

**THE HEALTH AND STATUS OF THE DEFENSE
INDUSTRIAL BASE AND ITS SCIENCE AND TECH-
NOLOGY-RELATED ELEMENTS**

HEARING

BEFORE THE

SUBCOMMITTEE ON EMERGING THREATS AND
CAPABILITIES

OF THE

COMMITTEE ON ARMED SERVICES

UNITED STATES SENATE

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THE HEALTH AND STATUS OF THE DEFENSE INDUSTRIAL BASE AND ITS SCIENCE AND TECHNOLOGY-RELATED ELEMENTS

TUESDAY, MAY 3, 2011

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

The subcommittee met, pursuant to notice, at 2:30 p.m. in room SD-562, Dirksen Senate Office Building, Senator Kay R. Hagan (chairman of the subcommittee) presiding.

Committee members present: Senators Hagan, Reed, Udall, Shaheen, and Portman.

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

Majority staff members present: Richard W. Fieldhouse, professional staff member; Peter K. Levine, general counsel; and Robie I. Samanta Roy, professional staff member.

Minority staff members present: John W. Heath, Jr., minority investigative counsel; and Michael J. Sistik, research assistant.

Staff assistants present: Kathleen A. Kulenkampff, Brian F. Sebold, and Breon N. Wells.

Committee members' assistants present: Carolyn Chuhta, assistant to Senator Reed; Casey Howard, assistant to Senator Udall; Roger Pena, assistant to Senator Hagan; and Chad Kreikemeier, assistant to Senator Shaheen.

OPENING STATEMENT OF SENATOR KAY R. HAGAN, CHAIRMAN

Senator HAGAN. The Subcommittee on Emerging Threats and Capabilities will come to order, and I thank you for being here. I do want to say that a vote has been scheduled at 3:30 today and, because of the nature of the vote, we have been asked to actually sit in our chairs at 3:30. So we'll adapt and see if the vote is on time. To be continued.

But this afternoon the Emerging Threats and Capabilities Subcommittee meets to consider the health and status of the national defense industrial base and its related science and technology (S&T) elements. These have been the subject of growing concern and will continue to be so as the Department of Defense (DOD) faces increasing budgetary pressures on its acquisition investments in the future.

Some of the key challenges include: the fragile nature of the supply chain and limited competition within a heavily consolidated defense industrial sector; growing global competition; a loss of skilled domestic expertise and manufacturing capability offshore; and the negative impacts from an outdated export control regime.

In addition, there are challenges attracting and retaining the best and the brightest scientists, engineers, and technologists, who are key components of the science, technology, engineering, and math (STEM) workforce, not only in the industrial sector, but also within DOD as well.

Overall, S&T is a key foundational basis for our national defense capabilities and the industrial base that produces them. Sustained research and development (R&D) over the last decades has allowed DOD, in close collaboration with the defense industrial sector, to develop unparalleled military systems from space to the depths of the oceans, and increasingly, in cyber space.

It is essential to continue investment in R&D and to strengthen the defense industrial base to preserve our technological advantages on the battlefield. This priority has been discussed in recent high-level policy documents such as the National Security Strategy and the Quadrennial Defense Review (QDR), as well as in studies by industry groups such as the Defense Business Board.

The subcommittee is interested in understanding how these policies and studies are translating into concrete strategies, plans, and programs within the DOD, how effective they are, and what actions Congress can take to assist in ensuring their success. While we rightfully acknowledge the sacrifices and service of our men and women in uniform engaged in operations around the world, we must also acknowledge the men and women who conceive, design, develop, and produce the extraordinary technology and equipment that allows our military to be the best in the world. They work in our diverse S&T, R&D, and manufacturing communities, both within the DOD and also in our universities, research laboratories, small businesses, and large corporations. They are essential partners in our national security, and we would not have had our remarkable military today without their brilliance, creativity, and innovation.

This hearing will consist of two panels. The first panel will consist of DOD officials responsible for monitoring the status of and improving the health of the defense industrial base, including related research, engineering, and workforce activities. Mr. Frank Kendall is the Principal Deputy Under Secretary of Defense for Acquisition, Technology, and Logistics (AT&L). In this position, he supports Under Secretary Carter in all matters relating to the DOD acquisition system, including all research, development, test, and evaluation, as well as manufacturing and industrial base policy matters. The subcommittee looks forward to hearing about the DOD's overarching strategies, plans, and programs to address the challenges mentioned previously.

Mr. Zack Lemnios is the Assistant Secretary of Defense for Research and Engineering. In this capacity, Mr. Lemnios has broad oversight of DOD's research portfolios, new initiatives in manufacturing, its STEM education and workforce efforts, and the DOD laboratories that interact with the defense industrial base.

Mr. Brett Lambert is the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy. This position was newly created by Congress to provide a strong focal point within DOD to deal with broad industrial policy issues. These include assessing the health of the various sectors of the defense industrial base, investing in new manufacturing and defense production technologies, and helping monitor independent R&D conducted by industry.

Then our second panel will consist of individuals with a wealth of industrial and prior DOD experience. The subcommittee is looking forward to hearing their views on the challenges facing the defense industrial base and their assessments of current DOD plans, programs, and initiatives designed to address these challenges, as well as any additional ideas they may have for progress.

Mr. Norm Augustine is the retired Chairman and CEO of Lockheed Martin. He has extensive experience in both the private sector and DOD and has been a keen observer of defense acquisition trends. He recently led a National Academy of Sciences report called "The Gathering Storm" that was instrumental in raising the visibility of the broader national challenges in S&T and our future STEM workforce.

Dr. Jacques Gansler is currently the Director of the Center for Public Policy and Private Enterprise in the School of Public Affairs at the University of Maryland. His prior service with DOD included the position of Under Secretary of Defense for AT&L, and he has been a thought leader on the broad spectrum of topics we are going to be discussing today.

Mr. Phil Odeen is currently a member of the Defense Business Board. He led a task force on the defense industrial base last year that laid out a number of recommendations to help the DOD sustain and improve the health of the defense industrial base. We look forward to hearing in further detail some of their recommendations and his assessment of how well DOD is pursuing them.

We want to thank all of our witnesses for your service in the cause of our national security and we look forward to your testimony. In order for us to have adequate time to discuss a broad range of topics, I ask that the witnesses keep their opening remarks to no more than 5 minutes each.

As soon as Senator Portman comes in, I will certainly ask our ranking member for his opening statement.

Senator Reed.

Senator REED. Chairman Hagan, I'm going to be very brief. First of all, I think we're all fortunate to have your leadership on this important committee.

Senator HAGAN. Thank you.

Senator REED. Thank you so much. Your knowledge of these issues and your engagement in these issues are remarkable.

I think my major task today is to admit that, despite his youthful appearance, Secretary Kendall is my classmate from West Point, and I'm jealous because he looks great and I—well, anyway.

Mr. KENDALL. I was going to say the same of you, Senator.

Senator REED. I thank you. Thank you very much, Mr. Secretary.

But I think this panel and the succeeding panel is vitally important because, as Senator Hagan pointed out in her statement, we're

losing our competitive edge, in terms of not just military technology, but so many technologies. We're not attracting to the defense establishments, both corporate and the government, the most talented individuals, as we once did in the 50s, 60s, and 70s. We have a whole new dimension of conflict, cyber conflict, which raises huge issues about not only competitiveness in that dimension, but also protecting what we have and thinking in an entirely new framework.

In fact, I feel sometimes like our predecessors must have felt in 1920 about the airplane. They were born in 1845, they were comfortable with the telegraph. Electricity, aah. Airplanes? We have to deal with these issues.

So we look to you gentlemen and the succeeding panel for the advice and the insights that are going to be absolutely critical. This could be the most important topic we consider long-term.

Thank you, Chairman Hagan. I will have to excuse myself. Thank you.

Senator HAGAN. Thank you, Senator Reed. I agree, this is such an important topic, and I do thank all the witnesses for being here. Secretary Kendall.

STATEMENT OF HON. FRANK KENDALL, PRINCIPAL DEPUTY UNDER SECRETARY OF DEFENSE FOR ACQUISITION, TECHNOLOGY, AND LOGISTICS

Mr. KENDALL. Thank you, Chairman Hagan. I'd like to ask that my written testimony be entered into the record.

The U.S. military's superior operational capabilities are enabled by the application of innovative technologies and products that assure our military dominance. These products are designed and built by our defense industrial base under the supervision of our government acquisition workforce. As Dr. Carter, the Under Secretary of Defense for AT&L, mentioned earlier this year, a strong, technologically vibrant, and financially successful defense industry is in the national interest.

Today I would like to summarize for you how DOD is addressing the health and productivity of both the defense industrial base and the defense acquisition workforce. I am joined by Dr. Lemnios, Assistant Secretary of Defense for Research and Engineering, and Brett Lambert, Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy. Together we will discuss policies and processes adopted by DOD to actively engage with the source of innovation and technology. This includes the defense industry, but also commercial and for-profit industry, not-for-profit entities, including Federally Funded Research and Development Centers, as well as defense laboratories, academia, and university-associated, affiliated research centers. These all sustain our technological superiority and a healthy acquisition workforce in both industry and government.

Let me start by saying a few words about the industrial base. DOD relies on a robust and capable base to develop, field, and maintain the high-quality equipment that is required to meet our national security objectives. Our industrial base today relies primarily on U.S. companies, but is also more global, more commercial, and more financially complex than in the past.

The defense industry, from prime contractors that work directly with the government to their subsystem and component suppliers, and even their raw material suppliers, is constantly changing, constantly adapting to DOD's requirements, and, as is to be expected, to the conditions in the marketplace.

In what Dr. Carter has called a new era for the industrial base, that marketplace is changing, and DOD, like industry itself, must adapt. DOD is doing so, but it should be clear that, while we anticipate significant change from the environment of the last decade or so, the sky will not fall on our defense industry. The defense budget is no longer growing, as it has for the past decade, and the President has charged DOD to find additional savings over the next 12 years. Secretary Gates is starting a comprehensive effort to carry out that task. DOD has already undertaken an extensive review to find efficiencies and we will redouble our efforts.

But at some point there is no alternative to reexamining fundamental missions and force structure. However, even given the reductions that the President has asked us to examine, we believe that there will still be large and fairly stable markets available for the defense industry. We do not foresee a precipitous decline like the one DOD and industry experienced at the end of the Cold War.

Today, unlike the end of the Cold War, we are not seeing a fundamental change in the national security situation. We will continue to face threats that range from emerging powers and transnational terrorists to rogue states. DOD's budget must respond to these enduring threats and we must rely on the defense industrial base to equip our forces.

As we enter a new era where defense budgets cannot be expected to steadily increase, we do expect market forces to be the primary mechanism by which industry responds to this change. DOD will, however, be monitoring industry closely and may sometimes in rare exceptions have to step in to protect critical capabilities or to ensure competition.

At the top tier of the industry, we do not believe additional consolidation would be in the interest of DOD or the Nation. At lower tiers, we will be watching for the anticompetitive situations or the loss of critical capability on a case-by-case basis and for cases where we can improve the acquisition strategy options available to DOD.

To be vigilant in this period of change, DOD has significantly increased its efforts to address the potential adjustments in industry. To begin with, DOD incorporated industrial base considerations into the QDR that was released last year. This was the first time DOD had brought the industrial base into the QDR, its highest-level strategic planning document. The industrial base will also be a factor in the comprehensive review that the Secretary has now been asked to conduct.

We have taken significant steps to address the changing environment under the umbrella of Secretary Gates' overall efficiency initiative. The Better Buying Power initiative that Dr. Carter was tasked to implement is the centerpiece of this effort. We engaged industry at the outset of this initiative and received over 500 separate specific recommendations, many of which were addressed. Better Buying Power began with 23 specific policy changes, but it is

in fact an ongoing continuous improvement program designed to increase acquisition efficiency. Better Buying Power is moving both government and industry into a new paradigm where financial incentives and productivity gains will continuously drive out unproductive costs.

We are also pursuing multiple concurrent efforts to map and better understand the increasingly complex defense industrial base so that we can deal with any problems that may emerge as market players attempt to make adjustments. In contrast to previous assessments, which were largely program or end product-focused, we are assessing the industrial base sector by sector and tier by tier to develop the data we need as the basis for any needed interventions. Mr. Lambert will have more to say on the industrial base and the steps we are taking there.

So let me turn next to the source of all our innovation, the Nation's scientific and engineering workforce in and out of government, and challenges that we face there. As the person responsible with Under Secretary Carter for the effectiveness of the defense acquisition system, if there is one thing that keeps me awake at night it is my concern for the capacity and capability of our collective industry and government scientific and engineering community, what Norm Augustine will refer to as "human capital" when he testifies later today.

As I review troubled program after troubled program and consider my own over 35 years of experience in defense acquisition, 16 years of which were in industry just prior to returning to government a year ago, I have to conclude that our capacity to deliver promised programs has atrophied to a disturbing degree. There are still plenty of capable people working in industry and in government, but the trends are not positive and I believe that many of the problems we are seeing in program management and execution are simply the result of lack of adequate numbers of properly educated, trained, and experienced professionals.

At the end of the day, delivering the products our warfighters need is industry's responsibility, and in many cases industry is failing. I believe there are many reasons for this loss of capability: the drawdown after the Cold War, the perception for 2 decades that the United States does not and will not face a peer competitor, the shift in interest among young graduates from aerospace and defense work to fields like biotechnology and information technology, just to name a few.

Mr. Odeen will testify that he believes this trend is being reversed, partly because of the current economy. I hope he's correct, but I'm skeptical. The government certainly must accept its share of the responsibility for this situation. Government people set requirements, dictate contracting strategies, impose cost and schedule constraints, and define acceptable performance by industry, all of which impact program performance. But industry has to design, build, and deliver the product.

On the government workforce side, there was a dramatic drawdown in the late 1990s, which we are currently trying to redress through the Defense Acquisition Workforce Development Fund and other measures. This will bring our numbers up. But more has to be done to improve capability as well as quantity. As the space-age

baby boomers like myself age out of the workforce, I fear this problem will only become more acute.

What can we do about this challenge? On the government side, we can insist that our key acquisition professionals have the education, training, and experience they need to attain the level of proficiency needed for success. This is a business that requires professionals. Key acquisition leaders in program, technical, and contract management and their staffs must be prepared to do their jobs and then be rewarded for doing so successfully. On the industry side, we can provide incentives to our suppliers to link successful performance on contracts more tightly to financial rewards. This linkage of profit to performance is one of the central tenets of the Better Buying Power initiative.

Dr. Lemnios will describe some of the programs we have put in place to encourage young people to enter science and engineering fields and some of the steps we are taking to support and encourage innovation in industry and government. We have a lot of work to do in this regard. Dr. Carter calls the acquisition workforce our number one program. It will be so for the foreseeable future.

A competitive and robust industrial base gives America its crucial technological edge. To this end, DOD does have responsibilities for investing taxpayers' money, preserving healthy competition, and managing across portfolios of defense systems. DOD has no desire to replace industry's profit motive. In fact, we need to use that motive as a strong incentive for superior performance. We are in this for the long haul and we need our suppliers to be in it for the long haul also with us.

The best strategy for all parties is to find win-win outcomes. DOD's initiatives like Better Buying Power, the sector-by-sector, tier-by-tier assessment of the industrial base, and programs to promote STEM programs, and reinvigorate defense R&D and the acquisition workforce in both industry and government are designed to achieve just that.

Congress has been actively involved in shaping and supporting DOD's initiatives. Your support in funding, expedited hiring authority, workforce recognition and incentives, and other human capital legislation has been very important to our progress. Congress has also supported DOD's engagement with industry, affording DOD the tools necessary to maintain a healthy industrial base. We appreciate the support and look forward to continued partnership to best serve the taxpayers and our warfighters.

[The joint prepared statement of Mr. Kendall, Mr. Lemnios, and Mr. Lambert follows:]

JOINT PREPARED STATEMENT BY HON. FRANK KENDALL, HON. ZACHARY J. LEMNIOS,
AND BRETT B. LAMBERT

INTRODUCTION

Chairman Hagan, Ranking Member Portman, members of the subcommittee, thank you for the opportunity to submit this written testimony on the U.S. Department of Defense's (DOD) commitment to maintain the health and productivity of the defense industrial base and the defense acquisition workforce.

The Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics is the principal staff element of the Secretary of Defense for all matters relating to DOD acquisition; research and development (R&D), advanced technology; developmental test and evaluation; production; logistics; equipment sustainment; in-

stallation management; military construction; procurement; environmental security; and nuclear, chemical, and biological matters.

I am the Principal Deputy to the Under Secretary of Defense for Acquisition, Technology, and Logistics and I am joined today by The Honorable Zachary Lemnios, the Assistant Secretary of Defense for Research and Engineering and Mr. Brett Lambert, the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy.

Today, I will discuss the Department's activities to sustain the health, vibrancy, and efficiency of the U.S. defense industrial base. The U.S. military's superior operational capabilities are enabled by our industrial base. For decades the United States has commanded a decisive lead in the quality of defense-related research and engineering conducted globally and in the military capabilities of the products that flow from this work. However, the advantages, which have enabled American preeminence in defense technology, are not a birthright and they must be sustained. The U.S. defense industrial base is critical to equipping our military with superior capabilities, as recognized by Dr. Carter earlier this year: "a strong, technologically vibrant, and financially successful defense industry is ... in the national interest."¹

I will discuss the policies and processes adopted by the Department to actively strengthen the sources of science and technology—the industrial base, defense labs and academia—to sustain technological superiority, provide innovative capabilities and acquire dominant warfighting weapon systems for our soldiers, sailors, airmen, and marines.

THE INDUSTRIAL BASE IN A NEW ERA

DOD relies on a robust and capable defense industry to develop, field, and maintain high quality equipment. America's industrial capacity and our capability enabled victory in World War II, maintained the technological edge against the Soviet Union, and today helps ensure that our military personnel in harm's way have the world's best equipment, supported by modern logistics and information systems. Our technological dominance is what enables us to accomplish our national security missions. To sustain this advantage, the Department must continuously sustain and strengthen the key sources of militarily relevant science and technology from its sources in the defense and non-defense industry, government laboratories, and academia.

As the era of sustained growth in the defense budget comes to an end, the Pentagon's stewardship task becomes more challenging. The Department needs to adapt its industrial base considerations and actions to the emerging reality of relatively flat defense budgets. In the past 2 years, the Department has significantly increased its efforts to address the implications of the changes in the arc of the national security budget on our defense industry.

Our base today is more global, more commercial, and more financially complex than it was in the past. The defense industry, from the prime contractors that work directly with the government to their subsystem and component suppliers and even their raw materials suppliers, is constantly changing, constantly adapting to the Department's requirements and to the conditions in the marketplace. This natural evolution in the base is inherent in a free enterprise system, but it can bring with it new challenges for a DOD that seeks to sustain and grow a strong defense industrial base even as budget growth declines.

Those challenges posed by a relatively flat defense budget vary across the many sectors of the defense industrial base. The situation for companies that offer platforms like ships and tanks differs from the situation for companies in emerging sectors like unmanned vehicles and cyber-defense. The situation differs at various tiers and with the products produced. At some levels, a key supplier may make a truly defense-unique product, while other suppliers at other tiers are motivated primarily by their sales to commercial markets, offering innovative products to the defense supply chain as a sideline—a sideline for them, in terms of revenue, that may be vitally important for the Department, in terms of military capability or cost control. Understanding and reacting to this complexity in the industrial base, the Department must increasingly tailor its relationships and policies to specific circumstances. One area of particular concern is maintaining adequate product "design teams" for the key weapons systems product types that the Department procures. A long hiatus between new program starts in a given area can call into question the continued existence of experienced design teams and the body of knowledge they bring to development of certain types of products. Once lost, rebuilding this type of capability

¹ Ashton B. Carter, "The Defense Industry Enters a New Era," Remarks at the Cowen Investment Conference, New York, NY, February 9, 2011.

can take a generation or more and the Department must be particularly vigilant about situations where this can occur.

To understand this increasing dynamism and complexity the Department is pursuing multiple, concurrent efforts to map and better understand the defense industrial base. This approach is in contrast with other more traditional narrow program-focused and product-focused assessments. The Department will replace intuitive judgments about the impacts of changing domestic demand, globalization, commercial-military integration, emerging sources of innovation, and other issues with data-driven industrial base evaluations. By continuously assessing the industrial base on a sector-by-sector, tier-by-tier basis, the Department will develop a reservoir of critical and actionable information.

Looking ahead, this deeper understanding will be increasingly important as the changing budget environment prevents the Department from readily addressing program management and industrial base challenges with the simple antidote of increasing expenditures. For the fifth time since the Second World War, DOD is facing a significant defense budget transition, in this case from a decade of rapid year-on-year growth. Nevertheless, we do not expect the base defense budget to fall precipitously, like it did in the post-Cold War transition. The Department will still be a significant market for the industrial base, will still support an innovative science and technology base, and with appropriate attention will still maintain our technological advantages.

That said, we do need to manage our investments more effectively to ensure a healthy industrial base. A decade of rapid budget growth driven by pressing operational needs has fostered an environment in which cost discipline has lost ground to the urgency of operational needs and projections of rapidly evolving threats, both in government and in industry. Greater efficiency is one answer. Secretary Gates' efficiency initiative, which includes Under Secretary Carter's Better Buying Power Initiative addressing the contracted expenditures of the Department, is already helping adapt both the Department and our industrial base to the new fiscal realities; but efficiency is only one part of the solution set to the challenges we face.

A HEALTHY INDUSTRIAL BASE

The industrial base equips our war-fighters. Industry makes the products that our service men and women depend upon. America relies on a defense industry that is healthy, robust, and innovative. A healthy industry is one that on the whole makes a competitive profit. Companies exist to make money, and without that potential no one would be competing to win defense contracts. As a whole, most corporations in our base fare well, particularly in comparison with other relatively mature industrial sectors. In addition, our primes typically have the advantage of strong backlogs and significant visibility into plans and programs in the markets they serve. DOD will not deny the businesses it deals with the opportunity to make a reasonable profit. Individual companies, however, if they do not provide the government with quality products that meet the Department's requirements on time and at reasonable cost, should expect to make reduced or no profits. In the high budget environments of the past many companies have grown to expect high margins independent of the quality of their performance. As budgets shrink this practice must stop.

A healthy industrial base is not just profitable. Being healthy also includes being fit, or if you will, lean. Competition, disciplined cost negotiations, and well structured contract incentives are the key motivators the government can employ to ensure that our industrial base is lean. Competition is one of the key drivers of productivity and value in all sectors of the economy, including defense. Sometimes competition is provided by having two or more providers of the same thing go head-to-head, but where this is not possible we can still harness this power through a wide variety of other competitive strategies that create a competitive environment where companies are not complacent about the work they will receive.

Contract incentives must provide rewards for good performance and consequences for poor performance. Achieving this balance is a key goal of the Department's Better Buying Power effort. As such, the Department is pursuing initiatives to reward contractors for successful supply chain and indirect expense management, such as increasing the use of Fixed-Price Incentive Fee contracts where it makes sense, but not where it puts unreasonable risks on industry.

As the budget environment changes, we expect companies to adapt to this new era through both organic efficiencies and inorganic growth and realignment. Successful companies are constantly trying to anticipate market shifts and position themselves to be more competitive and to achieve greater growth and profitability. In general this is a healthy process. So readjustment to new technologies, priorities, and defense budgets is likely to involve a normal course of realignment as compa-

nies move to position themselves for growth, competitiveness, and efficiency improvement.

The Department is very conscious that the top tiers of the defense industry have already consolidated significantly, and we do not anticipate it to be in the best interest of the warfighter or taxpayer to see additional merger activity among the top prime contractors. But we do expect some increased activity at the middle and lower tiers, activity that we will monitor closely. We will be particularly attentive and vigilant to vertical integration, especially when such combinations capture key suppliers or technologies that may restrict the availability of components and sub-systems to multiple players on a competitive basis. We have some tools to influence these activities, such as the Department's roles in the Hart-Scott-Rodino and the Committee on Foreign Investment in the United States processes, along with some Defense Federal Acquisition Regulation Supplement regulations concerning matters such as organizational conflicts of interest. In this new era it is critical that the Department communicate clearly, openly, and consistently about our concerns as early as possible. We don't want industry wasting its time and effort on unacceptable combinations or in pursuit of business arrangements that the government will ultimately find objectionable. The Department understands that we need to be transparent and consistent and avoid reversing direction whenever possible.

Toward that end, we have publicly described our expectations, or "guideposts," for any future industry rationalization and consolidation. Dr. Carter laid out these guideposts publicly in a speech he delivered in New York in February 2011. Well aware that each suggested transaction must be examined on its own individual merits, we have laid out the overall environment in which we expect this industry to operate. From the Department's perspective, we need firms and suppliers interested, as we are, in a long-term commitment to the base, not short-term financial gains which may ultimately erode the viability and vibrancy of our suppliers. In this respect, our viewpoint is similar to long-term investors who pursue a balanced portfolio and expect positive returns over time. This is a message we convey both publicly and privately in our interactions with both industry and Wall Street.

While working with our traditional suppliers as they reshape their business models and practices, the Department also encourages new sources of competition in the form of new entrants into our market. New entrants renew and refresh the technology base and ensure that defense is benefitting from the main currents of emerging technology, particularly commercial technology and technology originating in small businesses. We must redouble our efforts to lower the barriers to entry. We are addressing many of these barriers—such as needless or time-consuming paperwork—again as part of the Better Buying Power Initiative, not just because they impose unnecessary costs but also because we want to make it easier for companies to do business with us.

Our efforts to encourage competition in the industrial base build on our commitment to gain insight about the state of the base's health before dictating oversight—insight that the Department has historically lacked, especially about the companies at the lower tiers of the industrial base. We have undertaken an aggressive effort to map and assess the industrial base sector-by-sector, tier-by-tier (S2T2). The goal is to understand the gross anatomy of the industrial base. Just as doctors do not seek to understand the functioning of every individual neuron in the central nervous system, the Department does not seek to know the exact details and reasoning behind every supplier relationship. But we do need to better understand the industrial base's nervous system, circulatory system, and bone structure.

Improved understanding of the structure of the defense industry aligns with the Better Buying Power Initiatives. For example, the Department expects to reward prime contractors for successful supply chain management, efforts that add value to DOD by reducing the costs of the components integrated further up the product stream. Understanding subtier-level connections between the Department's programs will improve our own supply chain management, helping the Department's efforts to maintain economical and stable production rates at multiple tiers. A better baseline of industrial base data will assist programs' market-research efforts, including in the area of contracted services, where market research needs particular attention and where the Department tends to pay rates above commercial rates. Comprehensive information about industry's deeper structure will help program managers develop strategies to increase competition, as directed under the Better Buying Power Initiative.

As the budget environment changes we expect that some niche firms will have trouble staying in business due to temporarily decreased demand. We expect these firms to be proactive about their concerns, but the Department will be proactive also. We will attempt to identify early warning signs of particular product niches that may get into financial trouble due to temporarily decreased demand despite the

fact that they offer truly critical, unique and necessary capabilities. While we anticipate these cases to be exceptions, we must nonetheless be prepared on occasion to tailor our investment policies to preserve essential capabilities. We need sufficient insight to make these strategic investment choices.

The new S2T2 repository of industrial base data will also serve as a jumping off point for future assessments by all Defense components, ensuring that data collection and analysis cumulates, thereby increasing the value of all industrial base assessment efforts. Having one office in the Department leading this effort will prevent duplication of effort that wastes the Department's resources and harasses over-worked program offices and contractors with multiple, redundant requests. Sustaining and strengthening the data over time will also contribute required insight to the Department's merger, acquisition, and divestiture reviews and other industrial base policies.

While the Department certainly needs more systematic insight into the industrial base, we are already aware of the important outlines of major changes, and we are implementing policies to address the new realities. During the Cold War our industrial base consisted primarily of US-owned and -operated private firms building defense-unique products almost exclusively for the Department. This is clearly no longer the case. We now find ourselves buying products from international commercial and mixed defense and non-defense companies that service many customers—both within and outside of defense markets.

The Department has found that this shift from defense-unique to commercial companies is typically in the best interest of the warfighter and the taxpayer. Buying from commercial sources and taking advantage of commercial technology in areas like information technology incorporates more innovative products into the military's arsenal, and it does so at a lower cost to the taxpayer. It also injects more competition into our buying processes and allows for quicker integration of technology improvements into weapons systems.

But buying commercial goods and services is not without risks and complications as well as rewards. The commercial base has become increasingly global in nature. It maintains global supply chains, gets financing from global investors, and employs a global workforce. Globalization poses numerous advantages and challenges. Foreign competition pushes our domestic base to continue producing innovative, cutting-edge products that can compete with new international entrants, fomenting competition in price and capabilities throughout the vendor base. It allows the Department to benefit from a broader base of R&D and capital investments, augmenting our own investments that draw on the U.S. Government budget. Sharing technologies and processes among allies also helps ensure that when we engage around the world, our systems are interoperable to the greatest extent possible.

On the other hand, the benefits of globalization are tempered by potential risks. Some foreign nations and non-state actors are constantly trawling global supply chains, trying to gain access to critical U.S. technologies and information on U.S. defense systems. Similarly, the United States needs to address risks that counterfeit parts or even components intentionally designed to subvert crucial defense systems could slip in through the increasingly complex, global supply chain. The Department is strongly committed to rigorous systems testing and to our anti-counterfeit and program protection plan initiatives. We also cooperate closely with other parts of the government on some of these responses to globalization.

As a key example of the whole-of-government response to globalization, DOD—along with the NSC and the Departments of State, Treasury, and Commerce—is currently developing reforms to our export control process to protect our most valuable technologies—our “Crown Jewels”—while also streamlining the process to make it easier for companies to export parts or systems that are not critical defense capabilities. Improving the U.S. defense industry's ability to export is the necessary and expected flip side to our own increased openness to globalization of the defense supply chain: as foreign firms inject competition into the U.S. market, U.S. firms should gain equivalent advantages in overseas markets.

Globalization also poses unique risks of supply chain disruptions. Natural disasters can happen anywhere in the world, and even an entirely domestic defense supply chain could face disruptions. But if a disruption occurs at a domestic supplier, the Department can use Defense Priorities and Allocation authorities under the Defense Production Act to compel U.S. industry to prioritize DOD critical orders. Those authorities do not extend overseas, so when disruptions occur at foreign suppliers, the Department may have a more difficult time adjusting. We are working to alleviate this challenge by increasing the use of bilateral defense trade agreements and security of supply agreements with our allies.

