremely important capability that SOCOM needs around the world. While I will not get into the details of its operational capabilities, the program has been fraught with some problems over the years. But we still think it is one of our flagship capabilities we need.

What we have done as recently as March of this year is I called in the contractor, had a meeting in the Pentagon with the Navy, with the program managers, with the shipyard. We had everybody stand up in front of the boss and tell us where we are on this and how we are going to get this thing across the finish line.

I sent a personal message out yesterday to the same membership telling them we are going to do it again. Quite frankly, we are focusing on the ASDS and we are going to try and get this across the finish line because we really need it.

The Milestone C decision is in December of this year. By December 5 we hope to make that. We are not allowed to have any long lead items or purchase any long lead items until that decision is made. With the success we are having with the batteries and their arrival in June, that will be operating by July and we will have a chance to test it by September. I am starting to get cautiously optimistic that we are going to make Milestone C on this program, and we need to.

When we have taken it out and tested it and put it through its trials—and we are doing that right now—it has been very successful in performing the operations we want it to perform. We have had the battery problem. We are about to solve that. There are a couple of other problems that we are about to solve. But for the most part, I am cautiously optimistic that this time we are going to get it across the finish line.

Senator CORNYN. Thank you.

Secretary O'Connell, if you have watched some of the full committee hearings we have had recently, including Gordon England's confirmation hearing and that of Mr. Krieg yesterday, you can tell there is a lot of concern on the committee and in Congress generally about our acquisition programs. Unfortunately, the ASDS,

while it is something that the SEALs love—and I take General Brown at his word that it is an essential component in our abilities—we are concerned about management of those acquisitions.

Could you enlighten us or fill us in on anything General Brown did not cover that you think might be helpful to our understanding?

Mr. O'CONNELL. Just a couple points, sir, because I think General Brown covered them very well. I was privileged to attend his March session with the contractor. I do not think it was a session that could be described as pleasant for the contractor. Assistant Secretary Young from the Navy attended and was very supportive.

I think everyone realizes that this is a case where a unique requirement was identified. Perhaps the initial effort and some of the early decisions made on ASDS certainly have not been models of efficiency, but this was a really new concept. Part of the problem is that it involves one sophisticated platform being attached to another sophisticated platform, and that creates new demands because stealth in one system has to equal stealth in another.

As they worked through those issues and had some mechanical and other problems, they started to recognize errors that were made early on in the program. They went back and I think they have made an excellent good faith attempt to realign their production.

The point that I would like to make, more from a policy standpoint—and again, I understand that this acquisition has not been a model of efficiency. But if we can get it right, the opportunity it gives us for numerous special missions is particularly important as we face threats we really have not looked at for some time. I would be happy to talk about some of those in closed session.

But my final point is that I think the command, the DOD—and I would like to acknowledge the presence of my resource director here, Tim Morgan, who has worked diligently over the years establishing and working with MFP–11. We have had long talks about what do we do with ASDS. I still believe we are at the point where we are on track for Milestone C and I think General Brown has the right contractor here.

Senator CORNYN. General Brown, are you satisfied with the attention the Navy is now providing?

General BROWN. Yes, sir.

Senator CORNYN. Let me ask about one other area and then I am going to turn the floor back over to Senator Reed. This has to do with counterdrug, counterterrorism activities. Current law now allows counterdrug funding to be used for counterterrorism activities in certain countries, but otherwise precludes the use of these funds for counterterrorism activities elsewhere, including counterdrug activities along our borders in the United States.

My own impression is that when you get people who are engaged in lawless activity, whether it is smuggling human beings or drugs or weapons or the like, they do not necessarily discriminate other than to go for whatever generates the most money. So I wonder whether counterdrug funding should be available to support counterterrorism activities as an overall policy.

Mr. O'CONNELL. Sir, my quick answer to that is yes. The central transfer account and the general funding provided by Congress for

counternarcoterrorism is perhaps the most effective and flexible moneys in the Department. It can be rapidly shifted. It can be used for a wide variety of options. I can tell you, in the case of the first supplemental that we had for Afghanistan it was really the—if we had not had that seed money, we would not have been able to lay the foundation for a program that can be integrated by the combatant commander and eventually put an Afghan face on it.