Finally in order to have a healthy industrial base the Department must have an acquisition system that avoids false starts—programs that are canceled after sub-

stantial investments, but before serial production. We want our industrial base to produce high-quality systems that are delivered to the Department and that serve our warfighters' needs. The Department has a long history of beginning programs that we ultimately discover are unaffordable to produce. This certainly doesn't benefit the Department or the taxpayer and it doesn't benefit our industrial base. For these reasons the Better Buying Power Initiative stresses affordability as a key parameter of the defense acquisition process. We are now forcing planners in the Department to confront affordability constraints at the beginning of programs when requirements are formulated and we are putting cost caps on all new starts that we will enforce over the life of the program.

We must leverage creative innovation and turn it into real products, meaning that we need to continue our efforts to strengthen the focus on technology transition and manufacturing process development. As a 2006 Defense Science Board Task Force study led by Dr. Jacques Gansler concluded, use of immature manufacturing technology and processes, particularly among lower tier suppliers, substantially increases the cost of new weapon systems. The National Defense Authorization Act for Fiscal Year 2011 presented new opportunities to align assessments of subtler capabilities with programs like Title III of the Defense Production Act, the Manufacturing Technology Program, and the Industrial Base Innovation Fund that are geared specifically toward addressing these manufacturing readiness concerns. Congress has long championed these important programs, and we look forward to continuing our partnership to support the warfighter at the best value for the taxpayer.

SOURCES OF INNOVATION IN INDUSTRY, ACADEMIA, DEFENSE LABORATORIES, AND FEDERALLY FUNDED RESEARCH AND DEVELOPMENT CENTERS (FFRDCS)/UNIVERSITY AFFILIATED RESEARCH AND DEVELOPMENT CENTERS (UARCS)

The technologies that provide the basis for all our weapons systems are created through a variety of mechanisms in industry, academia, and defense laboratories. The Department maintains a strong relationship with industry through a variety of programs designed to foster collaboration and encourage innovation—Industry Independent Research and Development (IR&D) programs; the Small Business Innovation Research (SBIR) program; and Cooperative Research and Development Agreements (CRADA). The Department's IR&D program encourages firms to pursue innovative technological solutions to the most challenging operational problems, both for near-term missions and to prepare a vibrant tech base for an uncertain future. DOD reimburses approximately 1,200 firms in the industrial base for IR&D efforts, thus providing opportunities for innovation to both the large primes and the smaller mid and lower-tier firms. The IR&D funding is critical to ensure a healthy talent base in industry and to keep industrial design team skills sharp over the long term.

The Department has recently launched initiatives to increase communication with industry regarding technology needs and operational requirements to ensure maximum return on industry's IR&D efforts, which the Department reimburses as an allowable cost. For example, the Department is preparing Vendor Communication Plans which provide clear guidance and encourage communication between industry and government about requirements and technology objectives. The Department is also reaching out to industry to find new ways to collaborate through sharing of detailed information about their IR&D projects and the Department's technology roadmaps. We believe efforts like these will encourage Industry to continue to invest in high-quality R&D projects, and also help them identify the technical talent they will need for the near and long term to be a successful source of innovative technology for DOD.

The Department also uses its SBIR program to fund S&T talent at small businesses. In fiscal year 2010 the Department issued approximately 2,000 SBIR Phase 1 awards and approximately 900 Phase 2 awards. The Department also concluded approximately 2,500 CRADAs across a broad industrial base. SBIR projects and CRADAs leverage the innovation created by the industrial base talent to bring new ideas into the Department. These vehicles provide support to small businesses which are the greatest engines for innovation and growth in our economy.

The Department's basic research program, primarily with Universities, paves the way for our technological future—the scientific discoveries it yields today provide the foundation for tomorrow's capabilities. Given the increased global emphasis on R&D, the United States cannot assume an assured technological superiority on the battlefield; to do so it must remain on the scientific cutting edge. The President's commitment to an appropriately funded basic research program is reflected in the Department's fiscal year 2012 budget request. The budget requests increases the Department's basic research accounts by \$79 million to \$2.078 billion, or 2.2 percent real growth from the fiscal year 2011 President's budget request.

The Department also supports an extensive program to shepherd discoveries into solutions to today's problems and to develop the next generation of research leaders who will set the vision and exploit opportunities. In order to increase the effectiveness and value of the Department's basic research program, the research and engineering enterprise has redoubled efforts that: attract and inspire the best scientists to engage problems of defense importance, and to enable those scientists to better interact with developers and users; improve management practices and policies to enhance productivity and enable scientists to better communicate and collaborate; identify emerging areas of science with the potential for significance to defense capabilities; and focus DOD basic research on specific domains of defense interest, and on transformational scientific opportunities.

Basic Research is fundamentally about creating knowledge, and innovation occurs when that knowledge is used in creative ways. The Department believes sharing basic research information helps advance the progress of knowledge and attracts the best talent. Last year the Department reaffirmed and extended its policy towards removing restrictions on publication of fundamental research results. We believe this will encourage researchers to work in areas important to the Department.

Another key source of technological innovation is the Department's laboratories. The laboratories serve as the technical core of the Department and encompass an important pool of talent and resources. This footprint includes 67 DOD laboratories dispersed across 22 States with a total workforce of 60,000 employees; 35,400 of whom are degreed scientists and engineers who conduct DOD-relevant research leading to key technology demonstrations and publish thousands of reports and peer-reviewed technical papers. In many cases, this community defines a technical field with seminal work and leads the industrial base in their respective areas.

This highly skilled workforce and associated unique infrastructure perform state-of-the-art basic and applied research; respond to rapid need requests (prototyping, equipment modifications, etc.), support acquisition programs and the deployed forces. The defense industrial base looks to the DOD labs for new ideas and concepts for next generation weapon systems while academia works closely with the labs to transition new concepts into the military technical community.

Through special direct hiring authority granted by Congress, we have the ability to rapidly hire new graduates in emerging critical areas for the Department.² As a result of this authority lab directors have latitude to implement personnel policies to hire, reward, and train the talent necessary for them to execute their respective missions.

This authority has enabled lab directors to replace engineering staff lost through attrition and quickly respond to changing technology requirements. In fiscal year 2010 the labs used this authority to hire 114 qualified staff.

A source of unique capabilities in many areas where the government cannot attract and retain personnel in sufficient depth and numbers is the FFRDCs. FFRDCs operate in the public interest, free from organizational conflicts of interest, and can therefore assist DOD in ways that industry and for-profit contractors cannot. Our FFRDCs maintain long-term capability in core competencies in domains that continue to be of great importance to the Department, such as analysis, engineering, acquisition support, and R&D. I view them as a vital component of the overall acquisition workforce.

UARCs provide an effective conduit for capturing diverse university-based engineering and technology capabilities that are essential to the DOD. They advance DOD operations via application of leading edge research, development or engineering in specific domains and maintain core competencies in those domains for the benefit of all DOD components and Agencies.

STRENGTHENING THE GOVERNMENT'S ACQUISITION WORKFORCE

The Department is committed to a strong acquisition workforce in industry and government. Competitive pressure is used to motivate industry to increase its scientific and engineering capabilities. DOD, with assistance from Congress, is in the midst of rebuilding its own scientific and engineering workforce. Without a strong professional technical workforce the government cannot effectively define, evaluate, and manage the defense contractors who develop products for the Department. This workforce was downsized dramatically during the 90s and we are in a rebuilding phase that needs to continue. While we have made progress in restoring the workforce size, our single greatest concern is building the human capital available to DOD inside and outside the government. Talent matters! We need people with the

²Science and Technology Reinvention Laboratory (STRL, also known as "Demonstration Labs")

right ability, training, and experience to take on major responsibilities for stewardship of the taxpayers' investments in a broad range of national security systems. We are concerned about our program management, engineering management, and contract management capabilities. Our industry partners share identical challenges. We must actively attract talent (enrich the pipeline) and then support the newly hired acquisition workforce—build on their talent with key experience and training—engage, motivate, and retain. We must help the mid-career workforce prepare to lead the 21st century DOD acquisition mission as the “space age” workforce enters retirement.

This mid-career workforce is one fifth the size of the senior experienced workforce. We must deliberately provide opportunities to them to get the experience they need to take on major responsibilities and lead into the future.

In authorizing the Defense Acquisition Workforce Development Fund, Congress recognized the importance of training and developing the acquisition workforce. Anticipating the recruiting of new talent and the need to improve training, we have added faculty to the Defense Acquisition University, particularly in contracting, but also in the management and engineering disciplines. The training will equip the workforce to apply their skills and energies to managing their programs and the contractual efforts that deliver goods and services in support of national defense, to do so efficiently and effectively, and to eliminate wasteful effort which is spent, in effect, on managing the internal bureaucracy.

Strengthening the Department's Systems Engineering Workforce

A key focus within the Department's research and engineering enterprise is to ensure that the Department's engineering workforce is trained and experienced enough to meet the needs of complex systems engineering efforts, test and evaluation efforts, and ensure a future supply of talent, both for the Department and the industrial base. To ensure we are on the right path, the Department has launched a comprehensive survey of the Department's Systems Planning, Research, Development and Engineering-certified engineering workforce. This survey will assess the current competencies and identify any skills gaps that may exist between the workforce's current capabilities and those needed to meet current and future mission requirements. This assessment and resultant gap analysis will help shape future workforce development and human capital planning initiatives.

We have established several engineering workforce development initiatives to address the growing department and industry challenge of attracting and retaining the most qualified systems engineering technical leaders to address defense acquisition challenges. These initiatives include implementation of the engineering portion of the Key Leader Professional Development program, working with the defense industry and engineering professional organizations on education and training initiatives, and conducting national and international workshops that explore lessons learned in systems engineering education, training and experience development. One such initiative is the Systems Engineering Capstone pilot program, which is designed to increase systems engineering skills in engineering students, and increase the pipeline of systems engineers available to DOD. The program inspires students to solve the types of system engineering challenges evident among DOD programs. Three hundred undergraduate and graduate students at 14 educational institutions, including Service Academies and graduate schools, currently participate in this program.

Future Science and Engineering Talent; Science, Technology, Engineering, and Math (STEM) Programs

The Department's STEM Programs are focused on growing the pool of talent to replace the aging workforce. The Department requires specific expertise in established and developing disciplines. We continue to foster a strong relationship with future scientists and engineers.

In May 2010, the Department submitted to Congress its STEM Education and Outreach Strategic Plan. This plan, developed by 27 senior leaders from across the DOD, lays out our vision to develop a diverse, world-class STEM talent base by. The implementation strategy strengthens our STEM education and outreach portfolio and provides for specific processes and measurement criteria. The strategy includes a STEM governance architecture consisting of a DOD Executive Board, and links to the newly formed National Science and Technology Committee (NSTC) on Education and a defense industry forum. The STEM Board of Directors will meet later this spring to discuss the Implementation Strategy.

Core to the strategy is the National Defense Education Program (NDEP). NDEP invests in inspiring, developing, and attracting the current and new generation of STEM talent. NDEP also enhances students and world-class researchers' interest in DOD by offering opportunities for direct engagement with DOD labs and Component technical staff.

NDEP's K-12 program enhances STEM education through public-private engagement between DOD and local schools and organizations. DOD research and engineering professionals serve as direct conduits for inspiring students to learn STEM and, in the process, motivate many to pursue STEM careers. Currently, 1,750 DOD scientists and engineers in 26 States have engaged 180,000 students and 8,000 teachers.

The Science, Mathematics and Research for Transformation (SMART) program funds 670 undergraduate, graduate, and doctoral students in 19 DOD-relevant fields of study. SMART is a scholarship-for-service program—participants commit to 1 year of DOD employment for each year of academic support received. Since 2006, nearly 300 students have transitioned into the DOD workforce. The program is popular—we received 2,800 applications earlier this year and selections will be made soon.

The National Security Science and Engineering Faculty Fellowship (NSSEFF) focuses on distinguished scholars and graduate students. The program awarded long-term funding to 29 distinguished university faculty members to conduct basic research on topics essential to national security. Connections to the faculty enable the program to leverage more than 150 students and postdoctoral scholars serving on research teams. The NSSEFF enables partnerships between the faculty and their research assistants with scientists and engineers in the DOD laboratories, providing us opportunities to identify and recruit top talent.

CONCLUSION

We do not have, nor do we desire, an arsenal system. Today, a competitive and robust industry makes the weapons and support systems that give the U.S. military its crucial technological edge. Companies use their understanding of technology and business to choose investments, key technical talent, the best supplier networks, and other business strategies, and they can earn respectable profits from reliably delivering high-quality products. The Department has no desire to replace or reduce industry's profit motive, a strong incentive for good performance of which we intend to take more effective advantage.

The Department has its own key roles: responsibly investing taxpayers' money, preserving healthy competition, and managing across portfolios of defense systems where individual contractors cannot know how progress on one system will affect industrial capability to support another system. Fortunately, leaders in both the DOD and the defense industry widely recognize their coincident long-term interests in supporting the warfighter and protecting American national security.

But the leaders also recognize the key differences in their interests, too. We are buyers, they are sellers, and we both hope to negotiate good deals in our self, and collective, interests. The best outcome is to find win-win strategies, where contractors earn profits for superior performance and the Department gets quality products for a fair price. The Department's initiatives like Better Buying Power, the sector-by-sector, tier-by-tier assessment of the industrial base, and programs to promote STEM and reinvigorate defense R&D should position us all to find more win-win situations in the future.

Congress has been actively involved in shaping and supporting the Department's initiatives. Your support in funding, expedited hiring authority, workforce recognition and incentives, and other human capital legislation has been very important for our current success. Congress has also supported the Department's engagement with industry, affording the Department the tools necessary to maintain a healthy industrial base. Complete success will not be achieved overnight. As Secretary Gates has stated, "there are no silver bullets." Dr. Carter and I appreciate this support and look forward to continued partnership to best serve the taxpayer.

Senator HAGAN. Thank you, Secretary Kendall.

Secretary Lemnios, and due to time constraints, if you could limit it to about 5 minutes. Thank you.

STATEMENT OF HON. ZACHARY J. LEMNIOS, ASSISTANT SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

Mr. LEMNIOS. Chairman Hagan, Ranking Member Portman, members of the subcommittee, thank you for this opportunity to discuss DOD's research and engineering activities that foster innovation and our progress in growing our engineering workforce.

The defense industrial base, our defense laboratories, and our Nation's research universities are the envy of the world. They have consistently provided DOD with a wealth of ideas, research and engineering resources, and capabilities that give our men and women in uniform a decisive tactical edge. DOD maintains a strong relationship with the defense industrial base through programs designed to deliver capabilities and foster collaboration and encourage innovation.

The industry's Independent Research and Development (IR&D) investments, which DOD reimburses to over 1,200 firms at a total of approximately \$4 billion annually, has resulted in acceleration of capabilities breakthrough in a number of tactical areas. We're also relying on our small business community to provide additional avenues of innovation. Our small business innovation research program and DOD's cooperative R&D agreements with industry have a successful track record of driving innovation and transitioning concepts to capabilities.

In fiscal year 2010, DOD awarded approximately 2,000 phase one and 900 phase two Small Business Innovative Research (SBIR) awards and has over 3,200 contract R&D agreements with small businesses across this Nation. This provides an entire avenue of critical technology capabilities.

DOD's laboratories are another source of innovation and they serve as the technical core of DOD. This enterprise includes 67 laboratories across 22 States, with 60,000 employees, of which 35,000 hold degrees in science and engineering. These laboratories provide a unique opportunity for academia and industry to develop and test new ideas, new concepts, in operationally relevant environments.

DOD's basic research program has a strong coupling with academia and with industry and paves the way for the future. Today's scientific discoveries provide tomorrow's capabilities. The President's fiscal year 2010 budget request for basic research funding is just over \$2 billion for precisely that reason.

But in the light of this current environment, characterized by global R&D, reverse talent flow, and economic pressures, our challenge is to realign this tremendous research base to better meet the current and future needs of DOD. We must add depth and capacity to the acquisition workforce. We must communicate effectively with the S&T workforce to ensure that their products align with DOD's needs, and we must incentivize the defense industrial base. All of these topics you will hear about today.

The health of these three sources of innovation—the defense industrial base, the defense laboratories, and our universities—relies primarily on the talent they employ and those they can access. In each of these domains, talent matters. Our acquisition workforce is in the early stages of a revitalization. This is where we need immediate depth and understanding to develop and execute programs that deliver capabilities for DOD on schedule and within budget.

In authorizing the Defense Acquisition Workforce Development Fund, Congress recognized the importance of training and development. This last year we added 484 key staff in each of these areas to our Department's workforce.

We've also added faculty at our Defense Acquisition University to provide DOD with a workforce of continuing education and op-

portunities for many. In fiscal year 2010, Defense Acquisition University trained 46,000 classroom students, 193,000 web students, and delivered over 2 million hours of online content.

We've established several engineering workforce development initiatives, including systems engineering capstone courses. This has allowed us to connect with leading systems engineering universities to train an entirely new cadre of systems engineers for DOD and eventually for the defense industrial base.

Congress has granted our laboratories special authority to rapidly hire new graduates to replace the scientists retiring from their work in critical areas for DOD. In fiscal year 2010 we used this authority to hire 114 first-rate staff in critically significant areas across our defense laboratories.

Our STEM programs are focused on growing the research and engineering talent for DOD's future. Our national defense education program is targeted to attract and develop new STEM talent. Through this program, 1,750 DOD scientists and engineers in 26 States have engaged 180,000 students across the Nation and 8,000 teachers to inspire young students to join the ranks of the defense industrial base in DOD's key mission areas.

Our science, mathematics, and research for transformation program, our SMART program, funds currently 670 undergraduates, graduates, and doctoral students.

Senator HAGAN. Mr. Lemnios, if you could wrap up in about a minute.

Mr. LEMNIOS. Absolutely.

The key point here is that with DOD's investments in these STEM initiatives driving new areas for work in critical technology areas, we're strengthening the work of DOD, we're building the defense industrial base that's structured in new technical areas, and we're driving new concepts that will eventually find their way to support the programs within DOD.

We recognize that we're early in many of these phases. It's an effort that requires alignment across the defense structure and the private sector and this is something that we're absolutely committed to.

I thank you very much for the opportunity to address you this afternoon.

Senator HAGAN. Thank you.

Secretary Lambert.

STATEMENT OF HON. BRETT B. LAMBERT, DEPUTY ASSISTANT SECRETARY OF DEFENSE, MANUFACTURING AND INDUSTRIAL BASE POLICY

Mr. LAMBERT. Chairman Hagan, Ranking Member Portman, thank you for the opportunity to be here today.

As Mr. Kendall noted, DOD is reliant on having a robust and capable defense industry. The base does not exist in abstract. It's comprised of thousands of highly skilled workers pursuing advanced technologies, some of which are seemingly unimaginable, all in support of the warfighters.

What's often overlooked is that the goods and services that DOD relies upon reach far deeper into the overall U.S. economy than most appreciate. In many cases, such as the price of oil, steel, or

the increasing cost of health care, DOD's challenges mirror that of the overall U.S. economy. In short, we don't operate in an economic vacuum. While there are unique items produced solely for DOD and other Federal agencies, even these items often rely upon a complex supply chain of product providers which, if restricted at the second, third, or even fourth tiers, would jeopardize seemingly pure industrial players' ability to support the warfighter on an on-going basis.

Understanding these structures and tiers, their interdependence to one another and the programs they serve is central to pursuing an effective and sustainable industrial policy. Toward this end, we believe it is essential to gain insight into our base before dictating any oversight. Combing through the industrial base sector by sector, tier by tier, under the Security Standards Transition Team (S2T2) initiative outlined by Mr. Kendall will help us develop a reservoir of critical and actionable knowledge.

The improved understanding of the structure of the base aligns nicely with DOD's Better Buying Power initiatives. For example, DOD plans to reward contractors for successful supply chain management. The incentive can be informed by the examination now under way.

Likewise, understanding the sub-tier level connections among DOD's programs and across the Services will improve our program management and help DOD's efforts to maintain economical and stable rates of production.

The new S2T2 repository of industrial base data can also serve as a jumping-off point for future assessments of all defense components, ensuring that the data collection and analysis cumulates over time and thereby increasing the value of all industrial base assessments as we move forward.

Sustaining and strengthening the data over time will contribute to the required insight to DOD's merger, acquisition, and divestiture reviews, as well as other industrial base policies. Greater depth and breath understanding of our entire base will increasingly be important as the changing budget environment prevents DOD from readily addressing program management and industrial base problems with the simple salve of additional resources. That solution is simply no longer an option as the double-digit year over year growth that characterized the past decade is gone for the foreseeable future.

Greater efficiency is one answer in the new budget reality and DOD's efficiency initiative, including the Better Buying Power, is already helping adapt both DOD and our industrial base to the new fiscal realities. But efficiency through process improvements is only one part of the solution. We must also examine how the structure of our industrial base can impact costs without sacrificing critical capabilities. As Mr. Kendall stated, DOD is very conscious that the top tiers of the defense industry have already consolidated significantly. That said, we do expect more activity at the mid and lower tiers, activity which we will monitor closely. We will be particularly attentive and vigilant to vertical integration, especially when such combinations affect key suppliers or technologies that could be denied to other potential competitors or where lower-tier

firms would be denied opportunities to offer their components or subsystems to multiple players on a competitive basis.

In addition to guarding against constraints on competition within the existing base, DOD also encourages new sources of competition and new entrants to our market. New entrants renew and refresh technology and ensure that the defense is benefiting from the main currents of emerging technologies. We must redouble our efforts to lower the barriers to such entry.

We're addressing many of these barriers, such as needless and time-consuming paperwork, not just because they improve—they impose unnecessary costs, which are ultimately passed on to the taxpayer, but also because we simply must make it easier for innovative companies, particularly advanced technology companies, to do business with DOD.

We must also better leverage creative innovation and turn it into products, meaning that we need to redouble our focus on what in the commercial environment is referred to with “bringing product to market.” This requires technology transition and manufacturing capacity development. Use of immature manufacturing technologies and processes, particularly among the lower tier suppliers, brings with it a multitude of inefficiencies and substantially increases the cost of new weapons systems.

The National Defense Authorization Act for Fiscal Year 2011 offered new opportunities to focus on sub-tier suppliers as well as manufacturing capabilities. Congress has long championed these important efforts and we look forward to continuing our partnership in these matters.

Thank you for the opportunity and I look forward to your questions.

Senator HAGAN. Thank you, and thank you for all of your testimony.

Ranking Member Portman, if you have an opening statement.

STATEMENT OF SENATOR ROB PORTMAN

Senator PORTMAN. Thank you, Chairman Hagan, and I appreciate my colleagues being here. What I'd like to do is make a brief opening statement and then forego my questions until after the other members have had a chance, including you, to ask questions, because I have a lot of them. I thank you for holding the hearing today and I thank our panel and I look forward to the second panel as well.

I'm sure you did this at the outset already, but I just want to start, as we must today, congratulating your colleagues, the men and women in uniform who performed so admirably over the weekend, and of course our intelligence services. We are so grateful to them. This is a moment we've long awaited.

It also doesn't mean that al Qaeda and its affiliates are not going to continue to create enormous difficulties for us as a country and for the world. They were not dependent on one man and so we must remain vigilant.

We also have to be cognizant of the fact that we are in a difficult time around the world in so many respects. I just got back from a trip to Asia, Korea and India, and military growth by states in Asia and the Pacific continues to alter the regional balance of

power, and certainly what's happened in the Mideast with the Arab spring has altered the way we look at the Middle East and North Africa. We are still engaged in this battle with so many extremist groups that want to kill Americans by any means possible in places like Iraq and Afghanistan, but all around the world.

We have great challenges. As we've heard from the panel today, Chairman Hagan, we remain a dominant military force, the dominant military force, but we also have big challenges being able to maintain our superiority, our qualitative technological superiority, without driving our Nation further into debt and without depriving DOD with necessary funds in other areas that would compromise our security.

This is going to be a difficult process going forward and we appreciate your input. Having a robust defense industrial base is going to be critical to have the tools to do the job. I also believe that having an industrial base that has some diversity is critical to be able to maintain competition. One of the concerns I have with the consolidation that you, Secretary Lambert, were just talking about. Of course, our military base, our industrial base, hasn't been immune to everything else that's been happening in the economy and we do have a changing defense marketplace.

I recently read that the Chief of Naval Operations said he believes the defense industrial base today is as fragile as it's ever been. That's a pretty strong statement. Certainly you talked about the consolidation, the exodus of some companies from the sector, and the international marketplace being incredibly competitive these days.

Our workforce is aging in the industry, as you all know. Some of our brightest minds are exiting the stage. We still have too few students entering into the STEM disciplines, which are so critical to our national security. I know we're going to talk more about that in the questions, I hope. Of course, we have students from overseas still taking advantage of our superior educational opportunities here, but increasingly they're returning home. Some of the data I saw in preparation for this hearing, Chairman Hagan, about the degree to which Indian and Chinese students believe they have a better chance creating and starting a company and pursuing their dream back in India and China is concerning for the U.S. industrial base.

We have challenges we need to address. We need to ensure our competitive advantage is not reduced at this critical time. I realize some of these are going to take time to solve and I appreciate the remarks already and look forward to questions on that topic.

I will now defer to you, Chairman Hagan, and other members, and come back for my questions.

Senator HAGAN. Thank you.

I did want to update. I said earlier there was going to be a 3:30 vote. Now it looks like it's been postponed to 3:45.

I wanted to ask a question to you about the future scientists and engineers that we're all concerned about for DOD and the defense industry, following up on what you also said, that the majority of graduates from our universities with advanced degrees in the STEM fields are now, many of them, non-U.S. citizens. In the past, many would remain in the United States to pursue their careers

in their fields of study. But, however, increasingly they are now returning to their home countries.

Mr. Lemnios, do you believe that it would be in our national security interest for DOD and the defense industrial base to have access to this talent pool, and is it in our best interest to develop a pool of highly educated scientists and engineers who will then go back to their home countries and actually end up competing against us?

Mr. LEMNIOS. Chairman Hagan, that's one of the things that keeps me up at night. At the end of the day, we need the best minds and we need the best ideas. As I look—and I've visited many universities. In fact, just last week I was at a Big Ten conference of university provosts to discuss exactly that issue.

There are really two parts of that discussion. The first is where do the ideas actually reside. They reside in the departments that exist within our universities, and so we have programs and efforts in place to really bolster those concepts. But they also reside in the students. In that area, we have—we are in fact funding U.S. students and foreign students in our basic research program, and we have very few avenues to correct the issues that you discussed.

So I'm concerned about it. We're using the avenues that we have, and the connection between our universities and our service laboratories provides one avenue to get those ideas out of the university into another organization that allows those transitions to occur.

Senator HAGAN. What sort of authorization would we need to employ non-U.S. citizens with advanced degrees? Could the current military accessions vital to the national interest program that targets non-U.S. citizens with critical foreign language and medical skills also be applied to STEM-related fields and for DOD civilians? Feel free, all three of you, to please comment on this.

Mr. KENDALL. Chairman Hagan, I think there is some real potential there. I went to graduate school at Caltech in the 1970s and about a third of the students with me in graduate school in aerospace engineering were foreign students. Almost all of them stayed in the United States. Many of them got jobs in the defense industry or something related to the space program and so on. Today that's not happening.

It's not happening for a variety of reasons. One is the economic opportunities that they now have at home, which is understandable. But we're also not making it easy for those people to stay here. We're not making it attractive.

The United States is a very attractive place to live. Once you've come here and gone to grad school, it shouldn't be that hard to convince people that this is a place they would want to stay. But we need to remove some of the barriers to that. So I would be very much in favor of a program that allowed us to do that.

Senator HAGAN. How about the suggestion to staple a green card or a certificate of citizenship to the doctoral diploma of a graduating non-U.S. citizen who has studied in a field that's of importance from a national security perspective and is willing to commit to a certain time period in employment in the defense industrial sector or the DOD? Obviously, security clearance issues would also come up.

Mr. KENDALL. I'm not sure of the exact mechanism because I haven't really looked into this or the options carefully, but in general I think that's an attractive proposition.

Senator HAGAN. I will comment that one of my daughters also graduated from Caltech. Good school.

Mr. KENDALL. Great.

Senator HAGAN. What we're going to do is take a round of 6-minute questions. Let me ask one more and then we'll move on. The secrecy that was essential to the success of the counter-terrorism operation that killed Osama bin Laden highlights the critical requirement for our information technology and telecommunications network to be well protected. According to a report last year by the Defense Business Board's task group on assessing the defense industrial base, the services sector has grown rapidly over the past 15 years, with the number of companies involved nearly tripling and the dollar value of contracts more than doubling to over \$80 billion per year.

Two of the key sectors are information technology, telecommunications, and the intelligence, cyber area. Given the rapid growth in IT networks and companies involved in their operation, how is DOD ensuring that its network operations are secure and, with the DOD's recent efforts to in-source various activities, what do you think's the right balance in the information technology sector between in-sourcing and out-sourcing?

Mr. KENDALL. There are a large number of activities ongoing right now about cyber security. Dr. Lemnios and I are involved in several of them. We are looking at consolidating some of our IT. Our new CIO, Teri Takai, is working on that. We're trying to impose standards that are stronger across DOD. Because of the size of our enterprise, it's very hard to get everything under control, if you will. But we're making positive steps in that direction.

We're also trying to do a lot more on the S&T side of the house so we stay ahead of the threats. CYBERCOM, as I think you know, Cyber Command, has been stood up and is taking some strong actions in this regard as well. So DOD is addressing this on a number of fronts. We recognize it is certainly a major problem. Bringing in talent here is as important as anywhere. This is where—people my age generally do not understand this problem very well, very deeply, and we need people who are much younger and much more experienced in this world to come in and help us out. We're trying to get those people on board.

Mr. LEMNIOS. I would add that, again, there's a near-term operational challenge, which is the one that you have mentioned, but then there's a long-term challenge of what are the new ideas that would help us protect future networks? How do we think about the protection of large quantities of information? Certainly in the university environment information technology is one of those few areas that really attracts young minds. The other one, of course, is robotics.

But when you look at—when I visited first-rate schools, I spend time in the computer science departments, I spend time in the robotics departments. We have a set of challenges that DOD poses to these schools. We're attracting first-rate students, but it's going to take some time to build that cadre of engineers.

The K through 12 programs that we have are doing just that. They're doing that in partnership with the private sector. The undergraduate and graduate funded efforts are starting to show some light as we're graduating first-year students in those areas.

Senator HAGAN. Thank you. Senator Udall.

Senator UDALL. Thank you, Chairman Hagan. Thank you for holding this important hearing today. Before I direct some questions to the panelists, because the schedule is a bit up in the air, I wanted to acknowledge a native Coloradan, Norm Augustine, who's here and will testify on the next panel. He's an exemplary American when you look at his service record, both in DOD and in the private sector.

I'd also like to associate myself with the remarks that Senator Portman made in the context of the war on terror and recommend to all of us that we look at the Hart-Rudman report one more time, on which Mr. Augustine served. It was a seminal work. It was a prescient work. It predicted the events of September 11, not the exact events, but the threat that we faced.

Norm, if I remember, I think you made five recommendations, which hold today and are appropriate to the hearing we're having. I think you said for America to prevail we needed to invest in a comprehensive energy policy, that was an all-of-the-above approach; that our diplomatic efforts, number two, needed to be more people-to-people-based than embassy-to-embassy based; that our national security policy, third, had to be focused on what we now call counterterrorism and counterinsurgency, CT and COIN; and that in the end we needed to be tough and smart.

The fourth recommendation was to invest in our infrastructure, which I take to mean including our manufacturing base; and then fifth, that we needed to focus in a targeted way on R&D and STEM.

I think those recommendations all hold fast today and we would be well served as we face this continuing threat that Senator Portman outlined, to re-engage with all those recommendations.

Thank you for that important work and thank you for your continued involvement in keeping our country great.

Gentlemen, let me turn to you and start with the International Traffic in Arms Regulations (ITAR), which I think ties to the fourth and fifth recommendations that the Hart-Rudman Commission made. I've heard about it for the 12 years I've served in Congress. I'm increasingly frustrated. There's a crazy quilt of oversight. I think it puts us at a competitive disadvantage with nations like India, China, and France. I think that our efforts, well intended as they are, to prevent sensitive technology from falling into the hands of people who would do us harm are actually too complicated and they're actually hindering technological progress, and therefore we're falling behind in the very cause that we have, which is to be as smart as we possibly can about our national security needs.

So, I'd like to hear from each of you briefly, if I could, about ITAR, how we could improve this and do it as quickly as possible, because I think the sand is really running out of the hourglass.

Mr. LAMBERT. I can speak from the industrial perspective; you're absolutely right. We are losing opportunities not just for exports of our products, but for increased competition domestically. If you

have two weak competitors because both of them are unable to export, it makes their capability to service DOD as a whole much less attractive for DOD.

There has been a lot of activity. I think for the first time that I've been following it for 15 or so years as well, we have somewhat of a perfect storm in that there's a lot of motivation both within DOD at the Secretary's level as well as the Secretary of State and the administration, at the White House. So there has been a lot of activity.

We're making progress on the four firsts that you may have heard of. I don't know exactly where that stands now. It's being worked in the policy area. But I know in my communications with industry that is one of the major areas of concern that they raise. In our organization, we tend to work on a case-by-case basis, but it needs a comprehensive solution. I'm hopeful that, at least in certain areas, you'll start to see progress maybe as early as this summer in terms of recommendations from DOD.

Mr. KENDALL. Let me just add that there is a lot going on right now. Secretary Gates has taken a leadership role in this area, particularly in export control. The four firsts are all still being actively worked. I think the single licensing agency is moving forward; single-pallet possibility as well as some others.

We're also taking some steps to relieve the burden or the time at least that it takes to clear things for export. We've recently reorganized or added some additional streamlining, if you will, to the way we do that in DOD for the reviews that we conduct for security clearance. So that should have an immediate impact in terms of the time lines that people have to wait for approval for export from DOD for the things that we watch.

Mr. LEMNIOS. I would simply add that export control is one part of the issue. I think there's a bigger issue, and that is how do we address globalization of a whole range of technologies. So while we talk about export control at the system level, we've all seen examples of foreign-produced components that are very much on par with the best in class components we have in this country.

So we also have a challenge of producing the best in terms of performance and competing really at the global scale.

This is something that is indeed troubling. Again back to what do we see in our research community, driving our research community to build new capabilities that are unmatched globally is really where we need to be. You see a few examples of that. You see some of those examples in nanotechnology. You see some of those examples in microelectronics in selected fields. You see some of those examples in imager technology, where we have capabilities that are really second to none.

So rather than making sure we have a perimeter defense around a class of capabilities that we want to protect, we also need to couple that with making sure we excel in areas where we really do have leadership.

Senator UDALL. Thank you for those insights. I can't again overemphasize the sense of urgency I feel and my commitment to doing everything possible to change what's in effect is an internal intra-government set of regulations that hamstring us from all of the potential advances in national security and products and services

and economic growth that would come from a liberalization of ITAR.

Thank you.

Senator HAGAN. Senator Shaheen.

Senator SHAHEEN. Thank you, Chairman Hagan, and thank you for holding the hearing today.

Thank you all very much for being here to testify. I would like to follow up on Senator Udall's comments about ITAR and our export control system in general, because I met not too long ago with New Hampshire's High Technology Council and one of the things I heard from the members was their frustration with ITAR and their inability to compete with companies in other parts of the world.

You have talked about your commitment to address this. I know the administration's committed to addressing it. I know that there's some work going on. But why are we continuing to see obstacles to moving forward? I guess that's my first question.

Second is, what are we doing to solicit feedback from companies who are frustrated about the current system, who would like to weigh in and have ideas about how to streamline it? I'll throw it up to whoever would like to answer that.

Mr. KENDALL. I'll take the first half and ask Mr. Lambert to take the second half. On the streamlining side, from DOD's perspective what we're doing is trying to get greater control over the many different areas of technical review that we have to do, so that we can control that process and not have a system of a product going through one review and then discover we have to take it through another review in sequence.

So we identify early the cases that may be difficult and we get them into the right streams to review as quickly as possible and then we force them through in a timely way, so that there's some predictability and a reasonable span of time there for industry. We have heard industry loud and clear on that and we're reacting to that.

I'll turn it over to Brett to talk about the other effort.

Mr. LAMBERT. To Mr. Lemnios' point, from an industrial base perspective, we have to realize that globalization isn't really an option; it's a reality. The more we try to wall ourselves off from the rest of the world, the more we hurt our own companies' innovation, but as well as we in essence are giving passive support to foreign companies that can compete internationally when we can't.

Having been involved in many of the meetings about the reform, I would have to say that, since this hearing is largely about people, this is largely a people issue. It's inertia, it's the way we've done things in the past. So when you're asked to protect the crown jewels, the definition of "crown jewels" sometimes becomes animal, vegetable, and mineral, and you can't start with that.

So I think this has been a leadership question, and I've seen more movement in the last 12 months from the leadership of all of the involved departments, not necessarily the departments themselves but the leadership, than I've seen in 15 years. So I'm optimistic on this front.

Senator SHAHEEN. Well, that's encouraging. If there are ways that I or I'm sure this committee can help, we would very much like to do that.

Mr. Lemnios, I was very pleased to hear you talking about the importance of robotics as you were talking about STEM education. I have some legislation that would encourage robotic competitions and other kinds of extracurricular ways to get young people involved in the STEM subjects, recognizing that, as you pointed out, that there are a lot of students who don't learn by the traditional methods and therefore don't get excited about those subjects.

So I'd be very happy to have the endorsement of you or any of the members of DOD for that legislation and to talk about how we can promote it through policy means. That's just a little commercial there.

Under Secretary of Defense Carter recently stated in an interview with Bloomberg that small and medium-sized companies are centrally important in a healthy nuclear base. So how much would you say that the defense industrial base in this country relies on those small and medium-sized companies?

Mr. KENDALL. Senator Shaheen, we rely on them extensively. Approximately 22 percent of the work that we contract goes to small businesses. That's direct contracting out. That does not include all the small business work that's done by subcontracting, which is another very large fraction of what we do.

We're very actively engaged in promoting small businesses right now. Dr. Carter, as you mentioned, was just in Detroit for a day-long session with small businesses out there. I think there were hundreds of businesses that actually came to that event. We're doing a lot of outreach to small businesses. We're encouraging it very much throughout our acquisition system.

These businesses are the source of a great deal of our innovation. Programs like the small business innovative research project and so on contribute a great deal to the Department. So we're doing everything we can to involve them.

Senator SHAHEEN. I was really pleased to hear you mention SBIR because that's a program that I have heard from so many companies in New Hampshire that they've benefited from and it's resulted in the development of new technological advances, new products that have been very important, not just to the military but also for commercial use.

What would happen if Congress is not able to get SBIR authorized, reauthorized in this session? How much of an impact would that have on those small and medium-sized companies that you are looking to to produce the technological innovation of the future?

Mr. KENDALL. It would have a substantial impact. Those early awards through small business innovative research programs are really very important to startups. I've worked with startups in my previous life, and they give you a cachet that you've been recognized by the government as having a technology that might be of interest. The initial money isn't very large, but the subsequent rounds can be very critical to a company that's just starting to get going.

It's a competitive process and there's some recognition for that for those who make it through that successfully. We're trying to

streamline it a little bit because it takes a little bit longer than we would like. But we think it would have a very negative impact on small businesses if that program went away.

Senator SHAHEEN. Thank you.

Mr. LEMNIOS. I absolutely agree. My experience with the small business community is there's innovation you see there, where there are companies who are willing to take some risk in areas where larger companies just, for whatever reason, just don't. You mentioned robotics, I mentioned robotics. I spent a day at Deka and I spent a day with Dean Kamen, and—

Senator SHAHEEN. Who is a New Hampshire resident.

Mr. LAMBERT. Who happens to be from New Hampshire.

But you know, you spend a day with a small business like that and your mind explodes with new ideas. I don't see that in lots of companies. I see it in a select few, and protecting that and finding ways to transition that innovation into the large-scale is really the challenge that we have. So this is something that we absolutely need.

Senator SHAHEEN. Thank you all very much.

Senator HAGAN. Ranking Member Portman.

Senator PORTMAN. Thank you, Chairman Hagan.

Again, gentlemen, thanks for your testimony today. I'm going to go quickly here because there is so much to go over and so little time. But first is on the direct hire issue. Congress has to reauthorize, because it sunsets in 2013. So I would ask you, given the challenges we've heard about the DOD laboratories with regard to hiring, a shortage of engineers and scientists in particular, do you think that the direct hire authority has helped to be able to waive some time-consuming restrictions or not? If you think it has helped, are you supportive of its reauthorization and do you have any suggestions for improvement?

Mr. LEMNIOS. So it has helped. There's no other way to say it. We've hired 114 staff as a result of that authority. It probably could go faster. I'm not sure what the barriers are. But you've given us the authority. We're starting to use it.

We had a similar situation with the other transaction authorities that DOD has. There were few agencies that understood the value of other transaction authorities and once we sort of figured it out that's now being used broadly. So this is something I think is critically important.

Senator PORTMAN. Any other comments? Secretary Kendall?

Mr. KENDALL. I'd just like to add that anything that gives us flexibility to bring talent into the workforce is good. Mr. Augustine once worked in the Secretary of Defense's office, my former office before my time there actually, where he was the director, I think, for land systems, if I recall correctly. It was the tactical warfare programs office. He was able to come in as an expert, work there for a relatively short period of time—I think 2 years, or 3.

Mr. AUGUSTINE. 4 years.

Mr. KENDALL.—4 years, and then go back out to industry. Having that kind of talent available to come into the workforce and then go out again is enormously beneficial to DOD, and it rarely happens today.

Senator PORTMAN. Mr. Augustine, are you ready to suit up again? Udall needs you. [Laughter.]

Senator PORTMAN. Secretary Lambert.

Mr. LAMBERT. The ability—we find it in the workforce just in our small office, but the ability to bring in talent from outside quickly to tackle some of the challenges we have, especially at the lower tiers, is essential, and without these authorities it's difficult.

Senator PORTMAN. Would you please in writing—and maybe, Secretary Lemnios, maybe you're the right one, according to this. Just give us any suggestions on improvements, as it sunsets in 2013. My understanding is the House is working on this already and the Senate needs to get busy on it. We'd love to have your input on the subcommittee.

[The information referred to follows:]

The Services are effectively utilizing the Demo Lab authorities within the established limits of Title 5 statutes. My assessment is that these authorities provide the necessary flexibility to develop and preserve our technical workforce within the labs. The pay for performance system is a significant contributor to retaining our talented technical personnel and the direct hire authority ensures our labs can rapidly target and hire talented graduates as they enter the job market. Within the Department, the Under Secretary of Defense for Personnel and Readiness governs personnel policy, instructions, and directives and maintains an ongoing dialogue with the Services, specifically the labs, to ensure authorities are implemented and exercised to their potential.

Senator PORTMAN. I wanted to ask a little bit about competition. I talked earlier about what I believe is an important need to have a robust industrial base, not just to have consolidated strong companies, but to have enough companies that they compete with one another, both on the operational side and the qualitative side and on the cost side. Do you have thoughts about that in general? Where are we in terms of real competition in our industrial base?

Mr. KENDALL. Senator, one of the central tenets, as I think I mentioned, of Better Buying Power, Dr. Carter's initiative, is creating and maintaining a competitive environment for industry any way that we can. There is absolutely nothing more effective in motivating industry than competition, absolutely nothing.

We can rarely have real competition in terms of two sources of a product throughout the entire life cycle of a product. One of the things that John Young, who was the predecessor to Dr. Carter, did was to change the system a little bit to allow competition to go further into the design process, to preliminary design review. That allows us to very cheaply carry competitors further and get more mature designs and reduce risk before we go into the rest of design for production and production.

That's a good thing, but it only gets us so far. We want to do things beyond that. We want to do things where people are always looking over their shoulder a little bit at the guy who's going to come take their business away. You can do that with alternative types of systems. You can do it sometimes at the component level or the subsystem level. There are varieties of ways to try to get competition into programs. We are actively driving all of our program managers and program executive officers to try to find ways to do that in our programs across DOD right now.

Senator PORTMAN. Mr. Lambert?

Mr. LAMBERT. I would just add that in the industrial policy world we try to broaden a bit the definition of competition. There's a tendency to think of it in terms of pure peer-to-peer competition, one ship and two suppliers, or something of that nature, when the fact that it's much—you have a lot of other tools at your disposal. You have portfolio competition, a system to compete against a different system that can do the same thing. Our program managers have to be educated to think in terms of a portfolio competitive system.

Then even when you get down to a single supplier, you have other levers, as some have learned, where we're not necessarily hostage. You always have termination and looking at another portfolio, or you have, as I think Dr. Gansler has pointed out repeatedly, you have the competition for recompetes in contracts, particularly in the services sector, and that's an effective lever that can be used.

Senator PORTMAN. I will say, Secretary Lambert, it's tough to have termination or recompetes that are really effective when there is not again an alternative out there. It maybe won't surprise you, but I have strong feelings on this in terms of the second engine on the Joint Strike Fighter (JSF). I am distraught by the fact that we are going into a 30-year program with one manufacturer, as good as they might be, for the very reasons Secretary Kendall talked about: Quoting him here, "There's nothing that motivates private sector people more than competition, someone looking over their shoulder." This notion that you could terminate or recompete when there's no base there to do it is distressing to me, and I wish the Secretary and DOD would relook at that issue, because it's such a huge part of what we'll be doing over the next 30 years in terms of our weapons systems, hundreds of billions of dollars, and the opportunity to have multiple domestic producers it seems to me is critical.

But I won't ask you to comment on it because I don't want to get you in trouble, because I know you agree with me.

How about on the—how about on the tracked vehicles? Your report in 2010, Mr. Kendall, Mr. Lambert, the annual industrial capabilities report, says that the ground vehicle sector—your summary there said that, with the exception of the Expeditionary Fighting Vehicle (EFV), there are no major tracked vehicle programs under development or production. However, the industry maintains a significant amount of tracked vehicle overhaul work now. Your assessment concludes that the health of the industrial base for this critical military capacity depends significantly on EFV and continued upgrade and reset work for the Abrams tank.

With the cancellation of EFV and what I perceive to be a multi-year gap in the Abrams program in the upgrade work, what are we going to do? Do you stand by your assessment from last year that this will significantly affect the health of this vital part of our military industrial base?

Mr. KENDALL. Go ahead.

Mr. LAMBERT. We do have some programs that are getting started. We are looking at what to do about the EFV mission now that the program's been cancelled. We're starting the Ground Combat Vehicle program for the Army and there's a program to upgrade

the Army's artillery piece, the Paladin. So there are some things ongoing. I think there's some continuing work on Stryker as well. It's not to the volume that we might like to have, but we think it's enough to sustain the base.

Senator PORTMAN. You think it's enough to sustain the base even if there is this gap in the Abrams Main Battle Tank reset work?

Mr. LAMBERT. There is a concern about the plant in Lima, which I think is what you're referring to.

Senator PORTMAN. Yes.

Mr. LAMBERT. It's not clear that we can keep that plant open at this time.

Senator PORTMAN. Well, again that concerns me greatly, not just because it happens to be in Lima, OH, but because again it has this incredible workforce and capability that you can't suspend temporarily. Those people will leave, just as the engineers at GE will leave, and go off to do other things, and we lose an incredibly important industrial capability.

So I hope you'll work with us on that. I know that there's the Ground Combat Vehicle program coming up and maybe there's a way to ensure that we don't have that vulnerability.

With that, I'm over time here. I have so many other questions I'd love to ask, but I appreciate your being here today, and I apologize that our voting schedule is going to make it hard for us to stay for all the questions for the second panel. Thank you.

Senator HAGAN. Thank you.

Obviously, due to the vote, what I'd like to suggest is that we reconvene at the second panel as soon as this vote takes place. This is a resolution that we're putting forward honoring the excellent mission that our Special Operations Forces have just done, and we certainly want to honor all of the individuals and agencies that were involved.

So what I'd like to do is thank you for your testimony and we will have a recess, and as soon as we come back—I hope some of our members can come back—we will then start with the second panel. I envision it will probably be 15 minutes or so.

Thank you.

Mr. KENDALL. Thank you, Chairman Hagan.

Senator HAGAN. Thank you. All the questions that we have not been able to ask the first panel, we will submit those extra questions to you in writing. Thank you. [Recessed.]

I will reconvene our hearing. Once again, I apologize for the delay, but I could think of no better reason for the vote that we just took, and it certainly did pass unanimously for all the members there. I really do want to praise our military and in particular our special forces for the carrying out of that incredible mission.

If we could go ahead and start with our opening testimony for this panel, Mr. Augustine.

**STATEMENT OF NORMAN R. AUGUSTINE, RETIRED CHAIRMAN
AND CHIEF EXECUTIVE OFFICER, LOCKHEED MARTIN COR-
PORATION**

Mr. AUGUSTINE. Thank you, Chairman Hagan, members of the subcommittee. I'm pleased to have this chance to describe to you my thoughts on the defense industrial base and particularly to do

it in the company of two long-time dear friends. I would like to submit for the record a written statement, if I may.

Senator HAGAN. Please.

Mr. AUGUSTINE. I should also note that I am here representing myself and not any firm or organization with which I have been associated.

I would like to begin by asserting that in 21st century conflict that a strong defense industrial base is every bit as important; to have a strong Army or Navy or Air Force or Marine Corps or Coast Guard. Today there are about a quarter million people from our industry in Afghanistan and Iraq. Last week, sadly, two of them from the company I used to serve were killed.

At the end of the Cold War, it was generally agreed that America had the finest military equipment that was to be found in the world. I believe that to be true in general. I think the reason for this was that we have chosen to use the free enterprise system as best we can to supply our military forces, as opposed to adopting an arsenal system such as was done in the Soviet Union and many other countries.

However, this is an unusual free enterprise system. It's a system characterized by a monopsony at the top, with monopolies embedded in it for specific items of equipment. That means that this is a free enterprise system, or version of it, that requires very great responsibility on the part of both the buyer and the seller.

It has now been 20 years since the so-called "Last Supper," at which DOD gathered about a dozen of us who were running the major defense contractors at the time. We were told that the DOD was going to be buying less equipment, given the end of the Cold War; that DOD had no intention to pay for overhead for a lot of companies with half-full factories and no money to invest in R&D; and that it would be up to those of us from industry to solve the problem, DOD wasn't going to do it for us.

I still remember a chart that was shown on that occasion of 16 different categories of military equipment. In five of them the DOD said they could only afford two industrial participants and in six of them they could only afford one participant. Shortly thereafter, 5 years later, 75 percent of the companies were gone, as were nearly half the people in the industry, about three-quarters of a million people.

The question arises, was that a good thing? The question would be is it better to have 15 strong competitors in a sector than 2? Unquestionably, in my view, the former is. But that wasn't the choice. The choice was to have 15 weak competitors or 2 strong competitors, and in that case, clearly the latter in my judgment is a better outcome.

As we then turn to today and look at the major resources it will take to have a strong defense sector, I believe there are really five categories that need to be addressed. The first of these is financial capital. We sometimes forget that our defense sector has to compete with all the other industries in this country and in the world in fact for equity and for debt capital. Without that, they cannot modernize their facilities or run their businesses. There's no place in the Wall Street Journal listing where there are asterisks that say "This company is excused; it's a defense company."

Second and probably the most important is human capital, where our companies again have to compete with other companies in the country, whether they're in the defense business or not, and now have to compete with firms all around the world for people. Today 75 percent of the people who get Ph.D.s from U.S. engineering schools are not U.S. citizens. Half the bachelor's degrees in engineering or equivalent that are awarded in the entire world are now being awarded in China. Our K through 12 education system, particularly in STEM, is among the worst in the world on average. DOD confronts these same issues in terms of building an industrial base and maintaining it as the economy as a whole does, except that the DOD and the defense contractors require clearable people, by and large, and that poses a major challenge.

Third is knowledge capacity. Knowledge comes from basic research. There was a study released, a respected study, in the last 2 weeks by an organization in the United Kingdom that rather convincingly shows that China will surpass the United States in 2 years from now in terms of the number of technical papers published in respected journals. We all know the impact that technical breakthroughs coming from research can have in the outcome of warfare, whether you go back to the stirrup or the long bow or the rifle or the machine gun, the tank, the airplane, and so on. They can be decisive factors.

Fourth, there is the state of the manufacturing capability of this country. We now are down to 11 percent of the gross domestic product in manufacturing, 80 percent in the service sector. I would submit that it may be possible to build a prosperous nation with only a service sector or primarily one, but I would doubt very much that one can win a war with a service sector economy.

Many companies are leaving this country, putting their manufacturing abroad, and their research is following, or leading. I would commend to the committee the "Rising Against the Gathering Storm" condensed version that just came out, that has the reasons rather clearly stated as to why companies are doing this.

Fifth and finally is the ecosystem that pertains to the defense industrial base. There's a lot that could be said. Let me just say that the turbulence in that base in terms of schedule changes, requirements changes, budget changes, people changes, makes it almost impossible to manage the industrial base efficiently and effectively.

With that, Chairman Hagan, I'll close and turn to my colleagues. I'll be happy to answer any questions you might have.

[The prepared statement of Mr. Augustine follows:]

PREPARED STATEMENT BY HON. NORMAN R. AUGUSTINE

INTRODUCTION

Senator Hagan, Senator Portman, members of the subcommittee, thank you for this opportunity to share my views regarding the state of our Nation's defense industrial base. It is a particular privilege to sit alongside such distinguished colleagues and long-time friends as the other members of these panels.

In the way of background as to my perspective, I should note that my career has included 10 years' service in the Department of Defense, 30 years in the aerospace industry, a few years in academia, and participation in over 500 board meetings of commercially-oriented Fortune 100 companies.

Hopefully, my "retired" status permits me to take a somewhat detached, yet informed, view of the challenges confronting the Nation's defense industrial base. I should emphasize that I appear before you as a private citizen and that the opinions

I will express are entirely my own and do not necessarily reflect those of any organization with which I have been affiliated.

Following a few introductory remarks, I would like to address five specific categories of issues and then offer a few suggestions regarding the path forward. The categories I will consider are Financial Capital, Human Capital, Knowledge Capital, Manufacturing Capability, and the Defense Industrial Ecosphere.

PERSPECTIVE

In our Nation's early years, defense needs were primarily satisfied by what has generally been referred to as the arsenal system. Government-owned and operated engineering and manufacturing facilities fulfilled the relatively limited categories of needs of our Armed Forces. This is in fact the system that was employed by the Soviet Union throughout the Cold War and is still employed by the United States for a few items of uniquely military equipment.

As America began to build a broader and stronger commercial manufacturing capability and as military equipment became increasingly diverse, the Nation moved away from what was in essence a socialist system towards a free-enterprise approach to provisioning our Armed Forces—and in my opinion realized many of the same benefits following that transition that have been realized by the economy as a whole.

Following the collapse of the Warsaw Pact, leaders in our government concluded that there were too many firms supplying America's defense needs and that paying the overhead costs associated with such a structure was not in the Nation's best interest. This led to a dinner meeting in the Pentagon involving the senior leadership of both the Defense Department and major defense firms. The following day, in response to a reporter's question, I referred to the event as "The Last Supper"—a sobriquet that has stuck over the years.

During that meeting Secretary Les Aspin, Secretary Bill Perry and Director of Defense Research and Engineering John Deutch made unmistakably clear to those of us present from industry that there were more firms supplying the Nation's defense needs than the Nation could afford, and that it would be up to the industry to solve that problem ... and this would be done with the government's support but not its direct involvement. At the meeting a chart was shown—a copy of which I have retained to this day—which indicated that a massive downsizing of the industry and a concurrent increase in efficiency was expected. Interestingly, in the case of 6 of the 16 equipment categories cited in the chart, the Department of Defense said it could support only one industrial participant. In five other categories it indicated it was prepared to support only two suppliers.

A massive structural reengineering of the defense industrial base soon began. It ended about 5 years later with 70 percent of the companies or major elements of companies that supported national defense no longer in business ... along with fully half of their workers no longer employed in the industry. I am unaware of any other industry in our Nation's history that has undergone such a massive change in so short a period of time—and done so with as limited disruption as occurred. Literally billions of dollars were saved by the Department of Defense, savings that continue to this day, according to the government's own independent audits.

But, all things considered, was the downsizing a good thing? In my opinion, as painful as it was to implement, it was the only thing to do. Would I prefer an industry with a dozen strong competitors to one with only two or three? Of course. But that was never the choice. The choice was between an industry sector composed of a dozen weak competitors with high overheads and largely unused factories and little money to invest in research or talent on the one hand, or an industry consisting of two or three strong competitors operating efficiently on the other. In perhaps familiar words, what resulted was not the best of all worlds ... it was merely the best of all possible worlds.

I would hasten to add that I believe there is a major discontinuity that appears when one drops below two suppliers for a given category of equipment. I believe strongly in competition whenever it can be made to make sense—which is usually but, unfortunately, not always the case. With but one supplier, nationalization of an industry cannot be far behind ... and with that the loss of free-enterprise market pressures in favor of a demonstrably less effective socialistic approach that has failed throughout much of the world in the commercial sphere. As capable participants are added, competitive pressures grow—but this is governed by the law of diminishing returns. In short, there is a level of defense spending within any category of equipment below which competition simply cannot be sustained. Even in this case it may be possible to maintain competition at the lower supplier-tiers which represent roughly half of defense procurement dollars.

It also needs to be recognized that the defense industry operates in a strange sort of free-enterprise system: a monopsony with occasional monopolies embedded within it. Further, it must be recognized that for so-called “defense firms” to raise the capital, both human and financial, needed for their continued survival and contribution to the Nation, they must compete with every other firm in the country—not just other so-called “defense firms.” The rating agencies and equity markets make no concessions because a firm is in a business that happens to be critical to our national interests. Thus, defense suppliers, if they are to survive, must earn—and I do mean earn, as in deserve—returns commensurate with the firms with whom they compete in the financial and talent markets.

With this as background, it is particularly important to note that America can no more conduct a 21st century military operation without a viable defense industrial capability than it could without a viable Army, Navy, Air Force, Marine Corps, or Coast Guard. Indeed, the “defense industrial base,” as diffuse as it may be, is in effect one more “branch” of our Nation’s Armed Forces.

I would now like to turn to the five categories of issues that I mentioned in my introductory comments.

FINANCIAL CAPITAL

If defense-oriented firms are to modernize their factories and expand their capabilities when called upon to do so, those firms must have access to financial capital. This in turn implies that the firms must generate a risk-adjusted total shareholder return that is competitive not simply in comparison with other defense firms but in comparison with all firms, both domestic and abroad. In today’s financial markets money moves literally at the speed of light as it seeks opportunity—with little regard for geopolitical borders or government needs.

Thus, firms engaged in defense procurement are a microcosm of U.S. industry as a whole—and face many of the same challenges that are encountered by other U.S. firms, plus some that are unique to their activities.

HUMAN CAPITAL

Throughout the Cold War the most attractive option for a scientist or engineer who wanted to work at the leading edge of science and technology was to work either in national defense or in the Nation’s space program. Defense companies at that time had no difficulty attracting their share of our Nation’s best and brightest. Today, young people aspiring to that same goal have far more options available to them, ranging from the biosciences to info-sciences to nano-sciences and more. In recent years one-fourth of the graduates of MIT are said to have opted to go to work for financial firms on Wall Street. Many others find their way to Silicon Valley or to the Nation’s great biological research laboratories.

America’s science and engineering enterprise would barely function today were it not for foreign-born individuals who came to our country to attend our world-class colleges and universities and remained here to build careers. Fully three-fourths of the Ph.D.s in engineering granted by U.S. universities are awarded to non-U.S. citizens—a group that is increasingly returning home a few years after acquiring their degrees. The implications of this for the defense industry, with its dependence upon clearable employees, is evident.

Further, the Defense Department and its suppliers are not immune to the near-disastrous situation prevailing in our Nation’s 14,000 K–12 public school systems—particularly with regard to STEM education. The U.S. status in this regard has been thoroughly documented in a number of reports including the “Gathering Storm” series prepared by the National Academies.

In short, in seeking and retaining talent, defense suppliers face many of the same challenges as the Nation’s industrial firms as a whole—but to a magnified extent. This is not to suggest that there are not many highly capable and dedicated individuals serving within the defense industry today; indeed there are. But this group is increasingly narrowing itself to those individuals who just happen to have a special commitment to national security or a particular excitement for state-of-the-art rockets, aircraft, ships, and the likes.

KNOWLEDGE CAPITAL

New knowledge capital is largely derived from basic research. Ironically, the ultimate applicability of that research is often not evident, even to those who pursue it. It is doubtful, for example, that those working in solid state physics many decades ago had in mind building iPods, iPhones, iPads, GPS, precision-guided ordnance or night vision devices. Nor is it likely that the Russian mathematician working during the Cold War on equations characterizing the reflection of electro-

magnetic waves realized that his work would give America the key to building stealth aircraft.

Throughout history the course of conflicts has been tipped by technological breakthroughs—from the stirrup to the long-bow to gunpowder to the rifle to the machine gun to the tank to the aircraft to the ballistic missile to the nuclear weapon to spacecraft to night vision to precision guidance ... and more.