I believe—in fact, my Deputy Assistant Secretary for Counternarcotics was just out and is out on the southwest border looking at some of the tunnel technology that we have been able to develop through other narcoterrorism funding and see if we can apply that. We know that perhaps drugs come through those tunnels, and perhaps people come through those tunnels. That is an example of flexible use.

If either member has not visited the Joint Interagency Task Force-South in Key West, I would encourage both of you to do that, because it is a remarkable orchestra of an ongoing battle. You have the Coast Guard, the Navy, the Air Force, the Colombians, and our law enforcement fighting a 24-hour battle using real live surveillance, tagging and tracking, interdiction. It is a remarkable thing to watch. I think it is the wave of the future, and the central transfer account gives us extraordinary flexible capability, and so any restriction—anything that continues towards that type of arrangement I think is worthwhile, sir.

Senator CORNYN. Senator Reed.

Senator REED. Thank you, Mr. Chairman.

Mr. Secretary and General Brown, our interrogation policy for detainees has gotten us into some sordid and very regrettable situations. I would note that recent information from Freedom of Information Act requests suggests that some of the individuals in the 519th Military Intelligence Group in Iraq claim that they got some of their ideas from the Interrogation Rules of Engagement, from some of the special operations units, which raises the question at this moment not only of what happened and how it happened, but within the context of Iraq at least, where we know the Geneva Conventions apply, what are the operative rules of interrogation for special operators?

I say this because I find it in a way ironic. We have some special operators who have been charged criminally and they are at literally the point of the spear, in a hostile situation in which they are fearful for their life, their safety, and so many other things, which suggests to me unless the rules are very clear and very consistent with regulations then we are not doing them a service in putting them out there if there is any ambiguity, because in that environment unless there is a clear bright line there is a tendency to do things not only that we regret, but later they might be held accountable for.

So first, General Brown, are the policies consistent with the regulations and the law of land warfare?

General BROWN. Sir, I think they are. I would tell you that special operations has no unique interrogation policies. When we deploy forces to a geographic combatant commander's AOR on the battlefield, they are bound by the same policies as everyone else in that geographic combatant commander's AOR. If we were to be the

supported commander, it would then be our responsibility to publish those policies and rules of engagement and interrogation.

So I am not familiar with the 519th and I will go back and take a look at that and exactly what they said. We have had some Special Operations allegations.

Senator REED. Yes, sir.

General BROWN. I think there are about 40 of them. I think 13 of them are still under—I should not say that. I think about eight. I will make sure I get the record straight and I give you the exact numbers. I think we have had 13 people receive some sort of punishment or administrative punishment for some sort of problem with interrogation and handling of prisoners.

But to get to the bottom line, we operate under the same policies as everyone else in any AOR that we go to.

[The information referred to follows:]

The SOCOM does not dictate interrogation policies or techniques in Iraq. The Secretary of Defense transfers operational control of those forces to the Commander, U.S. Central Command, when they deploy in support of OIF. However, we are certainly concerned with ensuring that our forces comply with U.S. and international law regarding armed conflict. The overarching policies on interrogation are the same for Special Operations Forces as they are for conventional forces, although specifically approved techniques may vary. Subordinate units can craft more restrictive policies, but may not expand them. The current policies and techniques have all received legal reviews to ensure compliance with controlling regulations and the law of armed conflict.

Senator REED. That raises another question, which you may want to defer. With these new concepts of operational control elements, where just technically they would be under a combatant commander but in reality they are not I think tied in directly to a combatant commander, do those same rules apply? I think it is important.

General BROWN. I would be glad to talk about that in closed hearing. I would just tell you the rules do apply.

Senator REED. Thank you, sir.

Let me just move to another topic. In 2001, Under Secretary Doug Feith established the Office of Strategic Influence (OSI) and that had a rocky reception and there was a perception or fear that this might be a device to propagandize, even in a misleading way. In 2004, SOCOM established the Joint Psychological Operations Support Element (JPSE) and there are some suggestions that it has a role in terms of broadcasts, short-wave radio contacts, and Web initiatives. The question I think is, are we once again getting into this area that found so much resistance for the OSI. Mr. Secretary?

Mr. O'CONNELL. Let me start first and then I will pass to General Brown.