Unfortunately, America is losing its lead in science and technology. A recent report by the U.K. Royal Society projects quite convincingly that China will overtake the United States in science articles published in respected journals just 2 years from now. This relative decline of the U.S. position impacts firms supplying defense materiel to the U.S. Government just as it impacts every other U.S. firm competing in the high-tech arena. Further, U.S. industry as a whole, responding to the pressures of the financial marketplace, has largely abandoned its efforts in basic research in favor of development, and especially systems integration.

With respect to the state of applied technology, perhaps there is no better indicator of health than the number of new aircraft types that have been developed each decade since the 1940s. Those figures have continued to drop precipitously until today an engineer would be fortunate to work on two new aircraft types in his or her career. I once asked Kelly Johnson, head of the iconic Skunk Works, how many different aircraft he had worked on during his career and as I recall he said "32." The implications of this shrinkage with regard to the experience level achieved by today's engineers as they pass through their careers can be profound. Add to this that China is now graduating half the world's new engineers vs. the United States' 5 percent and it is not difficult to see where current practices are leading.

MANUFACTURING STRENGTH

The U.S. economy is now 11 percent manufacturing and nearly 80 percent services. While it is arguably possible to prosper economically with a pure service economy, the likelihood of winning major wars with a service economy seems remote. When U.S. firms weigh the benefits and liabilities of expanding their activities in research and development as well as in manufacturing, either in the United States or abroad, the answer is increasingly becoming to move abroad. It is generally considered that the more critical elements of those firms that serve in national defense must remain in the United States—for reasons that are presumably evident. This pressure does not, however, apply to the component suppliers who, though not generally considered a part of the "defense industrial base," are indispensable to it. A consequence is that the manufacturing surge capacity that the Nation has available with which to quickly expand its Armed Forces is rapidly diminishing.

To its credit, the United States has sought to reduce the loss of life among those serving in our military focus by placing increasing dependence on technological capability. Unfortunately, along with the latter have come increased unit costs ... and further declining production volumes ... still further exacerbating the industry's dilemma.

While such topics as contract-type and the preservation of competition deservedly receive a great deal of discussion in the manufacture of defense systems, other often overlooked factors can swamp the above issues in terms of impact. Prominent among the latter are:

- Unrealistic initial estimates of the size of the total production buys and production rates—which lead to excessive tooling costs and amortization penalties.
- Cutbacks in planned annual purchases—which diminish the significant gains that can otherwise be realized by moving down the learning curve.
- Uncertainty in year-to-year funding—which precludes efficient purchasing-quantities, discourages contractor investment in productivity measures, and leads to cancellation or renegotiation of sometimes thousands of subcontracts.
- Failure to discount future cash flows—something that would never be permitted in the private sector.
- Failure to provide reserves in proportion to the risk entailed in a task—again, something that could never be tolerated in the private sector.

DEFENSE INDUSTRY ECOSYSTEM

National defense today depends not only on companies generally associated with national security but also on the thousands of subcontractors and suppliers who provide the larger firms with everything from castings and forgings to microchips and lasers. Many of these smaller firms do not possess the financial staying-power or

resiliency of the larger firms and are thus even more vulnerable to turbulence in the procurement process.

Viewing the environment in which both large and small U.S. firms operate today, the outlook for our Nation's security, let alone the economy as a whole, is not reassuring. American firms spend over twice as much on litigation as on research. They commonly spend more on healthcare for their employees and retirees than on the basic material that go into their products. They are subject to the second-highest corporate tax rate in the world. They are motivated by the tax laws not to return foreign earnings to be reinvested in the United States. The patent system is ponderous and the export laws were designed for another era. The immigration laws discourage much-needed talent from remaining in our country. The prevailing tax and market structure encourages a short-term outlook and disincentivizes long-term investment—for example, research. The demise of the iconic Bell Laboratory, home of the laser, transistor and many Nobel Laureates, is but one example of the latter. If current plans are carried out the government will soon have the equivalent of two Army divisions overseeing defense procurement. While oversight is indispensable, the question of balance is nonetheless present—particularly when industry's response is likely to be to match that number of overseers within its own firms as a defensive measure.

THE WAY FORWARD

The first step in assuring a strong and efficient industrial capability with which to supply our Armed Forces is to take steps that will make American industry as a whole competitive. These include repairing our public schools; particularly in math and science; investing more in scientific research; controlling healthcare costs; reshaping our tax structure and encouraging; not discouraging, immigration of talented individuals in fields where America has legitimate needs.

Within the defense arena, useful steps include:

- Return to the practice of the 1960s, promoted by Dave Packard, to build prototypes of advanced systems—even though most of them may never be procured for operational use. This preserves the Nation's critical engineering design teams and advances the state of the art at a relatively low cost.
- Make it extremely demanding to begin new engineering development programs—and equally demanding to change or stop them, eliminating a primary contributor to waste.
- Invest in manufacturing process technology, much as manufacturing product technology has been supported in the past, with a focus on flexible, low-rate production.
- Establish practices that enable the Department of Defense to fulfill some of its needs by drawing upon the capabilities of commercial producers. An example from the past was paying commercial airlines the marginal cost of incorporating extra-wide doors in passenger aircraft that could then accommodate military materiel, if that should be needed.
- Make it practicable once again for people with industrial experience to serve in senior positions in government functions that require a knowledge of industrial practices.
- Seek to maintain competition in development and procurement to the maximum extent practicable.
- Rewrite the export laws, including those applicable to deemed exports, to reflect the global economy as it exists today, not 25 years ago.
- Standardize equipment across the Services and our allies wherever practicable so as to permit manufacturers to exploit the benefits of higher volumes further down the learning curve.
- Continue to purchase in very limited quantities those few truly critical items that are required to sustain key elements of the defense industrial capability—even if their immediate operational need may be questionable. This is akin to paying the premium on an insurance policy.
- Utilize multi-year procurements or unit buys whenever needs are clear.
- Continue efforts to fix the defense procurement system by repairing the requirements process; providing program stability; including Reserves in budgeting; and more.
- Strengthen the government's ability to serve as an intelligent buyer ... but have the government itself engineer or manufacture only those items that the private sector is incapable of—or unwilling to—provide. This is, of course, the basis of the free enterprise system, a system that has shown a strength vastly exceeding that of any other systems yet conceived.

The above is a long and demanding list, yet it is only a partial list.

Nonetheless, the task to be accomplished is critically important.

Thank you for affording me this opportunity to share my concerns regarding the defense industrial base. I will of course be pleased to address any questions you might have.

Senator HAGAN. Thank you.
Dr. Gansler.

STATEMENT OF JACQUES S. GANSLER, Ph.D., DIRECTOR, CENTER FOR PUBLIC POLICY AND PRIVATE ENTERPRISE, UNIVERSITY OF MARYLAND SCHOOL OF PUBLIC POLICY

Dr. GANSLER. Thank you very much for inviting me to this, what I think is critically important topic, and I appreciate your holding these hearings. As you're well aware, the national security environment for the 21st century has totally changed from that of the 20th century. However, the U.S. industrial base that supports it has simply been consolidated from around 50 major suppliers to a half a dozen. A 2008 Defense Science Board task force that I chaired concluded: "The Nation currently has a consolidated 20th century industry, not the required and transformed 21st century national security industrial base that it will need in the future."

Now, unfortunately, in the 3 years since that report, while there have been some positive steps taken, there has not been a noticeable improvement. In fact, in many areas the trends are actually adverse to the need. We have rising costs for equipment and services, stretched-out schedules, undesirable shifts in acquisition and procurement practices.

Let me give you a couple of examples. I'd like to have my complete text part of the record and I give a lot of examples there. But for example, a noticeable shift from what used to be best value awards to making awards on the basis simply of low bid, technically acceptable.

Another example is in-sourcing of non-inherently governmental work. Another area, stopping—Congress has actually stopped—public-private A76 competitions for non-inherently government work that's currently being done in house, even though the results of the competitions overwhelmingly show that we get higher performance, the cost savings on average of over 30 percent.

I could go on with these examples, but let me shift to the industrial base part of it. To meet the 21st century national security environment, the industrial base clearly has to be flexible, adaptable, agile, responsive, innovative, and it must provide high-quality goods and services at affordable prices, and, most important, in the quantities required.

Now, to achieve this I think it requires the government to change the way it does its business. As Mr. Augustine said, in a monopoly environment it's the government's responsibility to do that. It has to reform its laws, its regulations, its policies, its acquisition procurement practices, and in general it has to remove the barriers that have been created through what I would categorize as over-regulation and detailed input specifications, and shift much more to an emphasis on creating incentives for industry and focused on output results rather than input specifications.

Let me briefly just note the four findings of that Defense Science Board Task Force that I mentioned, whose objective was achieving

a 21st century industrial base. The first finding was: "Current trends and policies will not result in an effective industrial base." Second: "That the DOD must drive the industrial base transformation in order to support the 21st century military." Third: "The government must change in order to facilitate rapid and affordable acquisition of needed weapons, systems, and services." Fourth: "A weakened DOD acquisition workforce impedes the acquisition of military capability and government oversight."

This all involves changing the way the government does its business, which basically is a cultural change. For successful implementation of culture change, the literature is clear: it requires leadership with a vision, a strategy, a set of actions, a set of metrics to continuously monitor it.

So in order to stay within the time, let me simply tick off the ten recommendations that I have in my prepared statement and just briefly note them. The first one is, in order to do this the DOD has to articulate a national security industrial vision and adopt policies that match this vision and secure incentives for industry to achieve that vision, and then of course monitor it in order to see the realization of it.

I think perhaps the most important part of that vision is incorporating the competitive commercial marketplace into it. We have barriers significantly to that. In fact, let me just quote from a National Defense Industry Association report that just came out: "Removal of the many barriers—legislative, regulatory, et cetera, that prevent new suppliers, commercial particularly, from entering the aerospace and defense industries and previous suppliers from returning. These barriers include specialized cost accounting, export controls, intellectual property rights, government-unique flowdown requirements to the lower tiers," and so forth.

Second, the weapons requirements process has to shift to be focused on the netcentric system of systems in order to gain the force multiplier effect of the lower-cost, multiple distributed sensors and shooters, rather than the historic focus on self-contained complex, expensive platforms.

Third, we have to achieve lower costs and faster-to-field capabilities, while still getting better performance. The computer industry shows us we can get higher and higher performance at lower and lower costs. We have to use that model. That requires the DOD to change its requirements process in order to include cost and schedule and then use a block upgrade model where block 1 uses existing technology and continues to do R&D as future blocks evolve.

Fourth, we have to train as we fight, which means recognizing the very big role of contractors on the battlefield. Today in Iraq and Afghanistan we have about 270,000 contractors, more than we have in uniform, and yet they are performing non-inherently governmental functions, but they come with pretraining and lower cost, and the government has the responsibility for managing them and part of that means that they have to include the planning, training, exercise, education in order to prepare for this mixed force.

Fifth, we have to focus on staying ahead, and that means by adequately resourcing the engines of innovation. Now, historically the first things that get cut when the budget goes are research and

then training and travel. Well, we cannot afford to allow research to go away, especially for the small businesses, the SBIR program which was mentioned earlier, basic research at universities and government labs, the clear IR&D of the companies, the IR&D effort, if you will, and the important manufacturing technology areas. All of those have to be continued to be supported or we'll simply fall behind.

Sixth, we have to understand and realize the benefits of globalization while of course mitigating its risks. Today it's very clear that technology and industry are globalized and for the United States to take advantage of this from both economic and military perspectives we have to change our export and import laws. It's time for recognition of the globalization in this area.

Seventh, we have to achieve far greater use of best value competitions and foster long-term competitive dynamics. These incentives coming from this continuous competition are obvious in terms of competitive dual sourcing. The data are clear, but we're in many cases doing it in speeches, not in reality.

Eight, we have to transform the DOD logistics system into a world-class datacentric logistics system. It is the most expensive of all our acquisition phases, costing over \$270 billion last year, and carrying an inventory of \$90 billion, and not doing a world-class job by any measure in terms of responsiveness, reliability, asset visibility, cost, you pick one. It's absolutely critical that we revise that and that's an area for big cost savings as well as greatly enhanced performance.

Ninth, we have to recognize that over half of the DOD acquisition costs—in fact, in fiscal year 2009 it was 57 percent—are for services, and yet all of our regulations, policies, practices, education, et cetera, are based upon buying goods. That has to change. We have to recognize that an important part of our industrial base are the Services, not just the people building ships, planes, and tanks, and our policies therefore have to change.

Last, tenth, DOD, with Congress' help, has to move aggressively to strengthen the future high-quality, high-skill government acquisition workforce. I recently chaired a commission on Army acquisition and program management in expeditionary operations and the whole commission was shocked to find how much the DOD acquisition workforce, particularly at the senior levels, has been undervalued, not just in numbers, but in senior positions.

For example, in 1990 the Army had five general officers with contracting experience. In 2007 they had none. I give you lots of other examples. Without smart, well-trained, experienced acquisition buyers and managers, we will not get there in my opinion. It's simply not achievable to get the 21st century structure that we need.

In my prepared remarks I also discuss the other workforce concern, which is S&T workforce, which Norm Augustine just highlighted, and clearly that's an area that has to be addressed, both for security and economic competitiveness.

So, in summary, it's absolutely critical that the government changes the way it does its business and as a result that the national security industrial base is transformed into a flexible, adaptable, agile, responsive, innovative structure that provides high-

quality goods and services for 21st century military needs, but at affordable prices and in the quantities required. I think the men and women of our armed services deserve nothing less.

Thank you.

[The prepared statement of Dr. Gansler follows:]

PREPARED STATEMENT BY HON. JACQUES S. GANSLER, PH.D.¹

The National Security environment of the 21st century has totally changed from that of the 20th Century—as shown by the many areas listed in Table 1. However, the major supply-base change has simply been consolidation (from around 50 major suppliers to a half dozen). As a 2008 Defense Science Board (DSB) Task Force (which I chaired) concluded, “the Nation currently has a consolidated 20th century defense industry, not the required and transformed 21st century National Security Industrial Base it needs for the future.” (reference 1)

Unfortunately, in the 3 years since that report, there has not been a noticeable improvement. In fact, in many areas the trends are adverse to the need—with rising costs for equipment and services; stretched out schedules; and undesirable shifts in acquisition and procurement practices (as discussed below).

To meet the 21st century National Security environment, the industrial base must be flexible, adaptable, agile, responsive, and innovative; and it must provide high-quality goods and services at affordable prices, in the quantities required. To achieve this, requires the government to change the way it does its business, i.e. reform its laws, regulations, policies and acquisition/procurement practices. It must remove the current barriers—created through overregulation and detailed “input” specifications—and shift to an emphasis on creating incentives for industry to achieve the desired output results.

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TABLE 1: CHANGES DRIVING NATIONAL SECURITY TRANSFORMATION

1. Holistic View of Security:	Characterized by world-wide terrorism; pandemics; weapons proliferation; rogue nuclear states; energy dependence; insurgencies; environment; mass migration; regional conflicts; transnational threats; resource access (i.e., water, oil, critical materials); combining “soft” power and “hard” power for results.
2. Domestic Economics:	In a constrained resource environment, with likely reductions in defense spending (including reduced or eliminated Supplementals), trades between national security and other programs must be considered, including universal health care, Medicaid, Medicare, Social Security, and budget and trade deficits.
3. Warfighting Changes:	From Cold War operations to “net-centric” Warfare; Asymmetric warfare (biological, cyber, Improvised Explosive Devices [IEDs]); “war among the people” (hiding among the civilians); Joint and coalition operations; evolving doctrine requiring frontline decision-making; Systems-of-Systems (vs. autonomous platforms); “mixed force” (of contractors and military).
4. Industrial Sector Changes:	All sectors impacted by horizontal and vertical integration; commercial and foreign high-tech advances; open-network innovation; off-shore engineering and manufacturing; changing capital markets.
5. Globalization:	Technology and industry are globalized; geo-politics and scope of threats requires security coalitions; DoD no longer the leader in all military technologies; global financial markets enable borderless investing.
6. Technology Changes:	Including information technology, biological technology, nanotechnology, robotics, high-energy lasers, etc.; and evolutionary cycles, often measured in months rather than years. This requires not only a more responsive defense industry, but one capable of drawing on both the commercial and the global markets.
7. New Missions:	New DoD tasks include support of homeland security; missile defense; counterinsurgency; stability and reconstruction; cybersecurity; biodefense; non-kinetic situational influence of operations.
8. Unpredictability:	Today’s world requires agility, rapid responsiveness, and broad-based capabilities.
9. Intelligence Changes:	Intelligence is focused on integrated data, open-sources, language, and cultural understanding, as well as real-time intelligence flow between soldiers, sensors and command structure.
10. Government and Industry Workforce Changes:	The government workforce is aging; skill mix imbalance; rules vs. judgment; “managers” vs. “doers”; difficult to attract and retain top people. The industry workforce is also aging; eroded systems engineering skills; difficult to attract and retain top Science and Technology (S&T) people.
11. Defense Budget Changes:	Resource shifts from Equipment to Personnel, O&M and Homeland Security; major emphasis on services (vs. goods) e.g., 57% of acquisition dollars in FY09; frequent changes cloud spending outlook and planning (e.g., 50% procurement drop in 1990s, then doubling in 2000s).
12. Isolationist/Protectionist Constraints:	U.S. policy continues to inhibit the nation from gaining the security and economic benefits that could be realized from the global marketplace by, instead, focusing on “Buy American,” the Berry Amendment; obsolete International Traffic in Arms Regulations (ITAR) and export controls; and restrictions on foreign scholars, students, and S&T workers; all of which limit flexibility in acquisition options and cost savings.
13. Uncertainties regarding China and Russia:	With their large nuclear and conventional forces, and their internal changes, will they be integrated into the new global security environment.

Modified from DSB 2008

Let me cite a few of the recent acquisition/procurement adverse trends:

- A significant shift from contracts awarded on the basis of “best value” (i.e. a combination of risk [based on prior performance and technology status], proposed performance, schedule, and costs) to awards based on “Low Bid, Technically Acceptable”—which is an invitation to “buy in;” wait for directed contract changes (to be quoted high, in a sole-source environment); and not focus on quality, cost or schedule control, or “past performance” evaluation.
- A “requirement” to recompete all service contracts every 3 years (independent of performance and costs achieved)—which is a disincentive; compared to the incentive-based requirement to recompete every 3 years unless the supplier is getting higher and higher performance at lower and lower costs (in which case they deserve to receive the follow-on award).

- Not recognizing that “competition for an award” is dramatically different than “competition during execution”—where the former results in a monopoly supplier and large cost growth (from the many changes that came along—from technology changes, mission changes, interface changes, etc.); and the latter results in competitive efforts to continuously improve performance and reliability, and continuously lower costs (in order to get a larger share of each “best value” award). A current example would be the second engine for the F-35 fighter. Here, there never was a competition for the engine (only for the prime contract); and the history (from the “Great Engine War,” for the engines for the F-15 and F-16) is clear—the Air Force ran a continuous competition between Pratt and Whitney’s engine and GE’s; and they got higher and higher performance and increased reliability, at lower and lower costs, from both engines (saving over \$4 billion—net). Since the F-35 is the largest program in history (with 11 nations participating) and since engine maintenance is the highest cost element of the Department of Defense (DOD) support; and since the same two companies have both developed engines for this aircraft; instead of just giving speeches about “competition,” why not do it? Simultaneously, maintain the only two U.S. suppliers, and their lower-tier suppliers, for the future, competitive industrial base of military jet engines.
- Another barrier to competition—this time put in place by Congress—is the passing of laws inhibiting public/private competitions (via OMB Circular A-76 rules) for work currently being done by government workers, but which is not inherently-governmental work. The hundreds of cases in the past have shown savings of over 30 percent—no matter whether the winner is the public or private sector!
- Similarly, the current administration push for “insourcing” of work—without specifying that it is intended only for inherently-governmental work—is actually raising costs. (For example, the Air Force said they would save 40 percent by bringing equipment maintenance in-house; but the Congressional Budget Office (in October 2005) had stated “over a 20 year period, using military units would cost roughly 90 percent more than using contractors”—and “wrench-turning” is certainly not inherently-governmental (only the management and contracting for it is inherently governmental).
- Finally, some of the greatest, and most innovative, ideas in the past came from unsolicited proposals from industry (which then received an award for a “demonstration”). However, these unsolicited proposals are now being greatly discouraged, because they are getting a response that says, “Thank you for the idea, we will now put it out for competition—or otherwise it will hurt our competition scorecard.”

I could go on with the examples; but, instead, let me briefly note the four critical “findings” of the above-noted DSB Task Force (on achieving a 21st century industrial base):

1. Current trends/policies will not result in an effective industrial base.
2. DOD must drive transformation to support a 21st century military.
3. Government must change to facilitate the rapid and affordable acquisition of needed weapons, systems, and services.
4. A weakened DOD acquisition workforce impedes the acquisition of military capability and government oversight.

Since “changing the way the government does its business” and, correspondingly, “transforming the National Security industrial base for 21st century needs,” is basically a “cultural change,” the literature is clear—for successful implementation of a cultural change it requires leadership (with a vision, a strategy, a set of actions, and a set of metrics).

Let me draw on (and add to) the “recommendations” of the DSB Task Force, in order to address the above-noted four findings:

1. Articulate a National Security Industrial Vision; adopt government policies to implement the Vision; structure incentives for industry to achieve the Vision; and monitor ongoing industrial dynamics to ensure its realization.

Critically important is that this vision includes the incorporation of the high-tech, high-quality goods and services available in the competitive commercial market. A recent report from the National Defense Industrial Association (NDIA, February 2011; reference 2) stated “there are many capable U.S. manufacturers that simply choose not to work in the aerospace and defense industries.” They went on to observe the many barriers (legislative, regulatory, etc.) that “prevent new suppliers from entering the aerospace and defense industries, and previous suppliers from re-

turning (these “barriers” include: specialize cost accounting rules; export controls; intellectual property rights; government-unique “flow down” requirements to lower-tier suppliers; etc.). Finally, this group of defense industry executives concluded that “the existing suppliers base may not be the most conducive to helping the industry meet expanding requirements for improved security, higher levels of innovation and greater responsiveness.”

As I, and others, have written (in numerous articles and books), it makes economic and strategic sense (in terms of low cost, high quality, rapid response, surge capability, reduced overheads, etc.) to combine commercial and military engineering, production, and support in the same industrial operations. But to do so requires the removal of the above-noted barriers. It should be observed that other countries clearly recognize these benefits (of “dual-use” operations); and, in fact, the recently-released “Chinese defense industrial policy” explicitly advocates the use of “dual-use” (civil and military) industrial operations.

2. In the weapons’ “requirements process,” focus on interoperable, Net-Centric Systems-of-Systems (with independent “architects,” and enhanced government management and systems engineering, capability).

Here, it is particularly important, in order to gain the force-multiplier effect of distributed sensors and shooters, in a “net-centric” model (vs. the prior, “platform centric” model), that we pay close attention to cyber security—in our design, development and testing.

3. Achieve lower costs and faster-to-field capabilities, while still achieving better performance.

As the computer world has demonstrated—with higher and higher performance, at lower and lower costs, with each new generation of systems; and with new systems coming out on 18 month cycles—it is clearly possible, using product and process technology evolution, to simultaneously realize the dual objectives, of lower cost and higher performance. However, this requires changing the DOD “requirements” process, to include cost and schedule; and to fully-utilize a “Block upgrade” process—beginning with proven technology (for “Block I”), in order to get it out into the field rapidly. Then, continue with R&D, to prove out the technology for future “Blocks”. (This is a common commercial practice, known as “spiral development.”) It also requires a change in the DOD “requirements process” itself (as General Cartwright, Vice Chairman of the Joint Chiefs, has recently advocated) in order for the system to respond faster to the changing “urgent needs” of the combatant commanders; and to be able to make faster decisions, while trading off performance, schedule and cost, in early “blocks” of the equipment, as it evolves (see reference 3).

4. Train as we fight: Recognize the role of “contractors on the battlefield.”

Today’s military operations involve a “mixed force” of military, government civilians, and many contractors (e.g. in Iraq and Afghanistan, around 270,000 contractors—even more than the military). They are performing non-inherently governmental functions (with pre-training, and at low cost) but they must be government-managed; and there has been inadequate staffing, as well as inadequate planning, training, educating, and exercises in preparation for this “mixed force.”

5. Focus on “staying ahead” by adequately resourcing “Engines of Innovation.”

Historically, whenever there are shrinking budgets, the first things to be cut are research, training, and travel. With the need to “stay ahead” (i.e. to maintain technological superiority— which has been the U.S. security strategy for the past half century), we must make sure we don’t “eat our seed corn.” We must not allow our industry and university research budgets to shrink—especially in these areas: (1) for small businesses (e.g. via the “Small Business Innovative Research Program”); (2) in the Industry’s “Independent Research and Development” (which must remain “independent”—and which recently has been drifting toward efforts to support near-term “bid and proposal” efforts); and (3) in the important “manufacturing technology” effort (which must be geared to a focus on lower cost, but high quality, manufacturing processes—even when producing an item in relatively small quantities).

Finally, there are times when an R&D award (at the prime contractor level, or in a critical subsystem or part) may be the only way to maintain a competitive, potential second source in a key industrial-base area (and this award also serves to keep pressure on the current source, to continue to innovate—in order to remain competitive). Thus, there is a need for a strong link between the R&D organizations and those doing industrial base analyses.

6. Understand and realize the benefits of globalization while mitigating risk.

As I wrote in “Foreign Policy” (March 2009, reference 4), “The United States must face the fact that it no longer has a monopoly on the world’s best military technology. America’s path toward future security involves cooperating with allies and taking advantage of the best they have to offer, not cutting itself off and watching as its military superiority slips away.”

Given that one purpose of military procurements is to ensure competitive advantage over the other countries’ technological arsenals, the idea of depending on foreign sources for military equipment might seem ill-advised, even dangerous. But, in fact, virtually every weapons system used by the U.S. military today contains components that were manufactured or designed somewhere else—and their selection was based on higher performance; not on lower costs. Take, for example, the Army’s new mine-resistant, ambush-protected (MRAP) vehicles. Designed to protect soldiers in Afghanistan and Iraq, they have a V-shaped hull that was originally developed and refined in South Africa, along with armor that was designed in Israel, robust axles from Europe, and electronics from Asia.

Of course, critics argue that these arrangements are incredibly dangerous. After all, couldn’t the U.S. weapons supply be cut off during wartime if the country were too reliant on foreign parts? Most of these foreign sources, however, are from NATO nations or other countries with which the United States has had enduring military and commercial relationships. For example, despite very public opposition in some of these countries to U.S. actions in Afghanistan or Iraq, at no time did foreign suppliers (including 20 German and 2 French suppliers) restrict the provision or sale of components.

Skeptics also worry about “Trojan horses” built into foreign-supplied systems, particularly in the case of software. But this potential threat can be addressed through extensive and rigorous testing and reverse engineering; just as required in the financial and medical communities. Still others raise serious and legitimate concerns about military technology leaking into the hands of rogue regimes or terrorists, or being sold to third parties without U.S. knowledge. These are certainly excellent arguments for international arms-control treaties. But there’s no reason why such treaties need preclude legal arms trade among allies, along with mutually-agreed-to verification techniques.

More commonly, opponents emphasize the potential loss of jobs that might occur as a result of buying equipment from offshore firms. This was the argument critics in the U.S. Congress fell back on in March 2008 when the U.S. Air Force awarded a contract to build an airborne refueling tanker to Northrop Grumman, over rival Boeing. What made Northrop’s bid controversial was that it planned to convert commercial aircraft built by the European conglomerate EADS (using Airbus aircraft) for military use. Some parts would be built in Europe and then shipped to the United States for assembly in Alabama. The response from Congress was as predictable, as it was wrongheaded. Members from both parties swiftly denounced the decision to reward the lucrative contract to a “foreign firm” (even though it was to be built in Alabama).

The Defense Department should not become a social welfare organization; and its sole responsibility should be to supply U.S. warfighters with the best equipment at the best price. Luckily, though, these two goals aren’t mutually exclusive: in fact, the Air Force found that the presence of the Northrop/Airbus bid resulted in a dramatic reduction in the Boeing bid (as the eventual winner).

The United States is still the world’s largest military customer (in fact, larger than all the others combined), and it’s in the interest of international weapons manufacturers to do business where the buyers are. In the past decade, a number of major international firms have set up shop in the United States (bringing money and jobs to the United States, along with their technology; and even increasing U.S. trade exports). Alone, the Northrop deal would have created tens of thousands of U.S. jobs.

It is also inconceivable that the United States would be involved in any future military operation without being in some form of international coalition. This is primarily for geopolitical reasons (rather than simply military ones), but its importance cannot be underestimated. When operating in a coalition environment, the United States must be able to fully operate in an integrated fashion with its allies; and they all must have the best possible equipment.

Despite the benefits that military globalization has already brought, Congress continues to pass laws blocking its expansion. These laws can sometimes be directly detrimental to military operations. In 1998, export controls held up the production of a U.S. fighter plane for 7 months while a U.S. company waited for an export license to supply technical data to a Dutch company that was building parts for it. These U.S. export controls even prompted one major German defense contractor to instruct its employees to “avoid U.S. defense goods at all costs.”

In addition, the export control laws also create a significant barrier to commercial firms doing defense business. For example, when a commercial electronic part was used in a “Maverick” missile (and, therefore, under export control), it also was being used in a Boeing 737 aircraft, being sold (commercially) offshore. This resulted in an export violation; and caused Boeing a \$15 million fine. (See reference 8) Clearly, the commercial world market for electronic parts is far larger than the DOD’s, so such restrictions greatly discourage commercial firms from offering their high-performance, low-cost parts to the DOD. Obviously, this leads to specialized DOD parts (at low volume and high cost); and to reduced exports of any parts or equipment (including commercial) that are used in DOD systems. Neither of which results is desirable.

On the import side, the 1993 “Buy American Act” requires that 51 percent of all purchases by the Pentagon be produced in the United States. This often results in foreign-designed weapons systems being transferred to the United States for production at a significant increase in cost to the American taxpayer. Congress has occasionally flirted with expanding the act to cover all military purchases. (In fact, in 2004, the House of Representatives passed a law stating that all parts of all weapon systems must be made in the United States; on U.S. machine tools.) This requirement would have had disastrous consequences for military procurements (i.e. lower performance and higher costs); and in some cases would have required the government to create entirely new (subsidized) industries. (Fortunately, the Senate did not concur; so it did not become law.)

It is clear that, today, technology and industry are globalized; and for the United States to gain the advantages of this (for economic and military benefits) it is time to revise the Nation’s export and import control laws! The President currently has a Task Force addressing this issue.

7. Achieve far greater use of “best value” competitions, and foster long-term competitive dynamics.

I have written and testified frequently about the benefits (in cost and performance) of competition. But, there are (as described above) right and wrong ways to perform a competitive acquisition (see reference 5). Weapon systems are not interchangeable commodities (so you can not just “open the envelope” and pick the low bidder) the decision must be based on a combination of risk (based on “past performance” of the firm and current status of the proposed technology) and the proposed performance, cost, and delivery (i.e. “best value”); as well as the probability of maintaining these “promises” in the presence of the large number of future changes (that are unavoidable in this rapidly-changing world).

So, incentives are required (to achieve high performance at low cost); and the best one (over the long run) is the presence of, or a credible option for, continuous competition among two sources (known as “competitive dual-sourcing”).

The usual counterargument is that “we can’t afford the second-source start-up costs;” and “this time will be different”—“We will manage the sole-source contractor, and allow no government-imposed changes.” But this just doesn’t have any credibility!

8. Transform the DOD logistics system into a world-class, data-centric logistics system.

The DOD Logistics system is, by far, the most expensive of its overall acquisition phases (in fiscal year 2009 it cost over \$270 billion, and the DOD also carried an inventory of over \$90 billion); and yet, it is not world class (by any measure—responsiveness; reliability; asset visibility; cost; etc.). However, for warfighting, it is absolutely critical that “the right part gets to the right place, in the required time.” A comparison with the logistics systems of Walmart, UPS, Fed Ex, Caterpillar, etc. shows that it can be done; and that the DOD has no choice but to modernize its logistics systems—both for higher performance and for significant cost savings!

The only way to achieve this is to spend some R&D money on modernizing the existing DOD’s, 20th century, logistics systems (of which there are over a thousand relevant I.T. systems alone), and to continue its recent emphasis on “Performance Based (i.e. results-based) Logistics.”

9. Recognize that, while over half of DOD’s acquisitions are for services, all of the current regulations, policies, practices, education, etc. are based on acquiring goods; and this must change.

I recently chaired a congressionally-mandated DSB Task Force on “Improvements to Services Contracting” (reference 6, May 2011), and found that, in fiscal year 2009, 57 percent of all DOD acquisition dollars went to buying services. Of course, the boundary between hardware and services is increasingly blurred (i.e. buying transportation services as opposed to buying trucks). While specifying the requirements

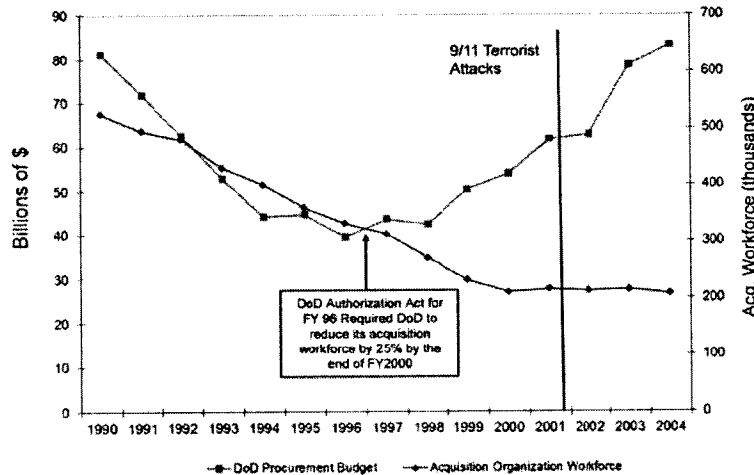
for the services, and effectively managing them, (often without clear metrics for performance) is extremely difficult, and requires extensive training and experience, this is not recognized or appreciated in current DOD policies, practices, training, education, and (particularly) in hiring and promotions. When it is realized that essentially all of the contractors in Iraq and Afghanistan are performing “services” (of an extremely wide variety), the importance of this area (to the military mission) should become clear. Additionally, when one thinks of “the defense industrial base” they tend to think of the firms building “ships, planes, and tanks,” and yet, they also need to consider those firms providing services (and receiving over half of the acquisition dollars)—and often providing these services “in harm’s way” (in fact, the dead and wounded from industry have recently been exceeding those in uniform).

It is time for policies, organizations, personnel activities, etc. to recognize that (like the U.S. economy) services are, and will continue to be, a big part of doing business in the National Security arena. This change must take place!

10. Move aggressively to strengthen the future, high-quality, high-skill, Government Acquisition Workforce.

When I chaired an independent Commission for the DOD on “Army Acquisition and Program Management in Expeditionary Operations” (reference 7; October 31, 2007), we were shocked to find how much the DOD acquisition workforce (particularly at the senior levels) had been undervalued. This is shown clearly by the data in Figure 1.

Figure 1: Overall DoD Acquisition Workforce Declined Even as Procurement Budgets Increased



Source of workforce data: DoD IG Report D-2000-088 Feb 29, 2000 & DoD IG Report D-2006-073 April 17, 2006
 Source of Budget data: Annual Defense Reports, available at http://www.dod.mil/execsec/adr_intro.html

Since the mid-1990s, as the dollars and actions for DOD acquisitions were rising dramatically, the acquisition workforce was being cut. (25 percent of this was by congressional mandate.) Even more critical than the numbers being cut, were the senior positions. For example, in 1990 the Army had five general officers with contracting experience; in 2007 they had none. In this same time period, the Defense Contract Management Agency went from 4 general officers to none (while their workforce went from 25,000 to 10,000). The Air Force had cut both their acquisition general officers and their SES acquisition personnel in half.

Without smart, well-trained, experienced acquisition buyers and managers, making the required changes in DOD buying practices, and achieving the required transformation of the industrial base (for 21st century National Security) will sim-

ply be unachievable. Fortunately, Congress has recognized this need with some important acquisition workforce legislation. Also, the Army has established the "Army Contracting Command," while Senator Collins and Representative Connelly have recently introduced a very positive set of bills to address acquisition workforce education and training. But progress is moving slowly—and (as described above) there have been many actions (by both Congress and the administration) that are more focused on "rule compliance" than on "results achieved."

One final personnel issue which must be addressed is the science and technology (S&T) workforce (in government and industry). It has been increasingly difficult to get U.S. students (in general) to go into S&T; and those that do, prefer to work in Hollywood animation, Wall Street computer modeling, or biotech; to working in aerospace and defense (the greater money, more work freedom, and greater job stability appear to be better). One of the unique government requirements (that is requested to be "flowed down"—even to university researchers and lower-tier defense workers) is that the workers must be U.S. citizens. (This is in spite of the fact that we allow 3 percent of the U.S. military to not be U.S. citizens.) Importantly, in 2006 the National Science Foundation reported that "35 percent of those obtaining graduate degrees in science and engineering, in U.S. universities, held Temporary Visas"—and they were even required to sign an agreement that they would leave the United States when their studies were completed. Given America's history as an "immigrant nation," and the number and quality of these foreign S&T graduate students, I would think that, after an appropriate security check, we should "staple a green card to their graduate degree;" and encourage them, along with their U.S. counterparts, to seek work in fields related to National Security. (Realizing that Enrico Fermi was not a U.S. citizen when he worked on the Manhattan Project for us; and that many of the founders of Silicon Valley were not U.S. citizens; it only makes sense to consider them.)

In summary, it is critical that the government changes the way it does its business (i.e. implement real acquisition reform); and, as a result, that the National Security Industrial base is transformed into a flexible, adaptable, agile, responsive, innovative, structure that provides high-quality goods and services (for 21st century military needs) at affordable prices and in the quantities required.

The men and women of our armed services deserve nothing less!

Thank you.

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Senator HAGAN. Thank you.

Mr. Odeen.

STATEMENT OF PHILIP A. ODEEN, MEMBER, DEFENSE BUSINESS BOARD, TASK GROUP CHAIR, ASSESSING THE DEFENSE INDUSTRIAL BASE

Mr. ODEEN. Thank you very much, Chairman Hagan. First of all, let me say thank you for holding this hearing. This is a very important issue but it seldom gets attention before Congress, so this is a great step forward. It struck me as an excellent example of what President Eisenhower called "absolutely critical, but not urgent, issue." People know how important it is, but they never quite get around to addressing it. So thank you for doing this.

I'm going to take a bit of a different tack in my comments. My prepared statement agrees with many of the things Jack and Norm have said, so let me just look at this issue in a different light. First, the health of the defense industry today. The traditional aerospace-defense companies are in very good condition right now. They have strong earnings, cash flow is excellent, their debt levels are low, and they have very solid investment grade credit ratings.

It may seem surprising but over the past decade they've been able to attract very capable technical people, both new college graduates and some experienced people. The economic situation in particular is a factor, although September 11 might have had an impact as well.

At the other end, because of the recession, experienced people are not leaving as early as they often did, so the companies have experienced a short-term step up in the capability of their workforce. Longer term, it's a different issue and there still is a "bathtub" in their experience base. They hired nobody in the 1990s, essentially, so they lack people who would have 10, 15, 20 years of experience that are simply not in that workforce. So you have a real gap there, made up temporarily by these more experienced people that are staying on.

The current situation is in stark contrast to the picture a decade ago. Following a decade of defense budget cuts, the industry consolidation that's been discussed, revenue and cash flow were declining, debt levels were high, and most of the companies had sub-investment grade credit ratings. Moreover the stock prices had done very badly throughout the 1990s. The company also had an aging workforce and great difficulty in recruiting capable technical talent, either new graduates or experienced people.

All is not well, even though the overall picture looks pretty good right now. There are some significant challenges that DOD and its industrial partners face. You have a web of third- and fourth-tier subcontractors that support larger firms in very important ways and they are in real disarray. Many of them are primarily commercial in their orientation and the 2008 recession, with its dramatic impact on the industrial base, hurt them badly. This has had a flow-through effect on DOD.

Because of the lower expected defense spending, stock prices are not doing well, despite very good earnings and very strong dividend increases. Stock prices today of all the major companies are well below the level in 2009 after the recovery from the 2008 stock crash. By contrast, the rest of the stock market has improved dramatically. Weak stock prices make it harder to attract capital, but also to reward people with stock-type compensation.

Perhaps the most difficult issue facing DOD today has been touched on already and that is the ability to access commercial technology, which is critical to most important defense capabilities. Let me talk about this briefly because it's one of my special concerns. Many critical defense capabilities rely heavily on the commercial sector, which leads, in fact often dominates, cutting edge technologies in computers, software, communications, and other areas of electronics.

The policy and regulatory changes made in the 1990s, which Jacques will recall, helped facilitate DOD's access to the commer-

cial world. Unfortunately these have been seriously eroded over the past decade. There are other barriers as well: the slow, complicated acquisition process and the multiple, complex regulations Jacques mentioned; a convoluted, opaque requirements process which makes it hard for companies to know what defense needs and where they should be directing their investment; buy-America laws and export controls, which you've discussed already.

Let me mention one of the nuances in export controls. If you're a high-technology American company with really interesting technology and opportunities to sell worldwide, you don't want to get involved with DOD. Before you know it, your item will be ITAR-controlled and your ability to export will be diminished dramatically. Many companies with good technology simply refuse to deal with DOD because of that risk.

There are a lot of future challenges for DOD, assuming reduced defense spending and the end of the wars in Iraq and Afghanistan. Some of these challenges have already become evident: tough decisions on the cancellation of existing weapons programs; very tough choices between buying more of today's traditional systems and next generation capabilities; pressure on investment spending from the growth in military personnel-related programs, in particular health care and retirement; and finally, the greater difficulty to maintain competition as we enter a period of lower investment spending. You're seeing these issues emerge already and they will grow in importance in the years ahead.

How will the defense industry react to this? As I said, they're doing well today, but as defense spending comes down they're going to have to respond. Small niche-type acquisitions can provide special new capabilities, and some additional incremental revenue, and you're already seeing this. They're going to diversify or attempt to diversify into those government markets that they see as stable or perhaps growing—intelligence, cyber, homeland security, areas like that. You may see some effort to move into the commercial sector, although, as Norm Augustine knows well, that has not been successful in the past. Also, you will see increased efforts to sell products internationally, especially to the Middle East and Asian markets, where there's a lot of procurement going on. Export controls are a complication here. The recent issue on the sale of fighter aircraft to India is an interesting case study of the problems that export controls create.

Mega mergers are not likely, as far as I can see. However, if the spending cuts are deep like they were in the 1990s, you're likely to see a different situation. It may force DOD to rethink its policy on mega mergers or at least support limited mergers of some sectors of the defense industry, for example shipbuilding. If there isn't enough money to support adequate multiple suppliers, they're likely to have to permit more major mergers.

How does DOD respond to this? First of all, there's no silver bullet, no one-size-fits-all policy, given the complex, multifaceted nature of the industrial base supporting DOD. In my view, DOD must make every reasonable effort to maintain some competition on those platforms that will be of continued importance in the future, not all major platforms, but those that will clearly be important for a long period into the future.

Even more critical strong competition, the next level down, major subsystems, such things as radar, aircraft electronics, fire control systems for ships, aircraft engines, and so forth. You must have competition in these areas if at all possible.

It will also be important for DOD despite lower budgets to invest in areas that are going to be central to the future effectiveness of the military—C⁴ISR is the obvious example—as well as promising new capabilities, such as unmanned systems that can really change the game. Investment to preserve options for the future, such as funding prototypes, can also be important. They give us choices as we go forward.

I've talked primarily about the hardware suppliers in my comments today, as have my colleagues. The important services sector, which is roughly half of DOD contract spending, will also face challenges that DOD will need to respond to. They're somewhat protected for a variety of reasons, such as the nature of their funding, their ability to be flexibly cut back and maintain profits and cash flow. They'll face big problems as well that I can cover in more detail during the discussion if you wish.

In closing, just let me again compliment the committee for addressing these issues. I know DOD is addressing them and your interest and support will encourage the Department to cope with the industrial base challenges that lie ahead.

Thank you very much and I look forward to your questions.

[The prepared statement of Mr. Odeen follows:]

PREPARED STATEMENT BY HON. PHILIP ODEEN

Good afternoon, I appreciate the opportunity to appear before you today. The Defense Industrial Base is a vitally important issue, but one that seldom gets attention from Congress. It is a perfect example of issues that President Eisenhower described as 'critical but not urgent.'

THE INDUSTRIAL BASE TODAY

The large Defense industrial companies are in sound condition today; strong revenue and cash flow, growing profits, and impressive balance sheets with limited debt and investment grade credit ratings. This is in stark contrast to the Industrial Base a dozen years ago, following a decade of sharp reductions in Defense spending and the massive consolidation of the traditional industry players following the so-called "last supper," hosted by Secretary Perry. Revenues had declined along with profits, cash flow was weak (in part due to the Department of Defense (DOD) policies), and the surviving companies had heavy debt loads and non-investment grade credit ratings. They also had an aging workforce and found it difficult to attract well-qualified technical and engineering talent.

Today's Defense Industrial Base is healthy in areas beyond its financial condition. Human capital has been rebuilt after a decade of attracting quality college graduates and experienced technical and engineering talent. This is due largely to the weak industrial economy and the good wages and benefits Defense industry offers. But I believe the attitude of our people post-September 11 contributes as well.

While the large primes and most major subcontractors are in good condition, the lower tier suppliers are a different story. The recent recession impacted many of them severely. Most of these firms primarily sell to larger commercial manufacturers, and commercial demand dropped sharply in 2008. A number of small companies providing items such as forgings and specialized components went bankrupt or had to close selected operations. Defense industry was able to work through these issues, but problems still remain. In many ways, these 3rd and 4th tier suppliers are the weakest link in the Defense industry supply chain. Hopefully the current recovery of the broader manufacturing sector will reduce the risks going forward.

DOD, however, relies on a much larger web of suppliers beyond the well-known aerospace and defense primes. In many areas such as electronics, information technology, and communications, most of the new technologies reside in the commercial

world—frequently in firms based outside our borders. Here DOD's outlook is far less positive. The policy changes made in the 1990s to facilitate DOD's access to the commercial world have largely been eroded. As a result, DOD is again forced to rely heavily on its traditional suppliers and sources of technology.

ACCESS TO TECHNOLOGY

Looking beyond DOD's limited access to commercial technology is DOD's own investment in the science and technology so critical to its future needs. During much of the second half of the 20th century, the United States was the leader in defense technologies. DOD had a robust research and development program and with its industrial partners, accounted for a significant share of the key new technologies that supported our military capabilities. That is far less true today—again due to a variety of factors.

- The growing importance to DOD of new areas of technology (communications, IT, etc.)—all areas led, and in many cases, dominated by the commercial world.
- Pressure within DOD budgets on S&T spending and similar pressures on Independent Research and Development spending by the aerospace and defense companies.
- The explosion of technology developments and products outside the United States, especially in regions such as Asia. As a result, technologies that are important to military capabilities are often available to anyone with “deep pockets.”

DOD and its traditional suppliers, have difficulty accessing these robust external sources of advanced technology for various reasons. Some are self-imposed, such as:

- Slow, complicated acquisition processes and complex and onerous rules and requirements, which deter commercial companies.
- A lengthy, convoluted and opaque requirements process that make it difficult for industry to understand future defense needs.
- ‘Buy America’ regulations and other barriers that often exclude foreign suppliers.
- Export Controls (both here and abroad) designed to limit the spread of defense-critical technology that can limit access to the United States as well as foreign technology.
- Other impediments are more traditional, ranging from inadequate knowledge of what is available in the wider industrial base (here and abroad) and the “not invented here” syndrome.

DOD is concerned by these issues and is addressing them. But support from Congress for the needed funding and legislative action will also be important.

Future Challenges to the Defense Industrial Base

Looking to the decade ahead and beyond, it is clear that DOD and its industrial partners will face escalating challenges, in part due the likely downward trajectory of DOD spending. This has implications for both DOD's access to needed industrial capabilities and the makeup of its traditional supplier base. It will also make it more difficult to maintain effective competition as consolidation continues and some firms narrow their focus to businesses where they have comparative advantages.

DOD's challenges are already obvious:

- Tough decisions to cancel existing weapons programs that may not be affordable in the future.
- Difficult investment choices between traditional platforms and next generation weapons and capabilities.
- Finding adequate funding for investments given the growing spending on military personnel (pay and benefits, retirement programs, and in particular, the rapid rise of healthcare spending).
- Trying to maintain competition when there are only a few (maybe two) providers.

The traditional Defense contractors will also face challenging times exacerbated by reduced defense budgets. Given the concentration of the Industrial Base today, we are unlikely to see the mega mergers and acquisitions we saw in the 1990s. Rather, companies will likely respond in other ways:

- Smaller—often niche—acquisitions to provide new capabilities, contract vehicles and incremental revenue.
- Diversification efforts, which are already in evidence as companies try to penetrate Government markets that are seen as growing or at least stable (e.g. intelligence, CYBER, and Homeland Security). Some limited efforts to expand into commercial markets can also be expected.

- Increased emphasis on international sales, despite the constraints of export controls (e.g. the recent failed effort to sell combat aircraft to India).
- Selling or spinning out declining or less profitable business areas, leaving a more focused and stable base business.

If the investment budget cuts are deep (as in the 1990s), more draconian actions will be needed, that could include mergers of large primes, or sectors of two companies (e.g. shipbuilders). This may prove unavoidable, but will further reduce competition. The smaller players will have other challenges. Do they sell, refocus on commercial markets, or leave the defense sector entirely? This is already underway as numerous small firms have been acquired by larger companies or, in some cases, gone private with the help of private equity firms.

All segments of the Defense Industrial Base will find it harder to attract and retain a capable workforce in a period of decline and contraction. I will leave this discussion to the expert, Norm Augustine.

THE SERVICES SECTOR

My remarks above have largely focused on the aerospace and defense hardware sector. The Services Sector—roughly half of Defense contract dollars—will also face a range of challenges, some different from those facing manufacturing companies. Services cover a broad range of offerings from complex software and Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C⁴ISR) technology to routine actions to maintain bases and facilities. It is highly competitive with 70 percent of the dollar value delivered via task order contracts (indefinite delivery/indefinite quantity, Government-wide Acquisition contract).

The Services Sector may be impacted less, given that much of their funding is from Operation and Management accounts. They also have capabilities that have readier applications in the commercial world (e.g. CYBER or IT). Also, they can quickly cut costs to maintain profits and cash flow, since they are not burdened by extensive facilities and infrastructures. But, they will be undoubtedly impacted despite these advantages. I can expand on the Services Sector in the discussion period if you have questions.

HOW SHOULD DOD RESPOND TO THESE CHALLENGES?

Determining how to best respond to these challenges will not be easy as the industrial base is large, complex, and multi-faceted. A variety of selected policies and programs will be needed. The appropriate proper actions for the hardware programs will depend on:

- The industry segment
- The competitive landscape
- The access needed to technology and products

The actions that will be required include:

- Preserving competition for key platforms whenever possible, even though it will be costly in the short term. At a minimum, preserving competition among the major system providers is important (engines, fire control systems, radars, etc.)
- Focused investments to encourage competition in new areas critical to combat effectiveness such as C⁴ISR or innovative capabilities with great potential, such as unmanned vehicles of all types.
- Use of tools such as Broad Area Announcements and prototyping to provide future options and maintain critical skills in the Industrial Base.

A major strength of the Services Sector is its robust competitive nature, its agility and the continued emergence of new, creative companies. This competitive landscape needs to be maintained. Properly administered task order contract vehicles, careful application of OCI (conflict) rules, and actions to enable nontraditional suppliers to compete will all help.

Conversely, DOD must avoid letting excessive competition damage quality of the services, which can result from an undue focus on low price. Best value must be the key mantra in most cases, especially those involving technology and specialized expertise.

Finally, the health of the Defense Industrial Base must be regularly monitored. This includes its financial condition, access to technology and the state of its human capital. We must not recreate the Defense industrial landscape of the 1990s.

CONCLUDING COMMENTS

I compliment the committee for addressing these issues. I know DOD is addressing them as well and your interest and support will help the Department cope with the industrial base challenges that lie ahead.

I look forward to responding to your questions and comments.

Senator HAGAN. Let me just say thank you to all of you for agreeing to come and share your information and background and testimony with this committee. I think it's extremely helpful.

I will go ahead and start with some questions. In last year's QDR it called for a consistent, realistic, and long-term strategy for shaping the structure and capabilities of the defense technology and industrial base. Given all of your prior DOD experience, do you feel that DOD has a long-term strategy that's executable and will it be able to account for the rapid evolution of commercial technology and the unique requirements of ongoing conflicts?

Do you want to start, Mr. Augustine?

Mr. AUGUSTINE. I'd be happy to. I think the first thing I would note is that the defense industry to a large degree is really a microcosm of U.S. industry as a whole, and U.S. industry as a whole, I believe, is greatly threatened by international competition today. We simply aren't very competitive and we're becoming less so. DOD has the added complication I've already mentioned of needing security clearances for its industrial base in many instances.

Does DOD have a long-term strategy for dealing with this? I would have to say I don't believe it does today. On the other hand, I have to give DOD credit that there's probably more attention being given to the defense industrial base today than there has been in a long time, and I think that's important.

There are many things that could be done in terms of a strategy. I would just cite one thing that stands out in my mind. Perhaps the most valuable asset that the industrial firms have are their advanced design teams. Our factories are valuable and so on, but the really irreplaceable thing is experienced advanced design teams. How do you maintain those, for example, when you develop one new airplane every 3 decades? In my judgment the only way you can do that is to adopt an approach promoted by Dave Packard, my former boss, when I was in the Pentagon. That is to prototype systems.

So to me the keystone of a strategy, at least one of the keystones, should be to adopt—to reinvigorate the prototyping program, the intention would not be to deploy the systems, but simply to maintain the state-of-the-art, advance the state-of-the-art, maintain the knowledge base, and the people base. It doesn't cost that much to do that. The payoff is enormous.

Senator HAGAN. Dr. Gansler.

Dr. GANSLER. Let me just pick up on Norm's last point, because I think it's really important to do the prototyping, but I think it's even more important to do it competitively, so multiple sourcing. I think that was as well what Dave Packard was really pushing.

I would argue that right now your question about rapid acquisition—I did a Defense Science Board study recently on rapid response to combatant commander's needs. We don't have a rapid responding system at all. Beginning with the requirements process and then the procurement process and all the gates that you have

to go through and the inflexibility of that system for rapid response—we do need to have a change in that process in terms of everything, including the budget process, so there would have to be some dollars available to rapidly respond as well. But then you need an ability to do the process much more rapidly.

We can do it. We've done it sometimes on some programs, but it's always a special case. In fact, in that hearing when we did the Defense Science Board we were kind of surprised to see every time someone would come up and talk about something that they had done rapidly, they started off by saying: We had to go around the system. You shouldn't have to do that. Fortunately, they had supplemental funding, and without supplemental funding they would not have been able to do that.

An area that I am very worried about, as I said in my remarks earlier, is research. If we start trying to save money, we put off the future for the present, and that's not going to be the smart move to make. It's eating our seed corn, if you will. We can't afford to do that.

Then lastly, I think, relative to the vision, having a vision statement that you don't implement is not effective. They give lots of speeches about trying to have competitive sources, at least two sources, in the United States and then, as Senator Portman mentioned, for example on the second engine for the JSF, where we have a strong history with the great engine war for the F-15 and F-16, that both engine suppliers got higher performance, higher reliability, lower cost. The Air Force in that smaller program said they saved over \$4 billion. This is a much larger program. Why aren't we doing it?

Well, because this year we don't have the money and this program we know how to manage better than we have all the other ones in the past, we won't have any changes, and all these things that I think are not credible.

So we have to implement this vision, not just talk about it in speeches.

Mr. ODEEN. Let me just add one other point related to that. The S&T spending, SBIR programs, are all important, but the most critical thing for DOD is to be able to reach out to that very large commercial technology sector, both in the United States and even overseas. I believe that has to be a key element of any strategy.

We're simply not going to be able to spend enough on S&T within the companies. There are IR&D programs that the Pentagon is spending on its labs. You have to reach out to the broader technology base of the country, which is huge in comparison to the amount of money spent on technology within DOD or by its suppliers.

So I think that this must be a key element of the strategy, reaching out to industry, finding ways to simplify the acquisition process, get rid of these barriers that keep companies from wanting to play. I think this is important and should be a key part of the strategy.

Dr. GANSLER. If you needed some examples of what he was just saying, Boeing just recently had to pay \$15 million for a commercial transport that had a part that happened to also be in a missile. It was a commercial part and therefore they had to follow export

controls for that little electronic part that was inside of its avionics in a commercial aircraft. That's kind of silly, isn't it?

In other cases where we were ahead commercially.

Senator HAGAN. How was that determined, investigated? How did that come up?

Dr. GANSLER. The ITAR list of parts. If a system is in a defense product, as a commercial item, if it's on that list of controlled items it automatically has to then get permission for export control.

Senator HAGAN. So they had—they paid the penalty, but continued?

Dr. GANSLER. No. Then they had to start getting export control permission for that electronic part.

Mr. ODEEN. They probably self-reported it.

Dr. GANSLER. Yes, they self-reported, in terms of how they found out about it. But it's just an absurd example, it seems to me, of overdoing the controls.

Another example that I've heard of would be the infrared area, where we used to own the night and we were way ahead. But our companies couldn't export infrared and so now the French are taking over the world market. They can export around the world. We have to be sensible about the fact that the world is now globalized. Technology is globalized, industry is globalized, labor is globalized, but we're trying to protect, and that's hurting us.

Senator HAGAN. Do you know the last time we updated these laws?

Dr. GANSLER. Yes. We update them all the time. We add more things to them. The problem is we haven't removed things from them.

Senator HAGAN. Dr. Gansler, in your written testimony, and you also mentioned it, you talked about low-bid, technically acceptable. Can you tell me a little bit of background? I guess I'm surprised, depending on what it is we're talking about.

Dr. GANSLER. We're talking about either services or products. I mean, I certainly know you wouldn't get your heart surgeon on the basis of lowest hourly rate and someone with a degree.

Senator HAGAN. Well, I think about all the high-tech instruments that we have to have to conduct the mission we just saw.

Dr. GANSLER. Exactly.

Senator HAGAN. I don't think I'd want somebody with just a technically acceptable item.

Dr. GANSLER. No. That's, the problem is that people say, well, gee, you could save money by taking the low bid, even if—I mean, how would you buy an engineer at the lowest hourly rate? If they happen to have a degree from the back of a matchbox and their temperature's 98.6, they're qualified as an engineer. That's not the way you should be buying services, nor is it the way you should be buying products.

Increasingly there's been a shift towards that throughout the DOD and the intelligence community, by the way. So I think we have to get back to recognizing that you pay a little more and you get a lot more, it's worth it.

Senator HAGAN. Last year's Defense Business Board study on the defense industrial base addressed the specific issue of the need for the defense industrial base to continue to have access to crucial

technology, expertise, and capabilities, what we're talking about. Mr. Odeen, as the leader of that study, how well do you think DOD is taking—is doing in taking the steps that were recommended to ensure its access to technology in a globalized world?

Mr. ODEEN. It's a little hard for me to say. They were receptive to the report. We briefed many of the senior people on it. We had very good exchanges. They understand the need to do that. But I'm not sure exactly how far they've gone on that. Perhaps someone from DOD could answer that. It's only been a year and a half, which seems like a long time, but that's not a long time for DOD to respond in terms of changing policies and regulations.

But they certainly "got it" based on my conversations, and hopefully they will move down that path in the months and years ahead.

Senator HAGAN. Thank you for your participation in that, too.

Dr. GANSLER. There are still problems in that area. For example, Ronald Reagan, not an ultra-liberal, said that fundamental research should be globalized; it should be independent of what countries the researchers come from or we can share cooperatively, we can publish freely. But a lot of the policies in recent years have said United States only people and, as Norm pointed out, most of the Ph.D.s today coming out of our universities are not United States and therefore can't take part in this research.

I'm sure you know that most of the people founding Silicon Valley were not U.S. citizens. Enrico Fermi was not a U.S. citizen; he worked on the Manhattan Project. We can take advantage of these foreign students and scholars.

Senator HAGAN. I agree. We were talking about that earlier. Actually, my next question has to do with that, the fact that we heard in the first panel some of DOD's initiatives and programs to attract and retain a new generation of scientists and engineers, but not only in DOD, but also for the broader defense industrial base.

Dr. Gansler, particularly in your statement you raised the concept that we talked about of stapling the green card to a degree of a graduating student in S&T who has had an appropriate security check. In your wide-ranging interactions with others on this topic, what do you see as the way ahead as far as implementing this proposal and what are some of the impediments or concerns that would have to be addressed for successful implementation?