Senator Reed, I was not in office during that time frame, but I have, because the issue was so contentious, gone back and talked to people and said, let us look at what really happened. I think my own personal view is that there were a series of unfortunate incidents that happened serendipitously to cast the intentions of that office in a bad light.

Primary among them was the allegation that somehow the OSI was designed to specifically mislead the foreign press. From everything I have seen, I have heard from the people I have talked to,

that was never the case. But I think because the press made the allegation, the Department reacted swiftly and that capability went away.

Now, many can argue, did we miss an opportunity by not having that type of capability prior to the war, during the war, and even after the war? I will leave that for the experts.

But in terms of our role currently in information operations, one of the five elements of information operations is PSYOP. Unfortunately, that term has tended to pick up unfortunate connotations over the years. Really, it should be just the opposite, because our PSYOP have been effective, they have been very helpful to the commanders, and they have targeted our adversaries when necessary.

That is my little take on OSI and I will pass the PSYOP question to General Brown.

General BROWN. Senator, while the name, the "Joint Support Element," was not selected at that time, we were actually discussing this long before the growth and the demise of the OSI up here. It came from a frustration that I personally had as the Army Special Operations Commander when we started OEF originally and started putting SOF on the ground. All psychological operations forces are resident in SOCOM and, once again, they are mostly resident, with the exception of our great Commando Solo aircraft up at the 193rd Pennsylvania National Guard, everything else is in SOCOM, and all that is in Army Special Operations Command.

But what immediately happened was that we did not have people with the PSYOP skills and background. Psychological operations forces are only allowed to tell the truth, and their purpose is to support the commander on the battlefield and to get his message out, a very powerful message and capability.

So what I envisioned was that we would stand up some teams that I could send to other geographic combatant commanders or a functional combatant commander, where we could send him some expertise to help say, this is what leaflets look like, this is how you develop them, these are the themes that are approved.

So while you always stand up a joint PSYOP task force—that is the doctrine—it quite frankly is a little slow getting its legs up under it when a war starts and additionally it is an ad hoc organization.

What I thought would be helpful is if we could build an organization that could go out and advise whoever needed that kind of advice on how you use SOCOM PSYOP products, the best way to get them, the best way to develop the programs, what the themes are, what the themes should be, and these teams—and that is basically what we are doing with this JPSE. We are standing up some deployable teams out of my headquarters that can go out and help anybody that needs that kind of help to do this.

Senator REED. They will be helping combatant commanders.

The reason I raised that question is because so much of what you do comes very close to the roles of other agencies, like the State Department, public diplomacy, like the U.S. Information Agency. I am trying to get a handle on the boundaries and the coordination between your role in this endeavor and those other agencies. Why do you not just comment on that?

General BROWN. With the standup of what we call the JPSE, the reality is the roles have not changed one bit. We still are a DOD agency. We advise the DOD and all of the combatant commanders on the best application of using, quite frankly, the products we develop for PSYOP missions.

Senator REED. Thank you.

Gentlemen, we are going to now recess this open hearing and then move to S–407 in the Capitol, where we can conduct the closed hearing. But let me say here publicly again how much we appreciate your responses to these questions. This has been informative and very useful, and we look forward to asking some additional questions and getting some follow-up on matters that you indicated earlier should be more appropriately handled in closed session.

So we will move immediately from here over to S–407 and we will reconvene as soon as we can all gather there.

[Question for the record with answer supplied follows:]

QUESTION SUBMITTED BY SENATOR HILLARY RODHAM CLINTON

MANNED AIRCRAFT

1. Senator CLINTON. Secretary O'Connell, there has been much discussion of military unmanned aircraft requirements. Does the special operations community have requirements for manned clandestine intelligence, surveillance, and reconnaissance aircraft? What might some of those requirements be and what sort of aircraft could meet those needs?

Mr. O'CONNELL. The U.S. Special Operations Command has both classified and unclassified requirements for intelligence, surveillance, and reconnaissance (ISR) aircraft supported by the fiscal year 2006 President's budget. The committee has been provided detailed budget justification materials describing special operations ISR programs. We will be happy to provide additional information detailing the manned requirements at the appropriate classification level.

[Whereupon, at 10:45 a.m., the subcommittee adjourned.]

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