Dr. GANSLER. Right now, by law I believe they're required to sign that they'll go home. That seems to me a silly law. I would not do that. We're a nation of immigrants. Why would you force them to sign that they'll go home when they're finished? Because they're here on a temporary visa and the concept behind the temporary visa is that they will agree to go back.

Well, when they get their Ph.D. maybe you do staple a green card with it, and many of those could easily be encouraged to go into the defense sector. We actually have 3 percent of the military as non-U.S. citizens. We let them get shot at and killed. Why won't we let them go into our defense industry or why won't we let them go into the government? There's some conflict there.

Mr. ODEEN. It's more than just defense industry. They can populate the broader industrial base. This is good for the United States and has various feedbacks to DOD. If there are issues, they don't

all have to go to work for a company like Lockheed Martin. They can go work for other companies that will be providing technology and products that will help the country more broadly, but can respond to defense needs as well. We should clearly encourage them to stay.

Dr. GANSLER. But at the lower tiers we now have again a law that says that the prime contractor must pass on all the requirements that they have to the lower tiers. So the point that Phil is talking about about the lower tiers, if they hire non-U.S. citizens they're again not following the directives that came from the prime down through law to the lower tiers. We should perhaps not require that to be passed on that it must be a U.S. citizen working on the widgets.

Mr. AUGUSTINE. I'd like to touch on that myself. There's a real dilemma here. The percentage of bachelor's degrees that are awarded in the STEM fields are about 4.4 percent of the total degrees awarded. So about 95 percent of our people are not studying in the STEM fields in college. That's one of the lowest ratios in any industrialized country, or any developing country at this point.

You go from there to the fact that when I graduated from college, and maybe my colleagues on the panel, if you wanted to work at the leading edge of the state-of-the-art, the place to work was either in the defense industry or the space program. Today that's not the case. There are a lot of exciting things in biotechnology and nanotechnology and information systems and so on.

There are certainly exciting things in the defense industry, as well, but the point is that there are options. There are a lot more options. When the students look at the bureaucracy of the defense sector, it's very tempting to them to go elsewhere, and I'm afraid that's been happening.

One of the recommendations that was made in "The Gathering Storm" study was that when a student graduates with a Ph.D. in one of the sciences or engineering, hard sciences or engineering, that they be given 1 year to gain a "permanent" job, and when they do gain that job that they then be given a green card and an expedited process to become a citizen should they want to do so. I don't think that's been acted on, but I believe it would be a useful thing to do.

Mr. ODEEN. Could I add one more comment about the STEM issue?

Senator HAGAN. Certainly.

Mr. ODEEN. The defense industry is very concerned about this longer term. I was on the Northrop Grumman board for a number of years, and they now give 90 percent of their charitable contributions, which are substantial, to STEM-type programs. The charity golf outings are gone, the symphony orchestras and operas are getting hit, because they're putting their money against STEM programs, 90 percent of it, because they're so concerned about the long-term implications it has for their business.

Dr. GANSLER. If I could add to Norm's point about citizenship, I can give you a specific example of that, too. A leading nanotechnology expert in the United States came to me and said: I applied three times for citizenship, I had my fingerprints taken, and

because it mentions in nanotechnology something about the word “nuclear” and he was an Iranian citizen, so they kept rejecting it.

I just got so fed up with it, I took his resume to Secretary Gates and said: “Bob, you have to get him approval,” and he did. But you can’t normally do that. So we have to make it a lot easier for people to get citizenship who want to be citizens.

He said to me: I’m going to have to go to Canada; I just can’t get citizenship here. That’s inexcusable.

Senator HAGAN. Let me move to the manufacturing technologies. In the written statement, the DOD mentioned the need to continue efforts to strengthen the focus on manufacturing process development. Mr. Augustine, in your statement you also mentioned the need to invest in manufacturing process technology. Do you feel that DOD is investing at an adequate level and in the right areas, and if not how can they improve?

Mr. AUGUSTINE. I really don’t believe that DOD is investing adequately. They do invest in product technology, as distinguished from process technology. The areas they tend to invest in, though, are probably not the ones that we’re going to need in the future. I think we’re going to need highly flexible, low-rate manufacturing technology and that really is getting very little attention anywhere in this country.

Senator HAGAN. I’m sorry? Say that one more time? Highly successful low-rate?

Mr. AUGUSTINE. Low-rate, highly flexible manufacturing technology. We have a situation where the bulk of the manufacturing technology used to come out of the private sector, non-DOD. Today that technology is moving abroad and DOD is therefore going to have to pick up a bigger load for this low-rate, highly flexible effort of the type used for defense.

Senator HAGAN. Dr. Gansler, you led a Defense Science Board study on DOD’s manufacturing technology program in 2006. Do you feel that DOD is following the recommendations of that study, and if not what do you think are some of the impediments to pursuing those recommendations?

Dr. GANSLER. I would strongly support the points that Norm just made, because in terms of the focus on manufacturing technology, manufacturing processes, the focus needs to really be on low-cost, small quantity, low rate. It’s not just being able to produce at a low rate, but it’s efficiently producing at a low rate. Usually people say, well, gee, if you just let me build another million of them I can lower the cost. But we don’t have the money to do that, and on the other hand we ought to be able to build at lower rates more efficiently with modern flexible manufacturing technologies. The focus in that area it seems to me is where I would place the emphasis.

I think there isn’t a full recognition, even though there’s lots of speeches being made about the importance of low cost. I think we have to incorporate into those speeches the importance of low-cost manufacturing processes, and a focus on research in that area I think is critical.

Senator HAGAN. DOD is taking efforts to revitalize industry’s IR&D activities and resurrect a more meaningful interaction with industry on communicating future R&D needs. What do you feel

that DOD's efforts in this area—are they being effective, and if not what other actions would you recommend?

Mr. ODEEN. Well, let me just make one comment. IR&D is obviously an expense. It is reimbursed by the government, but it goes into your overhead rate and therefore it competes with other things. In particular, bid and proposal money and IR&D used to be in the same category. I think they're now separating them again. But in a highly competitive kind of situation, the mere fact that you'll get reimbursed for it doesn't help if it drives up the overall cost of your product.

So there's a tough dilemma in the intensely competitive world we're in right now. We need to find ways to permit companies to spend reasonable amounts of money on that. DOD also needs to reach out, and I think they're beginning to do that, reach out more to take advantage of company technology. It often is not actively accessed by the Services to see how they can use it. So the companies invest in on technology the next big weapons competition, as opposed to trying to do more basic, fundamental technology research that could broadly benefit DOD.

Dr. GANSLER. We found that there were two shifts taking place in this IR&D. One was forgetting that the "I" stands for "independent," and the government was trying to suggest to the companies where they should spend their money; then second, that the companies were shifting a lot of what had been IR&D into the bid and proposal activities because they had been combined. So separating them out is really important.

Mr. ODEEN. I was going to say what Jacques just did, that the "I" stands for independent. You have a double-edged sword when the government says, we're going to get involved and help you. The government, well-meaning, believes that if they tell industry what it is they're interested in that industry will spend its money more effectively than if it doesn't know what the DOD wants.

The problem is that when you implement that, the government becomes very invasive and starts telling you what it is you should be working on, which is contrary to the whole idea of IR&D.

Senator HAGAN. Let me ask a question about the DOD laboratories. Across the Services, the DOD has an impressive laboratory enterprise with scores of facilities across the country that employ or fund a range of people, from the most junior postdoctoral student to Nobel Prize winners. Dr. Gansler, given that you were previous Under Secretary for AT&L and had oversight of DOD's laboratories, how well is DOD currently managing and utilizing its laboratory enterprise and how successful are the interactions between the DOD labs and industry and what are some ways to improve these interactions?

Dr. GANSLER. I think one of the main things is trying to recognize the directions of changes. One of the tendencies of any laboratory, including the DOD labs, is to do incremental change to old technology, try to make it a little bit better, but not to shift to totally new areas. One of the things that made Bell Labs so exciting was that they shifted in some cases into totally new semiconductors and things of that sort.

If you can—so-called disruptive technologies, if they could be encouraged in the laboratories, that would be great. One of the prob-

lems that comes up is that the military have an institutional inertia also, so they tell the labs, I want to continue to build airplanes with men in them and I want them to go faster and higher and so forth, but not encouraging them to, say, start doing unmanned systems, for example. That would be kind of a disruptive technology, is what I meant by the example.

To the extent that we can get some of the laboratories working into these areas that are disruptive, I think we can make a bigger impact in the long term.

Senator HAGAN. Should they not be doing that on their own? I mean, when you say we should get them—

Dr. GANSLER. Well, the problem is they are funded by DOD. That's what we were talking about, the importance of independent research from the industry because they're not constrained to doing just the incremental stuff. They can do the disruptive stuff that gets into a new field, and that's what we should be encouraging some of the labs to be doing as well.

Senator HAGAN. Do any of the others want to comment on this question?

Mr. ODEEN. One comment on the labs. I think the fact that they're now being able to attract some better people, that was talked about I think by Brett Lambert or one of the speakers earlier, is good, because they have had a real problem of an aging workforce and great difficulty attracting good people. A role they could play is to some degree reaching out to the commercial technology industry to look for solutions to the issues that they understand their Service faces. They can be an interface between the Service and the commercial world because they have an understanding of both the Service and its needs and also technology. So that might be a role that they do some of already, I think, but they could perhaps do more.

Dr. GANSLER. One other area that the labs have had some success with and that is cooperative ventures with university research. To the extent that that brings in some of these new ideas, I think that should be encouraged as well.

Senator HAGAN. We're very interested in technology transfer between our universities and corporate and, obviously, defense. In your view about this, how well is DOD engaging in technology transfer and transition to industry?

Dr. GANSLER. Well, the valley of death, getting over that is a really important part of the SBIR program, for example. To the extent that we continue to sponsor and help it, that's really an important way of doing it. Half of the total government's SBIR program, of the \$2 billion, about \$1 billion of that is DOD efforts, and that has been a major support for the small business and for new ideas coming in and for more rapid transition of ideas to application, to commercialization of these ideas, is what's behind the SBIR selections. That's an important one that I hope Congress can support.

Mr. AUGUSTINE. I would like to observe what a complex issue this really is: the company I used to work for operated several research labs. They happened to be Department of Energy labs as opposed to DOD labs, but the situation I think is similar. We were strongly encouraged to try to transfer technology outside the labs. But any technology that transferred into our company was viewed

as our taking undue advantage of our situation of operating the lab. So we built high walls so that no knowledge could get out of the lab and into our company. It would be like Boeing getting fined \$15 million.

In fact, we had a program where we got a share of the profit in startup companies that we helped create. The first couple years, we started about 15 companies—I say “we” did; the people who ran them started them—with the technology that the labs we were able to provide. These were independent little companies. About ten of them failed and a couple of them did so-so and one or two of them hit a home run and we made some money on them.

We got such criticism for taking advantage of our position with the government that I remember our chief of advertising came in and said: Look, you’re killing us; why don’t you get out of these places? So we said, don’t give us a share of these businesses any more, we don’t want anything to do with the profits.

So here’s a case of a really well-meaning rule, but as it was applied I think it hurt everybody. I also have a belief that the government should do only those things that cannot be done well in the private sector. I’ve traveled 109 countries and I have yet to see any system that’s better than our free enterprise system. I see us moving away from it across the board.

Senator HAGAN. So tell me what you want us to—what we should be doing?

Mr. AUGUSTINE. I will be very candid here.

Senator HAGAN. Please.

Mr. AUGUSTINE. I think our Congress and our administration views a job in the government as more important than in the private sector. I’ve experienced this for many years. This isn’t a new phenomenon.

Senator HAGAN. Some of us will take issue.

Mr. AUGUSTINE. I’m sorry?

Senator HAGAN. Some of us will take issue with that.

Mr. AUGUSTINE. Yes, I would hope so.

But I have testified many times where that seemed to be the case. I’m not an anarchist, I might add. I spent 10 years with the government. When I was with the government and in the position I held I could cancel a contract in industry and 10,000 people would lose their jobs and I’d probably get two letters. I can recall trying to close Frankfort Arsenal that at the time I don’t think had contributed anything since 1776, and it took us 4 years and many people even say it may have cost the President his job in a close reelection.

I think the government has to play an important role—and that role is to do high-risk, high-payoff, long-term research and engineering. When it begins doing other things, I think it hurts industry, particularly in a time of declining budgets.

Senator HAGAN. Let me ask about small business. All of you have mentioned the importance of small business and the lower tier suppliers within the defense industrial base. In your view, how can the roles that small businesses play in the defense industrial base be strengthened? I know that from our small businesses, they create so many jobs throughout our country.

Mr. AUGUSTINE. Small businesses do create a lot of jobs. They create most of the really new leading edge ideas that are so important. About half of the money that is put into the prime contractors goes back out to subcontractors, many of which are small businesses. They're the ones who know how to build the optical coatings or a particular kind of laser or a certain kind of chip or a package. That's a technology that's only known to those companies in many cases.

But small businesses don't have deep pockets. Just as when the government has a budget problem, it pushes it down onto the prime contractors, the prime contractors do exactly the same thing to the small companies. The small companies are the ones who suffer the most. I think one of the things that has to be done is to watch out for those companies that have very key technologies, and to create an environment so that new companies can start in a way that they can afford to do business with the Defense Department.

Dr. GANSLER. One specific thing that you can do is to start counting those lower-tier contracts to the small businesses. The goal for small business contracts is purely the government direct contract, and there are not many small businesses that build a fighter plane or a ship or things like that. Yet a large share of it and most of the small business participation is in the technology area and down at the lower tiers. Perhaps maybe even if you raise the percent of the work total that has to go to small businesses, but count the lower tiers and directly related.

Now, the other impact on the small businesses are the overburdening regulations and legislation that get passed on to them downstream from the primes. Again, that's a legislative requirement that everything be passed on, and perhaps a way of relieving that would be helpful to the small businesses as well, so that you could have some flexibility on what you pass down to them so that they have more flexibility and rapid response capability, the innovation that they could wring out, without being burdened by having to have the 12-foot-long bookshelf of the Federal Acquisition Regulations and things like that, hiring their own lawyers and writing contracts. It would be much helpful to them if they could do business in a commercial-like fashion at the lower tiers.

Mr. AUGUSTINE. If you would permit me to share a real-world story that applies to Jack's comment, some years ago I was running our company's astronautics group and one day a box showed up in the mail. When I opened it, it had a bunch of seals in it that we used on Titan launch vehicles. In it was a letter from the president of the company who manufactures the seals. He said: We really want to help America. We believe in America and want to do everything we can. Here's a 5-year supply of seals; will you please go away and leave us alone? That carried the message to me of how oppressive we were.

Senator HAGAN. Interesting story. Wow.

I was hoping we'd have a few others come in, but obviously with the vote and some of the other meetings that are going on—I think we've had a very good discussion on your perspectives, on the challenges and your views of the effectiveness of the various strategies, plans, and programs that DOD is pursuing to address the challenges facing the defense industrial base.

I want to ask you one closing question, and that is, in your view, if you can, what are the top three things that Congress can do to help address these challenges we discussed? I know that the exports area was certainly one of them, but if you have any details on the top three I would be very anxious to hear.

Mr. AUGUSTINE. Since my name starts with "A," I'll start out. It's hard to narrow the list to three, but one thing would be to fund—

Senator HAGAN. We'll certainly take extras, extra written testimony.

Mr. AUGUSTINE.—would be to fund a series of competitive prototypes. A second thing would be to fix the export laws. The way to do that is to build high fences around really important things, rather than what we do today, which is to build low fences around everything. If you go down the export list, you'll be amazed at what's on there: handcuffs, shotguns. There's something on there called "horses at sea." Seriously. I've never figured out why "horses at sea" are on the export list, but they're there. So that would be a second action.

It's hard to narrow down to a third one, but I guess it would have to do with people. That would be to find a way to encourage U.S. students to study science and engineering and encourage foreign students to come here and to stay here.

Senator HAGAN. Dr. Gansler?

Dr. GANSLER. My top three I think would be starting with the workforce as being I think essential, and this is—across the board, this is in terms of some senior people in the government with experience and training and so forth, on the military and civilian side, all the way down, because if you don't have smart buyers you're in trouble. Even if you had a good industry, they can't recognize them. So I'd go all the way down to the industry side as well.

Someone asked a question earlier about how you can get some people into the government. I know when Norm and I went in it was under something called Public Law 313. That doesn't exist any more, but it allowed us to come from senior positions in industry into the government for 3, 5 years, and then not have to get through that whole civil service system. They could hire people.

You now have provisions under highly qualified experts to be able to do that. We should take full advantage of that.

Senator HAGAN. But you're saying we used to have that and then we stopped it, and now—

Dr. GANSLER. We had Public Law 313. That was abolished, but now you have allowed, for example, 20 people at DARPA for highly-qualified experts. I think that could be greatly expanded in allowing people coming with industry experience into the government. Seeing both sides of the street is really important.

Senator HAGAN. I'm glad you brought that up, because I was going to ask that.

Dr. GANSLER. Workforce I think is my first one. I think globalization is my second one. How does the Nation gain the benefits of globalization instead of creating the barriers to globalization, which we have been doing? We talked a lot about that already.

My third one is commercialization, being able to bring in the technologies, the goods, the services, particularly the services. Almost every one of the services, 57 percent of what we buy, are in

the Yellow Pages. We ought to be able to take full advantage of commercial practices, commercial goods, commercial services, commercial firms, as part of the broadened industrial base, and globalized. It was no question in the tanker case that we gained an enormous benefit by allowing a foreign competitor to bid against Boeing. Boeing won, but at much lower prices than they would have if it wasn't for the presence of competition. So opening up the market. It's imports as well as exports that have to be addressed in globalization.

Senator HAGAN. How would you defend that against jobs in America?

Dr. GANSLER. Just the opposite. Actually, the presence today of the foreign firms investing in the United States have actually, increased as a result of their money coming in here, have increased our exports, our jobs, and our capital investments in the United States. When you put in—you know, a Finmeccanica comes here, EADS comes here, Thales comes here, AIA comes down here—go down the list of all the foreign companies that are now investing in the United States and helping our exports, bringing technology, creating jobs, and bringing high tech technology of their country so that we can take full advantage of it. I think it's helping our economic and job situation.

These people who we were talking about earlier with their Ph.D.s from schools, they're not replacing the unemployed today in America.

Mr. ODEEN. It's hard to add any after those three, but let me comment the latter one, the job issue. If you look at the Northrop Grumman-EADS tanker bid and the recent EADS bid as well, they were going to put a very large presence in the southeastern part of the United States and create a lot of jobs. I suspect they would have created as many jobs as Boeing will with its tanker. So it wasn't really a jobs issue, where the jobs were located.

If you're going to be a major supplier to the U.S. marketplace as a foreign company, you're going to build your presence here, like BAE Systems has and others have. So you're going to bring jobs here and perhaps export from here as well. So I don't think it's a jobs issue.

Second, the workforce issue. Letting there be a free exchange or maybe a managed exchange between industry and government, going both ways, has great benefits for both industry and for the government, and this has been mentioned earlier. In about 2001 I took a look at the senior leadership of the defense industry, in particular the top 10 or 12 companies. I think all but one of them were led by a person who had had a real experience in DOD at some point in time, like a Norm Augustine or Boeing's Frank Shrontz. They all had a time in the government to learn how the government operates. You're a better supplier if you understand the government, how the government works. You also bring a lot of knowledge to the government. So those exchanges I think are critical. Unfortunately it doesn't happen today.

Back again to the prototyping idea, I think that's a lot of benefit from it. Other ways to encourage fresh ideas? There are so-called broad area announcements (BAA) that ask for people to come in with creative ideas to solve military capability needs. That's an-

other way to draw in ideas, then have bakeoffs or a competition. Low level, not costly, but this really brings new and fresh technologies to the defense marketplace.

Senator HAGAN. I really do appreciate your time here, the fact that you had to wait for the vote. I really do appreciate it. But first of all, I appreciate the service that you've given and your testimony today. I do want to say that we will keep the hearing record open for 3 days to allow other members to submit statements and-or questions for the record.

Thank you, we will certainly take note of all of your great ideas and hopefully take action on them.

This subcommittee is adjourned.

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR KAY HAGAN

LONG-TERM DEFENSE INDUSTRIAL BASE STRATEGY

1. Senator HAGAN. Secretary Kendall, Secretary Lemnios, and Mr. Lambert, the most recent Quadrennial Defense Review (QDR), released early last year, addressed the need for strengthening the Defense Industrial Base (DIB). Specifically, it said, "America's security and prosperity are increasingly linked with the health of our technology and industrial bases. In order to maintain our strategic advantage well into the future, the Department of Defense (DOD) requires a consistent, realistic, and long-term strategy for shaping the structure and capabilities of the defense technology and industrial bases—a strategy that better accounts for the rapid evolution of commercial technology, as well as the unique requirements of ongoing conflicts." Is DOD developing an industrial base strategy that will be published?

Mr. KENDALL, Mr. LEMNIOS, and Mr. LAMBERT. The Department recognizes the DIB is more global, commercial, and financially complex than ever before, however in general the Department believes that market forces should shape the industrial base.

The Department regularly addresses specific industrial base concerns within programs and services to determine if intervention in the market is warranted. The expectation is that there may be rare cases when the Department would intervene to preserve competition or to ensure that sources for key products are maintained, but these interventions would be on a case by case basis. The Department has also embarked on a more comprehensive sector-by-sector, tier-by-tier (S2T2) analysis of the industrial base, which will help inform future programmatic decisions and allow for the continued monitoring of the health of the industrial base. A summary of the S2T2 analysis will be included in the annual industrial capabilities report submitted to Congress pursuant to 10 U.S.C. 2504.

2. Senator HAGAN. Secretary Kendall, Secretary Lemnios, and Mr. Lambert, what budget items, if any, in the fiscal year 2012 President's budget request are directly related to the development of this strategy?

Mr. KENDALL, Mr. LEMNIOS, and Mr. LAMBERT. A number of defense accounts are focused on supporting innovation and improvements in industrial capabilities. The Defense-wide Manufacturing Science & Technology line is currently funded at \$18.9 million in fiscal year 2011 and at \$17.9 million for fiscal year 2012. Additional Service and Agency Manufacturing Technology programs are funded at a total of \$189.4 million in fiscal year 2011 and \$193.7 million in fiscal year 2012. This brings total funding for Manufacturing Technology programs to \$208.3 million for fiscal year 2011 and \$211.6 million for fiscal year 2012. Furthermore, the Defense Advanced Research Projects Agency (DARPA) has a focus on disruptive manufacturing. DARPA is budgeted to invest \$54.4 million in fiscal year 2011 and \$91.5 million in fiscal year 2012 for manufacturing initiatives. Combined with the Manufacturing Technology budgets, these research and development investments total \$243.8 million in fiscal year 2011 and \$303.1 million in fiscal year 2012.

Defense Production Act (DPA) Title III activities are funded through the "DPA Fund." Under Executive Order 12919, the Secretary of Defense is designated the DPA Fund manager. The Title III Program, working with other Federal departments and agencies, has initiated a number of large-scale actions to create or expand domestic production capabilities for essential materials and technologies, including radiation-hardened electronics; lithium ion batteries; Vacuum Induction

Melted/Vacuum Arc Remelted specialty steel; beryllium production; renewable energy sources; satellite communications transceivers for warfighter communications; and advanced electronic materials, including silicon carbide and gallium nitride for next generation radars and electronic warfare capabilities, to name a few.

Additionally, to enhance the efficiency and effectiveness of long-term DIB strategy, the Department has funded a S2T2 assessment of the industrial base as a component of the Department's study budget. This project is a multi-pronged effort to collect industrial base data to inform acquisition strategy and industrial base policy decisions.

RECRUITING AND RETENTION EFFORTS

3. Senator HAGAN. Secretary Kendall, Secretary Lemnios, and Mr. Lambert, how is DOD measuring the effectiveness of its Science, Technology, Engineering, and Mathematics (STEM) education, recruiting, and retention efforts?

Mr. KENDALL, Mr. LEMNIOS, and Mr. LAMBERT. The DOD has a vision of inspiring, developing, and attracting diverse and world-class STEM talent to meet national defense needs. The DOD-wide STEM Education and Outreach Strategic Plan builds on and coordinates existing evaluation and assessment efforts for the Department.

At the post-secondary level, for each of these major programs, we measure DOD effectiveness using a mixture of qualitative and quantitative tools. The Department has several major thrusts, such as Science, Mathematics, and Research for Transformation (SMART), the National Defense Science and Engineering Graduate (NDSEG) Fellowship Program, and the Information Assurance Scholarship Program (IASP). Metrics and approaches include tracking scholarship and fellowship recipients who transition into the DOD STEM workforce, the number of current employees who participate in certain STEM degree completion programs, the geographic reach of efforts as represented by the diversity of applicants, and post-intervention feedback received from participants. To date, nearly 500 undergraduate to doctoral graduates from the SMART program and 240 from the IASP have transitioned into the DOD workforce.

At the K-12 level, individual STEM education efforts occur throughout the United States and are managed both locally and centrally by the DOD components. However, metrics for the effectiveness are imprecise.

4. Senator HAGAN. Secretary Kendall, Secretary Lemnios, and Mr. Lambert, could the current Military Accessions Vital to the National Interest (MAVNI) program that targets non-U.S. citizens with critical foreign language and medical skills be applied to STEM-related fields and for DOD civilians?

Mr. KENDALL, Mr. LEMNIOS, and Mr. LAMBERT. Section 504b, title 10, U.S.C., allows the Secretary of a Military Department to enlist other than U.S. citizens or legal permanent residents when such enlistment is vital to the National interest. The MAVNI Pilot Program used this authority to provide a unique opportunity to fill some of our most critical readiness needs, specifically with health care professionals and those who possess particularly important foreign language and cultural skills. MAVNI is statutorily limited to enlistment into the military and has no counterpart for civilian hiring. We are not aware of any STEM-related critical shortages in the military force structure, particularly at entry-level requirements.

Although the current MAVNI Program is not directly applicable for DOD civilians, it could be used as a starting point for analysis into the possibility of designing a similar program for civilian foreign students pursuing degrees in STEM-related fields at colleges and universities in the United States. The analysis would need to address Appropriations Act constraints, Immigration Law, personnel security requirements, and Office of Personnel Management non-citizen hiring regulations.

5. Senator HAGAN. Secretary Kendall, Secretary Lemnios, and Mr. Lambert, what would be specifically necessary, as some have suggested, to staple a green card or certificate of citizenship to the doctoral diploma of a graduating non-U.S. citizen who has studied in a field that is of importance from a national security perspective, has been appropriately cleared, and is willing to commit to a certain period of employment in the defense industrial sector or the DOD?

Mr. KENDALL, Mr. LEMNIOS, and Mr. LAMBERT. Providing a Green Card or Naturalization certificate to such a doctoral degree recipient, as posited in your question, would require changes to the Immigration and Naturalization Act of 1952, P.L. No. 82-414, and Title 8 of the U.S. Code. Naturalization would immediately qualify the recipient for employment with DOD.

However, under Executive Order 11935, only United States citizens and nationals (i.e., certain Pacific Islanders) may compete for competitive service positions. Federal agencies (not just DOD) are permitted to hire Green Card-holding non-citizens only when there are no qualified citizens available. A non-citizen may only be given an excepted appointment and may not be promoted or reassigned to another position in the competitive service, except in situations where a qualified citizen is not available. The non-citizen may be hired into the competitive service only if permitted by the appropriations act and immigration law, as well as any relevant Executive Orders or other regulations.

INDUSTRIAL BASE ANALYSIS

6. Senator HAGAN. Secretary Kendall, Secretary Lemnios, and Mr. Lambert, when will the initial S2T2 industrial base analysis be completed to a sufficient level to be shared with Congress?

Mr. KENDALL, Mr. LEMNIOS, and Mr. LAMBERT. The S2T2 effort is a process to expand the scope of the Department's industrial base assessments beyond traditional programmatic boundaries and to create a database on industry for use as inputs to many decisionmaking processes across the Department. S2T2 is not a "study" in the traditional sense. It draws from existing and ongoing work across the Department, the results of which the Services and program offices already share with Congress in various formats. S2T2 matches those ongoing efforts with a holistic Office of the Secretary of Defense-level look at the industrial base that will gather new data. Much of the data in the S2T2 effort will be company proprietary—data that will be very helpful for informing some of the Department's internal decisions—and must be carefully protected. We will need to determine the extent to which the final S2T2 analysis can be shared when we complete each analysis and ascertain the extent to which the included data is releasable.

The initial S2T2 effort will not be comprehensive but is based on a sample of companies and datasets. The Department will continue to refine and extend the data over time. From the initial phase, we expect actionable implications, and the Department will include such results, as appropriate, in the President's budget proposals in future years. Results from S2T2 work will also be included in the annual industrial capabilities report submitted to Congress pursuant to 10 U.S.C. 2504.

MANUFACTURING TECHNOLOGY PROGRAM

7. Senator HAGAN. Secretary Kendall, Secretary Lemnios, and Mr. Lambert, in 2006, a Defense Science Board (DSB) panel published a report titled: "The Manufacturing Technology Program—a Key to Affordably Equipping the Future Force". This report recommended that DOD's manufacturing technology program grow its investment level to 1 percent of the overall Research, Development, Test and Evaluation (RDT&E) budget. The fiscal year 2012 budget requested about \$200 million for manufacturing technology—which is only about a third of a percent of the RDT&E budget. Should the 1 percent level be a funding target?

Mr. KENDALL, Mr. LEMNIOS, and Mr. LAMBERT. The Department responded to the 2006 DSB report, which was a seminal study of the Manufacturing Technology program, by creating and funding a Defense-wide Manufacturing Science & Technology line in 2008. The line is currently funded at \$18.916 million in fiscal year 2011 and at \$17.888 million for fiscal year 2012.

The additional Service and Agency Manufacturing Technology programs are funded at a total of \$189.4 million in fiscal year 2011 and \$193.7 million in fiscal year 2012. This brings total funding for Manufacturing Technology programs to \$208.3 million for fiscal year 2011 and \$211.6 million for fiscal year 2012.

The report also recommended DARPA have a focus on disruptive manufacturing. DARPA is budgeted to invest \$54.4 million in fiscal year 2011 and \$91.5 million in fiscal year 2012 for manufacturing initiatives. These include three programs known as META, the Fast Adaptable Next-Generation Ground Combat Vehicle, and Open Manufacturing. Combined with the Manufacturing Technology budgets, these research and development (R&D) investments total \$243.8 million in fiscal year 2011 and \$303.1 million in fiscal year 2012. Such increases demonstrate the Department's commitment to these priorities, particularly in the current constrained fiscal environment. The recommendation made in 2006 that 1 percent of the RDT&E budget go to manufacturing and technology arose in a much different fiscal environment than exists today.

Additionally, the S2T2 analysis referenced previously includes assessment of industrial and technological capabilities resident in manufacturing sectors. The output

of this activity will provide some insights for the development of future-year defense budgets, including manufacturing-related programs. The Department does not believe that an arbitrary spending target for manufacturing technology is needed or appropriate.

INDEPENDENT RESEARCH AND DEVELOPMENT

8. Senator HAGAN. Secretary Kendall, Secretary Lemnios, and Mr. Lambert, Under Secretary of Defense, Ashton B. Carter, has stated that he wants DOD to reinvigorate industry's Independent Research and Development (IR&D) efforts and increase the interactions and insights between DOD and industry. What is DOD specifically doing to revitalize industrial IR&D?

Mr. KENDALL, Mr. LEMNIOS, and Mr. LAMBERT. DOD reimburses IR&D expenses as allowable indirect costs for approximately 1,200 firms in the DIB. The DOD IR&D program is one of the Department's key sources for technology innovation. In the mid-1990s, the law governing IR&D oversight was changed to provide contractors more autonomy in their choice of IR&D projects, which effectively eliminated DOD oversight of a contractor's IR&D projects and investment objectives. As a result of this change, the Department's science and technology and defense acquisition program managers lost insight into IR&D projects planned and underway and thus lost opportunities to leverage the DIB's IR&D efforts in DOD programs. The change also resulted in a loss of information relevant to the DIB's overall IR&D investment trends and technology thrusts. The net effect is the Department does not have access to the information it needs to enact policies relevant to the IR&D program that will maximize the benefit the Department and the DIB can derive from the DIB's IR&D efforts.

The Department is launching two initiatives to open up new channels of communication with industry. The Department believes the initiatives, when combined, will provide opportunities to better leverage the innovation in the DIB's IR&D efforts for DOD programs.

The two initiatives are:

1. Collect IR&D project data; store it in a centrally located and protected data base accessible to government science and technology and acquisition staff.
2. Request annual IR&D strategic plans that describe a firm's overall IR&D strategic investment objectives, trends, and technical thrusts.

9. Senator HAGAN. Secretary Kendall, Secretary Lemnios, and Mr. Lambert, are there any legislative actions that might need to be taken to assist these efforts?

Mr. KENDALL, Mr. LEMNIOS, and Mr. LAMBERT. DOD recommends no additional legislation.

ACCESS TO FOREIGN TECHNOLOGY

10. Senator HAGAN. Secretary Kendall, Secretary Lemnios, and Mr. Lambert, last year, the Defense Business Board's Task Group on Assessing the Defense Industrial Base issued a report that, among a number of recommendations, stressed the importance of DOD retaining access to critical technologies in the DIB. What is the impact of a budget reduction in fiscal year 2012 of about one third to the Foreign Comparative Testing (FCT) program and our ability to search and analyze technologies available globally?

Mr. KENDALL, Mr. LEMNIOS, and Mr. LAMBERT. FCT is only one of several programs in our portfolio that facilitates access to technologies from traditional and non-traditional industrial base suppliers. Although FCT is one of the few programs focused specifically on accessing and evaluating technology from our foreign partners, it is not the only one. All of our technology investment programs, and many of our acquisition programs, can reach out across the global market, and have done so.

For instance, under The Technology Cooperation Program, we established an action group comprising the United States, Canada, United Kingdom and Australia to coordinate on Technology Watch/Horizon Scan programs—those programs that look for emerging technologies. Though not specifically focused on global reach, we do have mechanisms within the international agreements process that leverage these technologies. FCT is one of several value-added programs we had to reduce funds in our fiscal year 2012 budget request in order to support the Secretary's Defense Efficiency-Baseline Review initiative. The Secretary's reform agenda required a zero-based review of all programs, aligning the fiscal year 2012 resources with the most critical priorities and eliminating or reducing funds for lower-priority func-

tions. We do plan to revisit the decision in future-year deliberations, and adjust funding thresholds among our various technology programs, as needed, to support ongoing operations.

TECHNOLOGY TRANSFER AND TRANSITION

11. Senator HAGAN. Secretary Kendall, Secretary Lemnios, and Mr. Lambert, in the National Defense Authorization Act (NDAA) for Fiscal Year 2009, Congress asked DOD for a report on its broad technology transfer and transition activities. Two years later, this report has not yet been delivered. When is DOD planning on completing and delivering this report to Congress?

Mr. KENDALL, Mr. LEMNIOS, and Mr. LAMBERT. The Department is aware of the reporting requirement and is updating the report to reflect current activities for technology transfer and transition. The revised report is in coordination within the Department and we anticipate sending it to Congress shortly.

12. Senator HAGAN. Secretary Kendall, Secretary Lemnios, and Mr. Lambert, it appears that Secretary Lemnios, the assistant Secretary of Defense for Research and Engineering ASD(R&E), is increasing quick reaction special projects at the expense of technology transfer and transition programs (e.g. the Defense Acquisition Challenge (DAC) program and the Technology Transfer Initiative (TTI)). What is the rationale?

Mr. KENDALL, Mr. LEMNIOS, and Mr. LAMBERT. It is true that the budget request for the Quick Reaction Special Project (QRSP) program has increased from a budget request of \$78 million in fiscal year 2011 to \$92 million in fiscal year 2012. We did not, however, increase the QRSP at the expense of DAC and TTI. As part of our annual program review, we assess the relative effectiveness of all our programs. We assessed that the work sponsored under DAC and TTI was just as effectively conducted by the Military Departments. We determined that an additional Office of the Secretary of Defense (OSD)-level investment was no longer needed.

LABORATORIES AND THE DEFENSE INDUSTRIAL BASE

13. Senator HAGAN. Secretary Lemnios, from your perspective, what are the roles of DOD labs?

Mr. LEMNIOS. The Department's laboratories are an important part of the science and technology enterprise. The Department's laboratories serve as its technical base, and fulfill several key roles, including, but not limited to:

- rapid technical responses to warfighter operational needs,
- technically competent, unbiased assessments of commercial and defense industrial solution technologies,
- key sources of breakthrough technologies for future acquisition programs, and
- a unique conduit to transition the knowledge gained from basic research investments into warfighting capabilities.

14. Senator HAGAN. Secretary Lemnios, what are their core competencies?

Mr. LEMNIOS. The DOD Laboratories have many Core Competencies closely aligned with national defense objectives. I consider a core competency to be the people (scientists and engineers), technical skills, and physical infrastructure (labs/equipment) to develop and deliver new technology products; and provide support to new and deployed warfighting systems. For example, DOD Labs maintain core competencies in topics such as energetic materials, submarine hydroacoustics, and radar electronics to support advances in future acquisition programs. In an effort to scope and categorize DOD Lab core competencies more systematically, I have initiated a three-phase process:

- Phase 1 is currently assessing the laboratories' competencies in the seven S&T priorities (data to decisions, cyber technology, autonomy, electronic warfare & protection, human systems, countering WMD, and engineered resilient systems) established by the Secretary of Defense in his 19 April 2011 memorandum.
- Phase 2 will assess abilities to support technical requirements in cross-cutting technology areas that were identified in the 2010 QDR and recent DPPG.
- Phase 3 will examine the laboratories' support to unique Service requirements, e.g., oceanography, armor, and space technology.

After completion of these phases, I believe we will be able to better access core and critical technologies.

15. Senator HAGAN. Secretary Lemnios, Congress has provided a broad range of personnel authorities, such as the Laboratory Personnel Demonstration program and direct hiring authority to allow DOD laboratories to recruit and retain the best and brightest scientists and engineers. What is your assessment of how well the Services are using these authorities?

Mr. LEMNIOS. The Services are effectively utilizing the Demo Lab authorities within the established limits of Title 5 statutes. My assessment is that these authorities provide the necessary flexibility to develop and preserve our technical workforce within the labs. The pay for performance system is a significant contributor to retaining our talented technical personnel and the direct hire authority ensures our labs can rapidly target and hire talented graduates as they enter the job market. Within the Department, the Under Secretary of Defense for Personnel and Readiness governs personnel policy, instructions, and directives and maintains an ongoing dialogue with the Services, specifically the labs, to ensure authorities are implemented and exercised to their potential.

I have personally visited several DOD laboratories and spoken with many of our scientists and engineers, a growing percentage of whom are in the early stages of their careers. I have found a bright, energetic and talented workforce that is dedicated to supporting our military through the development of new technologies and weapon systems. I have not seen, nor am I aware of any impediments to exercising the demo lab or direct hire authorities.

16. Senator HAGAN. Secretary Lemnios, what challenges are the labs facing on the personnel issues that are not under your direct control?

Mr. LEMNIOS. Lab personnel policies are the responsibility of the Under Secretary of Defense for Personnel and Readiness (USD(P&R)). P&R maintains a high level of communication with the labs and supports rapid implementation of all the Demonstration Lab authorities that have been granted by Congress over the past several years. As an example of a lab personnel challenge, I am concerned about the significant fraction of lab staff that is eligible for immediate retirement, and what the subsequent effect on lab capabilities would be if large scale retirements occurred.

I am also concerned about the rapidity by which our labs can hire new talent. I am familiar with the practices we used at Lincoln Lab to hire top quality talent. We could have people in the roles and working in a matter of weeks. This is not the case in DOD labs.

QUESTIONS SUBMITTED BY SENATOR JEANNE SHAHEEN

NATIONAL DEFENSE EDUCATION PROGRAM

17. Senator SHAHEEN. Secretary Lemnios, the National Defense Education Program (NDEP) has been reduced in this year's budget request so that there will be approximately 50 fewer graduating students in the SMART program per year that will be available for employment at DOD laboratories. Given the need for more scientists and engineers in DOD, what was the rationale for this budget reduction?

Mr. LEMNIOS. The National Defense Education Program (NDEP) provides support ranging from K-12 students through world-class researchers, and ensures a steady stream of new technical talent into the Defense workforce. In view of increasing budgetary pressures, the SMART program is being re-aligned towards a steady state of about 800 students vice the original projection of 1,000 when SMART began in 2006.

SMALL BUSINESSES

18. Senator SHAHEEN. Secretary Lemnios, DOD's fiscal year 2012 budget proposes the elimination or reduction of many programs critical for transition of R&D production, including DAC, TTI, FCT, and Manufacturing Science and Technology (S&T). What are you doing to better assist small- and medium-sized firms in the transition of R&D projects to the defense and commercial marketplace?

Mr. LEMNIOS. DOD has an active technology transfer program that assists small- and medium-sized firms to develop products that have defense and commercial applications. Companies are offered access to government developed technology and encouraged to recognize opportunities to apply technologies developed for commercial applications against DOD needs. We also work with these firms to jointly de-

velop technologies for both military and commercial applications. We use Cooperative Research and Development Agreements (CRADAs) to allow both the private sector and DOD activities to provide technical expertise to mature the technology. On a non-interference-with-mission basis, we also allow these firms to use DOD laboratory equipment and facilities when it is in the best interest of the government. We provide technical assistance to companies working through advanced defense technology clusters funded by the Small Business Administration and plan to provide this same assistance to the “innovation clusters” which will be formed and funded via the administration’s Jobs Accelerator and Innovation Challenge, announced on May 20, 2011.

The Small Business Innovation Research (SBIR) Commercialization Pilot Programs within the Military Departments are also used to bridge gaps in moving technologies into acquisition. The program allows DOD components to spend 1 percent of their SBIR budget on commercialization activities that accelerate the transition of SBIR-funded technologies to Phase III and focus on systems being developed, acquired and maintained for the warfighter. Plans for the recently authorized Rapid Innovation Fund Program include projects which assist small- and medium-sized firms in the transition of R&D projects to the defense and commercial marketplace.

19. Senator SHAHEEN. Secretary Kendall, the NDAA for Fiscal Year 2011 authorized the Rapid Innovation Program, which was funded at \$439 million for fiscal year 2011. Could you elaborate on implementation plans for this program?

Mr. KENDALL. The Department issued guidance on August 12 providing an implementation plan for the Rapid Innovation Program Fund. The guidance is attached.



ACQUISITION
TECHNOLOGY
AND LOGISTICS

THE UNDER SECRETARY OF DEFENSE

3010 DEFENSE PENTAGON
WASHINGTON, DC 20301-3010

05-12-11

MEMORANDUM FOR ASSISTANT SECRETARY OF DEFENSE FOR RESEARCH AND
ENGINEERING
SERVICE ACQUISITION EXECUTIVES
U.S. SPECIAL OPERATIONS COMMAND ACQUISITION
EXECUTIVE
DIRECTOR, DEFENSE ADVANCED RESEARCH PROJECTS
AGENCY
DIRECTOR, DEFENSE THREAT REDUCTION AGENCY
DIRECTOR, DEFENSE LOGISTICS AGENCY
DIRECTOR, NATIONAL GEOSPATIAL INTELLIGENCE AGENCY
DIRECTOR, MISSILE DEFENSE AGENCY
DIRECTOR, OFFICE OF SMALL BUSINESS PROGRAMS
DIRECTOR, JOINT SCIENCE AND TECHNOLOGY OFFICE FOR
CHEMICAL AND BIOLOGICAL DEFENSE
DIRECTOR, DEFENSE MICROELECTRONICS ACTIVITY

SUBJECT: Defense Research and Development Rapid Innovation Fund (RIF) Goals and
Implementation Guidelines

Section 1073 of the National Defense Authorization Act for FY 2011,
Public Law 111-383, and the 2011 Defense Appropriation Act provide the Department of
Defense with authorities and funds to facilitate the rapid insertion of innovative technologies into
military systems or programs that meet critical national security needs such as those supporting
the resolution of operational challenges characterized by Joint Urgent Operational Needs.

The attached document details the Department's goals for use of the RIF authority and
appropriation and provides guidance for RIF implementation and reporting. The goals reflect the
Department's emphasis on rapid, responsive acquisition and engagement of small, innovative
businesses in solving defense problems.

My point of contact is Mr. Ron Kurjanowicz, OASD(R&E), at 703-697-5776 or
ronald.kurjanowicz@osd.mil.

Ashton B. Carter
Ashton B. Carter

Attachment:
As stated

cc:
USDC

ATTACHMENT

SUBJECT: Defense Research and Development Rapid Innovation Fund (RIF) Goals and Implementation Guidelines

- **RIF Goals:**
 - **The Department's goals for the RIF are to transition:**
 - Innovative technology, primarily from small businesses (including Small Business Innovation Research [SBIR] Phase II projects), that resolve operational challenges characterized by Joint Urgent Operational Needs (JUONs) or other critical national security needs.
 - Innovative technology, primarily from small businesses (including SBIR Phase II projects), into existing Acquisition Category (ACAT) I-IA, II, III, IV programs, or into other defense acquisition programs.
 - DoD-reimbursed Independent Research and Development (IR&D) technology developed by defense industrial base tier 2 and 3 suppliers that resolve operational challenges characterized by JUONs or other critical national security needs.
 - DoD-reimbursed IR&D projects developed by defense industrial base tier 2 and 3 suppliers into existing ACAT I-IA, II, III, IV programs, or into other defense acquisition programs.
- **RIF Implementation Guidelines:**
 - **Organization:**
 - The Military Department Service Acquisition Executives (SAEs) and the Director, Office of Small Business Programs (OSBP), will establish RIF processes that support the Department's goals and meet the guidelines outlined in this Attachment.
 - The OSBP processes will combine and represent the interests of the organizations listed in the Appendix into a common RIF solicitation.
 - The Assistant Secretary of Defense for Research and Engineering (ASD(R&E)) will coordinate RIF activities among the Military Departments and OSBP.
 - The Military Departments and OSBP will forward the name(s) and contact information of their RIF point(s) of contact (POC(s)) to the ASD(R&E).
 - **Solicitation of Technical Proposals:**
 - The Military Departments and OSBP will use Broad Agency Announcements (BAAs) to solicit technical proposals for RIF funding.
 - For efficiency purposes, the Military Departments and OSBP may combine efforts to publish a common BAA. The solicitation's technical areas shall

Attachment

identify the DoD organization(s) seeking proposals for that area. The Components' personnel shall be responsible for conducting the evaluations of proposals submitted to the areas where they were identified as having an interest (See "Evaluation of Technical Proposals" in this Attachment).

- The BAA will list the targeted JUON challenge areas and the targeted ACAT I-IA, II, III, IV or other acquisition programs.
 - The OSD Joint Rapid Acquisition Cell (JRAC) will collaborate with the RIF POC's to agree on a common list of JUON challenge areas.
- The ASD(R&E) will provide the list of tier 2 and 3 suppliers in the defense industrial base according to their participation in IR&D to the RIF POC's.
- The BAA will be open for 45 days.
 - The RIF solicitation process shall include the opportunity for potential bidders to submit a white paper to determine government interest. RIF POC's shall attempt to provide responses to white paper submissions within 5 business days, circumstances permitting.
- **Evaluation of Technical Proposals:**
 - Component Program Executive Officers (PEOs) or Program Managers (PMs) will conduct the evaluations of the technical proposals and provide funding recommendations to the Source Selection Authority (SSA).
 - The SAEs will appoint a SSA to review the PEO or PM recommendations and select the proposals that will be funded using appropriated RIF funds.
 - The USD(AT&L) will appoint the SSA for the organizations listed in the Appendix.
 - In a combined solicitation that represents the interests of the Military Departments and the organizations listed in the Appendix, the SAE-appointed SSA remains responsible to select the projects to be funded using their respective RIF funds. The USD(AT&L)-appointed SSA shall only select projects to be funded by the defense-wide RIF funds.
 - The following source selection criteria are RIF-specific. They are to be added to the minimum evaluation criteria required by the FAR or DFARS.
 - Project is relevant to the targeted JUON challenge areas or acquisition programs identified in the solicitation, and it:
 - Enhances military capability; and/or
 - Accelerates the development of military capability; and/or
 - Reduces the development costs of acquisition programs; and/or
 - Reduces the sustainment costs of fielded systems.

- Project can be completed within 24 months from award.
- Project costs are reasonable and realistic, and total cost does not exceed \$3 million.
- SSAs will use the following selection preferences, listed in order of priority:
 1. Small business projects, including SBIR Phase II or IR&D projects, that accelerate the deployment of military capability to resolve operational challenges characterized by JUCNs or other critical national security needs.
 2. Small business projects, including SBIR Phase II or IR&D projects, that show a clear transition path to fielding the technology into existing ACAT I-IA, II, III, IV and other defense acquisition programs.
 3. Projects from other than small businesses that accelerate the deployment of military capability to resolve operational challenges characterized by JUCNs or other critical national security needs.
 4. Projects from other than small businesses that show a clear transition path to fielding the technology into existing ACAT I-IA, II, III, IV and other defense acquisition programs.
 - Projects recommended for award that simultaneously satisfy both priority areas 1 and 2 shall be selected before projects that satisfy only priority 1.
 - Projects recommended for award that simultaneously satisfy both priority areas 3 and 4 shall be selected before projects that satisfy only priority 3.
- **Awards:**
 - Contracts, cooperative agreements, and other transactions are allowed for purposes of issuing RIF awards.
 - The Military Departments and OSBP RIF processes shall include procedures to preclude a single firm from receiving multiple RIF awards for equivalent technical proposals submitted to another Component's RIF BAA.
- **Phased Implementation:**
 - The Department will implement the RIF in phases
 - Phase 1 (August to December 2011): Development of Military Department and OSBP RIF processes leading to project selection and awards. Funds released for RIF awards are:
 - Army \$24 million
 - Navy \$24 million
 - Air Force \$24 million
 - Defense-wide (OSBP) \$27.5 million

- Military Departments and OSBP may expend up to 3 percent of the RIF-appropriated funds for program management and administrative expenses.
 - The SAEs and the Director, OSBP, in collaboration with the organizations listed in the Appendix, shall accomplish the key RIF implementation tasks not later than the following dates:
 - August 2011: Development of Component RIF processes; and
 - September to December 2011: BAA publication, evaluation of technical proposals, and awards.
 - The ASD(R&E) shall assess the effectiveness and efficiency of the Phase I implementation processes and results and report the findings to the USD(AT&L) by December 23, 2011.
- **RIF Reports:**
 - Military Department RIF POCs shall forward the following information to the ASD(R&E) not later than 15 business days following completion of awards under a BAA:
 - The competitive, merit-based process used;
 - A list of the projects funded under the RIF;
 - The amount of funds awarded for each project;
 - The JUCON challenge area and/or acquisition program that the RIF project supports; and
 - Anticipated transition timeline for the project.
 - The Director, OSBP, will be responsible for the preparation and completion of all congressionally mandated reports regarding RIF implementation and awards.
 - **Waivers to Implementation Guidelines:**
 - The USD(AT&L) is the waiver authority for deviations from the implementation guidelines and for the selection of technical proposals that exceed the 24-month or \$3 million criteria. Submit waiver requests through the ASD(R&E).

APPENDIX

SUBJECT: Organizations Represented by the Director, Office of Small Business Programs, in Rapid Innovation Fund Implementation

- U.S. Special Operations Command
- Defense Advanced Research Projects Agency
- Defense Logistics Agency
- Defense Threat Reduction Agency
- Missile Defense Agency
- National Geospatial Intelligence Agency
- Defense Microelectronics Activity
- Joint Science and Technology Office for Chemical and Biological Defense

Appendix

20. Senator SHAHEEN. Secretary Kendall, with the moratorium on congressionally-directed spending, how do we ensure that ideas in the seed stage of development continue to be funded?

Mr. KENDALL. The Department has a robust science and technology investment portfolio that provides competitive funding opportunities for technology developers with ideas in the seed stage of development. In most cases, “seed stage” ideas would be appropriate for basic or applied research funding.

Small businesses can compete for DOD funding through the Small Business Innovation Research (SBIR) program. In particular, 15 U.S.C. 638 authorizes 2.5 percent of the DOD extramural R&D budget set aside for the SBIR program. Small busi-

nesses can compete for DOD funding through SBIR, currently funded at \$1.2 billion per year.

21. Senator SHAHEEN. Secretary Kendall, SBIR is one answer, but by itself, insufficient. How is DOD addressing start-up funding vital to getting many of our small contractors off the ground?

Mr. KENDALL. Small businesses are a critical part of the DOD supply chain. To maintain our technological edge on the battlefield, we recognize that small businesses are critical to providing innovative solutions to DOD needs. The Department is committed to maximizing the contributions of small business in DOD acquisition and is working to create a business environment that understands, appreciates and leverages their value. Each DOD component is expected to seek improvements in leveraging small businesses, and to establish aggressive Small Business Targets based on its unique product needs. In addition to the \$1.2 billion of SBIR funding awarded to small businesses, the Department awarded 21 percent of all eligible contracts to small businesses in fiscal year 2010.

We also participate in Administration efforts to encourage and provide assistance to start-up entrepreneurial businesses. For example, we are participating with other Federal departments via the President's Start Up America initiative and the Jobs Accelerator and Innovation Challenge. Furthermore, the Department is implementing the Rapid Innovation Fund (RIF) which Congress authorized in the NDAA for Fiscal Year 2011. One key goal of the RIF is to give small businesses opportunities to provide innovative technologies that resolve operational challenges or other critical national needs. Implementation will start with a pilot effort in fall 2011.

TITLE III

22. Senator SHAHEEN. Mr. Lambert, the Defense Production Act (DPA) Title III Program (Title III) serves a critical role to ensure domestic production capacity for items essential for national defense. However, DOD's fiscal year 2012 request for the program is only \$19 million and it will shrink to \$12 million in fiscal year 2013. Could you explain DOD's decision to reduce funding in this critical area, particularly given that programs funded under this area are proven, needed, and provide immediate benefit to the economy?

Mr. LAMBERT. DPA Title III activities are funded through the "DPA Fund." Under Executive Order 12919, the Secretary of Defense is designated the DPA Fund manager. The amount included in the DOD budgets request each year for Title III is only a portion of the amount of funding available for this important program. Other Federal agencies are appropriated funds for their agency-specific projects; those funds are transferred to DOD as the Fund Manager for execution. The current DOD Title III budget reflects priorities set during the regular budgeting process to maintain previous ongoing initiatives. DPA Title III provides powerful tools to support our Nation's manufacturing capabilities, but the Department remains constrained in its ability to prioritize this program in the current fiscal climate.

Additionally, the President has convened a Defense Production Act Committee (DPAC), consistent with the 2009 DPA Reauthorization (Public Law 111-67). The role of the DPAC, which is comprised of the heads of various Federal Departments and agencies, is to advise the President on the effective use of the DPA for mobilizing industry for important national needs. The DPAC is currently developing a strategic focus for future Title III activities, conducting comprehensive assessments of industrial capabilities, and determining appropriate mitigation strategies, including use of Title III, in areas critical to multiple DPAC members.

23. Senator SHAHEEN. Mr. Lambert, for the Senate Armed Services Committee to better understand the expanded uses of Title III and the proper funding levels, it is critical that Congress receives detailed information on the specific industrial bases or technologies that shortfalls have been identified that Title III could address. Please provide this information.

Mr. LAMBERT. The Title III Program, working with other Federal departments and agencies has initiated a number of large-scale actions to create or expand domestic production capabilities for essential materials and technologies including radiation-hardened electronics, lithium ion batteries, Vacuum Induction Melted/Vacuum Arc Remelted specialty steel, beryllium production, renewable energy sources, Satellite Communications transceivers for warfighter communications and advanced electronic materials including silicon carbide and gallium nitride for next generation radars and electronic warfare capabilities, to name a few.

Additionally, the President directed the Secretary of Defense to lead a cabinet level inter-agency body known as the DPAC to advise him on the effective use of these powerful authorities. Such advice will be informed by the DPAC's ongoing efforts to identify cross-cutting manufacturing shortfalls. This analysis includes an examination of cross-program interdependencies, early indicators of risk, areas of limited competition, impact of reliance on foreign sources, and areas of limited needed industrial capacity.

SHIPBUILDING INDUSTRIAL BASE

24. Senator SHAHEEN. Mr. Lambert, in an April 21 article in Bloomberg, the Chief of Naval Operations, Admiral Gary Roughead, USN, commented that: "The industrial base is really a strategic asset . . . the industrial base today, particularly as it applies to shipbuilding, is probably as fragile as it has ever been." Can you elaborate on the current state of the U.S. shipbuilding industrial base, and DOD's efforts to ensure that our current capabilities are maintained?

Mr. LAMBERT. Our shipbuilding industrial base has emerged in the past three generations as a national strategic asset. Today's Surface Navy is at its smallest size since the early 1900s. As we work through the implications of managing the defense enterprise during a slowdown in spending, it is crucial that we preserve the capabilities resident in our shipbuilding industrial base in order to build and maintain a Fleet for the demands of providing global presence and readiness wherever our Nation's interests are challenged.

Within our shipbuilding industrial base, thousands of firms and suppliers—some big, others small—help build, maintain and equip our Fleet. These firms, their suppliers, and their suppliers' suppliers, are each links in a chain that, if broken, can have unforeseen consequences on our military capabilities. To ensure the Nation has the shipbuilding industrial capacity it needs, we must better understand the different supplier tiers, their interdependence to one another, and the programs they serve across the Department.

The Department and industry must manage resources in ways that do not hollow out the capabilities of our Nation's Fleet or recklessly jeopardize our shipbuilding industrial base.

QUESTIONS SUBMITTED BY SENATOR CLAIRE MCCASKILL

CRITICAL INFORMATION TECHNOLOGIES

25. Senator MCCASKILL. Mr. Lambert, as I understand it, most cybersecurity-related projects by DOD have focused on cost and schedule enhancement enabled by sourcing production globally. While cost and schedule are always critical considerations, I am also concerned that there has not been enough consideration about risk management and system security implications, particularly as they relate to outsourcing the manufacturing and/or production of high-value, mission critical DOD Information Technology (IT) systems to other countries. I know that Senator Levin's staff is doing an important investigation on the issue of the security of the IT supply chain—and I support that—in part because there are concerns that malware, or other malicious computer code, could be inserted into the global IT supply chain for computers and software destined for U.S. Government use. What are your thoughts regarding the threat posed by malware or malicious software on critical DOD information technologies?

Mr. LAMBERT. Globalization continues to impact today's information and communications technology (ICT) sector. While globally sourced technology provides innumerable benefits to the Department, it also provides our adversaries with increased opportunities to compromise our supply chain by inserting malware into ICT to access or alter data, and intercept or deny communications. Even though the risk of such a supply chain attack may be tolerable for many consumers of commercial ICT, the DOD cannot ignore these risks to its national security missions. Managing DOD's risk will require a greater awareness of the threats, vulnerabilities, and consequences associated with acquisition decisions; the development and employment of tools and resources to technically and operationally mitigate risk across the lifecycle of products (from design through retirement); the development of new acquisition policies and practices that reflect the complex global marketplace; and partnership with industry to develop and adopt supply chain and risk management standards and best practices.

DOD represents a small portion of the commercial ICT market; therefore, it is unlikely that our assurance requirements can drive the development of commercial off-

the-shelf products. However, the DOD is taking a proactive risk management approach to address this issue, enhancing the acquisition process in light of the changing global market to ensure processes are strong and risks are mitigated.

DOD is in the process of institutionalizing the Trusted Defense Systems/Supply Chain Risk Management strategies described in the Trusted Defense Systems response to the NDAA, section 254, delivered to Congress in January 2010. The Department's strategy for achieving trustworthy defense information and weapons systems in light of supply chain risk contains the following core elements:

1. Prioritize scarce resources based on mission dependence.
2. Plan for comprehensive program protection.
3. Detect and respond to vulnerabilities in programmable logic elements.
4. Partner with industry.

The forgoing strategy is being implemented to protect DOD systems from supply chain risks, but this plan does not directly address commercially-owned and operated telecommunications infrastructures which may be facing similar risks. DOD and DHS are co-leading an Interagency Task Force that will in partnership with industry develop a more complete understanding of the relevant technical risks to the U.S. telecommunications infrastructure and will assess the dependency of vital governmental and economic operations upon that infrastructure. It will then evaluate a range of potential technical risk mitigation strategies.

26. Senator MCCASKILL. Mr. Lambert, what is DOD doing in the public-private sector in support of U.S. Comprehensive National Cyber Security Initiative (CNCI) and Supply Chain Risk Management (SCRM)?

Mr. LAMBERT. A foundational piece of DOD's CNCI work in the public-private sector is the Enduring Security Framework (ESF). The ESF is a public-private partnership that includes the chief executive officers and chief technology officers of major information technology and defense companies. The ESF now meets regularly with top officials from the Department of Homeland Security, the Office of the Director of National Intelligence, and DOD.

CNCI #4 coordinates and redirects research and development efforts, and CNCI #9 defines and develops enduring "leap-ahead" technology, strategies, and programs: DOD is spending over \$500 million in cyber-related R&D in both classified and unclassified domains. The majority of these projects are competitively sourced from the private sector. One of the largest projects is the National Cyber Range (NCR) that includes the Johns Hopkins Applied Physics Lab and Lockheed Martin. The NCR will provide an environment for realistic, qualitative and quantitative assessments of potentially revolutionary cyber research and development technologies. The range must be capable of testing a variety of technological thrusts. The goal of the NCR is to enable large scale experimentation and testing of new cyber technologies.

CNCI #5 connects current cyber ops centers to enhance situational awareness: DOD is conducting a voluntary Cyber Security/Information Assurance (CS/IA) pilot program with the DIB. The DIB CS/IA Pilot program leverages DOD Cyber Crime Center intrusion forensic capabilities to analyze threat data and share threat information among the DIB companies. This unique threat sharing among DIB companies, which did not exist prior to the program, is believed to be responsible for preventing compromise of DOD information in the recently publicized hacking attempts on DIB companies.

CNCI #8 expands cyber education: DOD has a full-time director of Science, Technology, Engineering and Mathematics (STEM) education. At military installations and DOD laboratories, our scientists and engineers-military and civilian-support science fairs and competitions, mentor our scholarship and fellowship recipients, and partner with science and math teachers in the classroom. An objective of the program is to inspire students, parents, teachers, and the public to engage in STEM discovery and innovation.

CNCI #11 SCRM develops a multi-pronged approach for global supply chain risk management. Globalization of the technology marketplace provides increased opportunities for adversaries intent on harming the United States by penetrating the supply chain to gain unauthorized access to data, alter data, or interrupt communications. DOD and the private sector must manage risks stemming from both the domestic and globalized supply chain in a strategic and comprehensive way over the entire lifecycle of products, systems and services. This requires a greater awareness of the threats, vulnerabilities, and consequences of decisions. It also involves the development and employment of tools and resources to technically and operationally mitigate risk across the lifecycle of products (from design through retirement), and the development of new acquisition policies and practices that reflect the complex global marketplace. DOD will collaborate with industry to develop and adopt supply-

chain and risk-management standards and best practices. This initiative will enhance Federal Government skills, policies, and processes to provide departments and agencies with a robust toolset to better manage and mitigate supply-chain risk at levels commensurate with the criticality of, and risks to, their systems and networks.

CNCI #12 extends cybersecurity into critical infrastructure domains: DOD has been in discussions with DIB companies about voluntarily extending the Einstein “shield” to their private cyber infrastructures. Einstein 3 will draw on commercial technology and specialized government technology to conduct real-time full packet inspection and threat-based decisionmaking on network traffic entering or leaving Executive branch networks. The goal of Einstein 3 is to identify and characterize malicious network traffic to enhance cybersecurity analysis, situational awareness and security response. It will have the ability to automatically detect and respond appropriately to cyber threats before harm is done, providing an intrusion prevention system supporting dynamic defense.

QUESTIONS SUBMITTED BY SENATOR ROB PORTMAN

NATIONAL SECURITY STRATEGY

27. Senator PORTMAN. Mr. Lambert, in the 2010 National Security Strategy (NSS), the administration proposed that by 2020, the United States would restore leadership in higher education by seeking to lead the world in proportion of college graduates. The NSS also calls for heavier investment in STEM areas, and expanding the educational opportunities to underrepresented groups, including women. This is a noble, albeit, vague goal. What is DOD doing to assist in this effort?

Mr. LAMBERT. DOD is a long-term, continuous sponsor of science and engineering education, and places specific emphasis on U.S. college students pursuing STEM degrees.

DOD supports the NSS goal with the Department’s STEM Education and Outreach Strategic Plan. DOD’s National Defense Education Program has sent 1,750 DOD scientists and engineers into K–12 schools in 26 States supporting 8,000 teachers and inspiring 180,000 students. Since 2006, the SMART Scholarship for Service Program has supported hundreds of U.S. undergraduate and graduate STEM degrees with nearly 300 becoming employees in the DOD S&T/laboratory community. Continuing its historic engineering graduate student support, DOD awarded 200 new 3-year graduate fellowships through the NDSEG Fellowship Program while an additional 400 are receiving their second and third year of support for a total of 600 in the program. At the faculty level, DOD supported 29 distinguished faculty members’ basic research with some of the largest, longest-term educational grants in the Nation. These National Security Science and Engineering Faculty Fellowships simultaneously engage and financially support more than 150 of the best graduate and post doctorates in DOD-relevant research areas. DOD provides substantial annual support to the Historically Black Colleges and Universities and Minority Institutions program. Throughout DOD there are more than 130 subsidiary education, training and outreach programs that inspire and develop students in STEM—from K–12 enrichment initiatives such as STARBASE, the Science and Engineering Apprenticeship Program, and JROTC, to college preparation (Great Minds in STEM), financial support (SMART, NDSEG, and the Information Assurance Scholarship Program), internships (Naval Research Enterprise Internship Program), undergraduate, graduate, postdoctoral and faculty education.

DOD continuously funds STEM education as a matter of tomorrow’s national security.

28. Senator PORTMAN. Mr. Lambert, how do you see this goal being achieved?

Mr. LAMBERT. The National Security Strategy STEM goal was stated in the paragraph “Improve Education at All Levels” and is a total government commitment to restore U.S. leadership in higher education by seeking the goal of leading the world in the proportion of college graduates by 2020. DOD has a vital, continuing, national security interest in attaining this goal and has over the long-term, spent its appropriated funds to do so. DOD will continue to do more than its share to achieve this NSS goal. However, the total goal can only be achieved by coordinated efforts from all sectors of government, industry, the educational community, and society working together. In this regard, DOD is an active participant in the Office of Science and Technology Policy’s Committee on STEM Education which seeks, among other things, to coordinate STEM education in the Federal Government.

29. Senator PORTMAN. Mr. Lambert, the 2010 NSS states, “We have launched a number of science envoys around the globe and are promoting stronger relationships between American scientists, universities, and researchers and their counterparts abroad. We will reestablish a commitment to science and technology in our foreign assistance efforts and develop a strategy for international science and national security.” What short-term benefits have been seen through this effort thus far?

Mr. LAMBERT. DOD supports the Office of Science Technology and Policy science envoy initiative while managing complementary efforts for global scientific exchange through the international science offices of the Army, Air Force and Navy. These international offices—located in London, Santiago, Tokyo, and elsewhere—are intended to contribute awareness of scientific strengths internationally and to fund talented international performers that fill gaps in existing portfolios. Short-term benefits provided by these efforts include facilitated scientific relationships between U.S. researchers and other global leaders, broad scientific situational awareness to inform technological strategic planning, and the “transition” of research breakthroughs throughout the world into technology development to support the U.S. national security requirements.

30. Senator PORTMAN. Mr. Lambert, is this exchange of ideas cultivating a renewed commitment to S&T in our own country?

Mr. LAMBERT. Our Nation’s commitment to science and technology (S&T) is spurred on not only by a sense of urgency to remain technologically dominant in areas of high priority to national security, but also through mutually beneficial partnerships with innovative international partners, such as those facilitated formally through the international research offices of the military services. It is in the United States’ interest to support expanded international science partnerships, and it is our policy to continue them.

Today’s S&T is more global and distributed than ever before. While the United States remains among the world leaders in fast moving areas such as information technology, engineered materials, digital and quantum communications, and nanotechnology, among others, it is also the case that we are not the dominant leader in all S&T that we once were. Consequently, it is important to remain engaged in S&T throughout the world, to be aware of the advances and collaborate at the leading edge of science and technology.

EDUCATION AND OUTREACH STRATEGIC PLAN

31. Senator PORTMAN. Secretary Lemnios, in 2009 the first STEM Education and Outreach Strategic Plan for 2010–2014 was produced and signed-off on by you. Since that time, what successes has the STEM Development Office seen?

Mr. LEMNIOS. There have been numerous successes throughout the Department since the Strategic Plan was submitted to Congress in May 2010. Broadly, it generated interest and awareness in the Department’s role in fostering innovation and growing STEM workforce and capabilities.

The SMART Program, in particular, is demonstrating positive results in attracting high quality students to the DOD workforce. As a scholarship-for-service program, SMART scholarships range from 1 to 5 years for bachelor’s, master’s and doctoral students majoring in a STEM discipline or field. In 2011, applications rose from 2,600 to over 2,800 and SMART graduates transitioning into the DOD workforce increased from 130 to more than 230. In 2012, we estimate that approximately 270 will become DOD employees. Building capacity in STEM critical areas such as systems engineering is also important. The Systems Engineering Capstone project funded teams of undergraduate and graduate students from both military and civilian institutions for the purpose of working on authentic DOD challenges. In addition, students received important mentoring from military and DOD civilian systems engineers as well as industry professionals.

Across the Department, greater attention has been paid by Components to align STEM education, training and outreach to their technical workforce needs. The Army Education and Outreach Program (AEOP) implemented a management approach for a more cohesive strategy for its \$17.2 million K–12 STEM investments. In 2011, AEOP awarded a cooperative agreement to execute a Virginia Tech led consortium of academic and nonprofit institutions to stimulate STEM education and outreach and highlight Defense career paths. The Navy committed to doubling STEM investments, including initiatives that reach under-represented students in Los Angeles, St. Louis, and the Bronx. In March 2011, the Air Force issued a STEM Workforce Strategic Roadmap, entitled “Bright Horizons” that explains how they will manage their STEM workforce. Among other activities, the Air Force oversees

the NDSEG Fellowship Program that supported nearly 800 graduate students enrolled at 79 graduate institutions.

32. Senator PORTMAN. Secretary Lemnios, what amendments/additions have you made to the plan since it was first published?

Mr. LEMNIOS. The Education and Outreach Strategic Plan was developed as an overarching document that sets a foundation to achieve the vision of inspiring, developing and attracting a diverse, world-class STEM workforce to meet the national defense needs. Following the congressional plan submitted in May 2010, the STEM Development Office has been working closely with the Military Departments as they develop their STEM strategic direction and service specific initiatives. As examples, the Air Force recently issued its STEM workforce strategic roadmap, "Bright Horizons;" the Navy's STEM2 Stern effort is providing guidance and planning for STEM investments, and the Army Education and Outreach Program is focusing on their K-12 investments. Currently underway is a strategic implementation framework that will provide a focused approach to the Department's current and future STEM investments and aligned to the NSTC Committee on STEM Education efforts and the DIB needs. This focused and integrated approach includes collaborative roles and responsibilities of the DOD components. Optimizing our STEM investment is more critical than ever and we are building a strong partnership across DOD to do so.

33. Senator PORTMAN. Secretary Lemnios, what kind of budget/resources are required to run the office and implement the plan?

Mr. LEMNIOS. The STEM Development Office (SDO) employs 3 to 4 DOD employees to run and implement the plan. In turn, each of the DOD Components must have staff and resources that SDO can draw on to implement their portions of the Plan.

34. Senator PORTMAN. Secretary Lemnios, what measures are being used to assess the effectiveness of your efforts?

Mr. LEMNIOS. The measure of effectiveness for STEM activities is challenging, and a problem we continue to work at. To this end, I have reconstituted a STEM Board of Directors at a more senior level, with representatives from the military departments, as well as USD(P&R) and USD(I). We have invited the Department of Education and NSF as observers. Among the tasks the board will take on includes the understanding requirements, our gaps, and the efficiency of current programs to address them.

At the end of the day, the measures of success must focus on whether the DOD can find the right mix and numbers of employees to deliver national defense capabilities. So, for example, the SMART program is assessed as to what fields of study the students pursue, and how many stay in DOD lab jobs after their required service period is over. Similarly, for the Systems Engineering Capstone project, effectiveness is assessed based on how many students participate in the DOD-inspired course projects, which is an indicator of students who are more inclined to pursue DOD S&T careers.

RECRUITMENT AND RETENTION

35. Senator PORTMAN. Secretary Lemnios, I understand that the military Services are having trouble recruiting, retaining, testing, and evaluating personnel at some test ranges because of, among other things, the remoteness of those test ranges; differences in pay; the length of time to hire new employees; the loss of the Federal Career Intern Program; and Base Realignment and Closure (BRAC). Do you agree with that assessment? If so, how do you intend to ameliorate how each of these factors negatively impact recruitment and retention?

Mr. LEMNIOS. As part of the Developmental Test and Evaluation Fiscal Year 2010 Annual Report, components reported on recruitment and retention of qualified T&E personnel. There were no specific issues noted with their ability to recruit talented personnel at the Test Ranges. The components discussed many efforts in place for recruitment and retention including:

- Expedited Hiring Authority
- Section 853 Funding
- Targeted Recruitment
- Competitive Salaries
- Monetary Awards
- Intern Programs

- Career Fairs
- Tuition Assistance
- Funding to Offset Student Loans
- Career Development/Developmental Assignments

There was minimal impact of BRAC on T&E Specific positions. Only the Army specifically noted a BRAC impact for the Army Test and Evaluation Command. The Army reported that “efforts are underway to fill these positions using competitive and noncompetitive procedures, targeting diverse applicant pools (Federal and private sector employees, departing military, college graduates, etc.), and at entry, developmental, full-performance and senior levels.”

36. Senator PORTMAN. Secretary Lemnios, the Systems Engineering workforce directly supporting the Director for Systems Engineering is now at 117 and is projected to meet the goal of 172 by fiscal year 2012. By contrast, the 59 people supporting the Director for Developmental Testing are expected to decrease to 52 next fiscal year and not expected to meet the goal of 70. Given the importance of developmental testing to ensuring the timely fielding of new, needed combat capability, what are you doing to reverse the trend in developmental testing hires?

Mr. LEMNIOS. In general, the supply of qualified personnel for Developmental Test & Evaluation is not the issue. The current plan to reach a goal of 70 personnel has been impeded by overall restrictions on new government hires. This has affected 9 government billets, including the Principal Deputy SES position for DT&E. We have attempted to compensate for these gaps in government personnel through detailees and rotational assignments. While the number of oversight positions in OSD is important, so is rebuilding the Developmental Test and Evaluation competencies of the components. The overall test and evaluation workforce has grown from 7,420 personnel in fiscal year 2008 to 8,591 in second quarter of fiscal year 2011. This represents a growth of 16 percent.

37. Senator PORTMAN. Mr. Kendall, last August, Secretary of Defense Gates said that his greatest fear is that in economic tough times people will see the defense budget as the place to solve the Nation’s deficit problems, and that those cuts would be disastrous in the world environment we see today. With the current budget cuts that the President has proposed to DOD, how do you see it affecting our competitive advantage in S&T?

Mr. KENDALL. The Department is still formulating the budget for fiscal year 2013. Until we integrate all competing needs and requirements, it is not possible or prudent to speculate on how possible reductions will affect our competitive advantage in S&T. It remains clear that the Administration continues to value S&T. Recognizing the potential advantage it brings, the Department will balance this advantage with competing priorities in the fall budget development.

THE FUTURE OF THE DEFENSE INDUSTRIAL BASE

38. Senator PORTMAN. Mr. Kendall, in Dr. Jacques Gansler’s 2007 report, “Achieving a 21st Century Defense Industrial Base,” he states that, “. . . the Defense Industrial Structure, the controlling policies, practices, laws, and the Services’ budgets and requirements priorities have not been transformed to match the needs of [the post-September 11] world.” Would you agree with Dr. Gansler’s assessment?

Mr. KENDALL. Dr. Gansler’s 2007 report is informative and insightful in many respects. As we adjust to the needs of the post-September 11 world, the Department’s industrial policies must also be adjusted. However, the Department relies primarily on market forces to create, shape, and sustain the industrial, manufacturing, and technological capabilities in the industrial base. As the wars in Iraq and Afghanistan continue to evolve, and our Nation continues to recover from the worst economic recession since the Great Depression, the Department faces significantly greater constraints on resources. This evolution will have a significant impact on the DIB. The Department must work closely with our partners in the defense industry to ensure we are better stewards of the taxpayer’s money in these fiscally austere times.

39. Senator PORTMAN. Mr. Kendall, how is DOD attempting to adapt the defense structure to more technological and unconventional warfare?

Mr. KENDALL. DOD relies on a responsive market driven industrial base and in general does not direct the internal structures of privately-owned corporations that constitute the DIB. Rather, these companies adapt to meet the requirements of the Department as expressed through its planned expenditures on research and acquisi-

tion programs and on its requirements as expressed to industry in any number of ways. As DOD requirements for materiel and service solutions to conduct more technological and unconventional warfare increase, the DIB is adapting to provide these solutions.

The Department also periodically conducts analyses/assessments to identify and evaluate those industrial and technological capabilities needed to meet current and future defense requirements. We use the results of these analyses/assessments to make informed budget, technology investment, acquisition, and logistics decisions. DOD industrial assessments evaluate and address changes in key systems, subsystems, components, and/or material providers that supply many programs and affect competition, innovation, and product availability. DOD components also conduct their own assessments when: (1) there is an indication that industrial or technological capabilities associated with an industrial sector, subsector, or commodity important to a single DOD component could be lost; or (2) it is necessary to provide industrial capabilities information to help make specific programmatic decisions. These assessments generally are conducted, reviewed and acted upon internally within the DOD components.

ACQUISITION WORKFORCE

40. Senator PORTMAN. Secretary Lemnios, the recently enacted Weapon Systems Acquisition Reform Act (WSARA) identified the deterioration in the DOD's core competency in systems engineering and developmental testing as an important cause of why the cost of acquiring major weapon systems have skyrocketed over the last decade or so. As such, the WSARA called on DOD to develop the relevant workforce to reacquire that competency. Where is DOD in building up its systems engineering and developmental testing workforce?

Mr. LEMNIOS. The Department's systems engineering workforce (defined as those acquisition personnel designated as part of the SPRDE-SE/PSE Defense Acquisition Workforce Improvement Act (DAWIA) career field) grew by 4,972 personnel between fiscal year 2008 and second quarter fiscal year 2011. This growth is a 14 percent increase over the fiscal year 2008 baseline of 34,527 personnel. The Department is currently exceeding the system engineering workforce growth target established in 2008.

The Department's test and evaluation workforce (defined as those acquisition personnel designated as part of the T&E DAWIA career field) grew by 1,171 personnel between fiscal year 2008 and second quarter fiscal year 2011. This growth is a 16 percent increase over the fiscal year 2008 baseline of 7,420 personnel and is a combination of in-sourcing, re-coding, and new hires. The Department is currently exceeding test and evaluation workforce growth target established in 2008. DASD (Developmental Test and Evaluation) (DASD(DT&E)) is currently working to ensure that all appropriate Government positions are DAWIA Test and Evaluation (T&E) coded and at the required level of certification.

A USD(AT&L) memorandum dated August 25, 2010 identified eight Key Leadership Positions (KLP) that must be staffed with qualified, certified acquisition personnel in each Major Defense Acquisition Program (MDAP) and Major Automated Information System (MAIS) program office. Among the eight KLPs identified are Program Lead Systems Engineer and Program Lead for Test and Evaluation. The DASD(SE) and DASD(DT&E) are assisting in the development of qualification and training requirements for these positions.

41. Senator PORTMAN. Secretary Lemnios, to the extent that DOD has not performed to plan, what are the most substantial challenges to its ability to build up this important part of the acquisition workforce?

Mr. LEMNIOS. DOD is currently performing to plan in staffing its systems engineering and test and evaluation acquisition workforce.

The fundamental workforce challenges facing the DOD are the same as those facing industry: Attracting the best and the brightest technical talent in a competitive environment. The increasing complexity of systems and necessity for testing and evaluation rigor require recruitment of a technically-skilled workforce.

There has been some concern that current hiring policy will impact the growth of the systems engineering and test and evaluation workforces. On March 16, 2011, USD(AT&L) and USD(Comptroller) co-signed a memorandum, entitled "Continuation of Defense Acquisition Workforce Improvement Initiative", noting that Defense Acquisition Workforce Development Fund (DAWDF) hiring continues and clarifying that the military departments may request in-sourcing exemptions within current budget levels for critical acquisition positions. This memorandum has clarified the

process by which the Military Departments may continue to grow critical acquisition workforce areas, which include the systems engineering and the test and evaluation workforce.

42. Senator PORTMAN. Secretary Lemnios, how does DOD intend to overcome those challenges?

Mr. LEMNIOS. We are working directly to grow the pool of talent available to support our systems engineering and test and evaluation workforces.

As an example, in direct support of our Science, Technology, Engineering, and Mathematics (STEM) Strategic Plan, the DASD(SE) has implemented a Systems Engineering (SE) Capstone project with 10 universities affiliated with our Systems Engineering Research Center (SERC) and with the four Service academies. The purpose of this effort was to explore techniques to improve SE knowledge and career interest among undergraduate and graduate engineering students and to increase the available pool of candidates for SE positions in the DOD. This effort provided students with substantive practical experience with SE concepts and skills, and with opportunities to apply these skills in the context of product development. The first year of this program has been very successful and we have recently implemented a second year as a follow up. We believe that this project will continue to increase the pool and capabilities of systems engineering talent for future DOD workforce needs.

The DASD(DT&E) is working with the DOD components to identify and appropriately code all Government positions that conduct acquisition related Test and Evaluation (T&E) to insure that they are captured as part of the appropriate DAWIA workforce and that they are supported in achieving requisite acquisition certification.

The DASD(DT&E) and DASD(SE) are working with the DOD components to identify their future needs for their respective technical workforce so that appropriate attention can be focused on recruiting, training and retaining skilled, talented, and certified personnel.

43. Senator PORTMAN. Secretary Lemnios, I understand that the Services are proposing to change their original acquisition workforce goals. In particular, the Services want to hire about 1,400 fewer professionals in the Systems Planning, Research Development, and Engineering and Systems Engineering/Program Systems Engineering (SPRDE-SE/PSE) career field. Given how vital these functional capabilities are to helping senior acquisition managers make fully-informed investment decisions on major weapon systems (especially about technological and integration risk), why should Congress be comfortable with this change in goal?

Mr. LEMNIOS. The Department has not formally changed the acquisition workforce goals established in 2008.

SPDRE workforce growth to date has been consistent with the 2008 plan and Secretary Gates' initiatives to restore and rebalance the acquisition workforce. DAWDF funding continues to be used effectively to recruit, train, and retain engineering personnel for the DOD acquisition workforce.

The DOD fiscal year 2012 budget overview stated: "DOD intends to hold the civilian workforce at fiscal year 2010 budget levels. This action does not apply to our ongoing acquisition workforce improvement strategy to hire about 10,000 new DOD acquisition civilians by 2015, as measured from fiscal year 2008 levels. The action may impact our continuing conversion of contractor filled positions to new DOD civilians (includes 3,000 acquisition positions so far). However, DOD will continue to ensure that inherently governmental functions are performed by career Federal employees." On March 16, 2011, Dr. Carter and Mr. Hale co-signed a memorandum entitled "Continuation of Defense Acquisition Workforce Improvement Initiative" clarifying the Military Departments' ability to request exemptions for additional insourcing authority for critical acquisition positions. It is our expectation that the military departments will exercise these authorities in rebalancing their workforce growth to meet the 2008 acquisition workforce growth plan.

44. Senator PORTMAN. Dr. Gansler, a recent article from Business Week stated that of the Indian and Chinese students who received a degree from an American college and returned home, 72 percent of Indian returnees and 81 percent of Chinese returnees said the opportunities to start their own businesses were better in their home countries. Furthermore, the speed of professional growth was also better back home for 54 percent of Indians and 68 percent of Chinese. How do you see the United States being able to compete with international businesses when entrepreneurs make it a point to not startup in the United States?

Dr. GANSLER. Unfortunately, today it is U.S. policy to make these top scientists and engineers (e.g. from India and China) sign an agreement (when they get their temporary student visas) that they will return to home when they get their degrees. This should change!

In the past, Silicon Valley was largely founded by non-U.S. citizens; and Enrico Fermi was not a U.S. citizen when he worked on the Manhattan Project.

It is U.S. policy to not restrict basic research on government contracts to U.S. citizens, but many agencies (e.g. DOD, DHA, Department of Energy) have been doing it anyway. This discourages graduate students in science and engineering (e.g. from India and China) from developing an interest in starting up a company in the United States based on their funded graduate research work; or from starting a U.S. company after their degree with a government-funded SBIR project.

We need to create incentives for these people (after appropriate security checks) to want to remain in the United States (after getting their degrees) and to start up companies. Instead, we have created barriers to their doing so.

SMALL BUSINESSES

45. Senator PORTMAN. Dr. Gansler, would you agree that current policies in the United States are discouraging talented individuals from starting a small business, particularly one that could contribute to the national defense?

Dr. GANSLER. Besides the barriers to non-U.S. citizens (discussed above), there are growing concerns by U.S. citizens about starting new businesses in the national security area. Specifically, these concerns are driven by the projections of shrinking national security budgets, as well as the requirement to deal with the excessive, complex, and costly procurement rules imposed by Congress and the executive branch (e.g. specialized cost accounting; intellectual property demands; export control barriers; et cetera). Additionally, they see how hard it has been to extend SBIR legislation, and the tendency of many in security agencies to view SBIR as a "tax" on their program dollars (rather than a benefit). Finally, they know that whenever budgets have shrunk, in the past, the first area cut is usually R&D; which startup firms (of course) require.

46. Senator PORTMAN. Dr. Gansler, what would you say needs to be done to encourage more businesses to contribute to the national defense?

Dr. GANSLER. Firms (small and large) would be interested in doing national security work if they were rewarded with sales and profits for doing better and better work at lower and lower costs (i.e. providing greater and greater "value"). Instead, recently there have been many examples of a national security shift (driven by budget concerns and recent acquisition policy initiatives) to awarding contracts on the basis of "low bid, technically acceptable;" and providing award fees based on "input" rule compliance, instead of "output" results/performance achieved.

I am a strong advocate of the benefits of effective competition; and even the credible threat of introducing it. But when a firm does a great job, at an affordable cost, they deserve to receive a sole-source follow-on as a reward. But the current "score card" would list this as a "noncompetitive" contract; so it would count against the agency, and be discouraged; thus removing the incentive for the firm to achieve such beneficial (to the government) results.

INDUSTRIAL BASE CONSOLIDATIONS

47. Senator PORTMAN. Mr. Augustine, in your June 26, 2006, editorial to Defense News, titled: "The Last Supper, Revisited," you said that it was "inevitable that much of this restructuring would occur sooner or later." Knowing what you now know about the fallout from the defense budget cuts of the 1990s, do you foresee any large-scale consolidations among our domestic contractors? If so, why?

Mr. AUGUSTINE. Without knowing the depth of actual budget cuts in the future it is of course impossible to state the extent of future consolidations that might be appropriate. If the cuts are extensive, it may be that further downsizing among the major defense domestic prime contractors would be appropriate. However, I think it is unlikely this will occur since in part because the administration has made clear that it does not intend to permit further consolidation under any circumstances. Combinations with foreign firms appear to be permissible; however, I believe they are unlikely at the prime contractor level.

I do believe that consolidation among subcontractors and third-tier suppliers is both appropriate as well and as needed. That particular tier was not affected to the extent the prime contractors were affected following the "Last Supper" meeting and

there do appear to be opportunities where cost savings could be made without significantly damaging the DIB. There is always the danger that we as a nation tend to focus on the health of the prime contractors whereas per se but fail to recognize that they would be unable to carry out their responsibilities without the support of the subcontractor and supplier base.

48. Senator PORTMAN. Mr. Augustine, what effects would consolidation have on products produced by the DIB and would these items be of value to the American taxpayer?

Mr. AUGUSTINE. The impact of consolidation depends greatly on the size of the defense budget since one of the requirements for the industry is, within reason, to match its capacity to whatever the defense budget might prove to be. Previous consolidation of the defense budget tended to produce greater efficiency under circumstances where companies were over-sized compared to their market. On the other hand, consolidation can reduce competition and that tends to increase costs, thereby offsetting some of or more than, the potential savings. In general, one should try not to have fewer than three sources for any given item of equipment—and most certainly not less than two. Given the latter, and a reasonable-sized defense budget, I believe the DIB will be able to produce items of value to American taxpayers and to our Armed Forces. It should, however, be noted that this would require a far larger DIB than the DOD has in the past indicated was affordable.

COMPETING INTERNATIONALLY

49. Senator PORTMAN. Mr. Augustine, with an increasingly globalized economy, do you see the American DIB being able to compete with foreign companies?

Mr. AUGUSTINE. It is my belief that if we remain on the path we are now pursuing as a nation, America will continue to erode its ability to compete with foreign companies, just as has been occurring for the last several decades. Since the DIB must draw upon many of the same suppliers as the commercial market; rely largely upon technology created for the commercial market; and utilize financial sources identical to those of the commercial market, it is my belief that the DIB will continue to deteriorate along with the overall U.S. base. If we are to change this glide path, we will need to repair our K-12 education system, reverse the ongoing deterioration of our higher education system, significantly increase our investment in research, and create a regulatory and policy environment that is conducive to strengthening American competitors.

50. Senator PORTMAN. Mr. Augustine, if the American DIB cannot currently compete, what should be done so that they can be competitive or to keep a competitive edge?

Mr. AUGUSTINE. Although the answer to this question was previously summarized, to those interested in America's future competitiveness I would commend the "Gathering Storm" reports prepared by the National Academies of Science, Engineering, and Medicine in 2005 and 2011.

COMMUNICATING WITH INDUSTRY

51. Senator PORTMAN. Mr. Odeen, a report recently published by your group, the Defense Business Board, recommended that DOD open a dialogue with defense industry companies to improve understanding between what DOD wants, and how industry can provide a timely, cost efficient, and quality product. This is a view shared by the top acquisition official, Under Secretary of Defense, Ashton B. Carter. In your view, has DOD adopted this recommendation?

Mr. ODEEN. You asked two questions related to a 2008 Defense Business Board report on improving the dialogue between DOD and Defense industry. I chaired the report and discussed it with senior OSD officials at that time. They were responsive to the issues raised and our recommendations, and the Deputy Secretary issued a letter in the fall of 2008 directing that communications with industry get higher priority, and directed that specific steps be taken to improve the dialogue.

During the transition after the 2008 election. I briefed the senior OSD Acquisition nominees on the report and they indicated they fully understood the importance of robust communications with the Industrial Base. Since that time I have been told a number of times by industry executives that senior DOD Acquisition officials have been open to meetings and listened to their questions and concerns.

With regard to your specific question about enhancing the dialogue regarding DOD's equipment requirements to ensure industry delivered more responsive, time-

ly and cost effective weapons and equipment. I am not able to provide a specific answer. As a result of ours and other critiques of the capabilities requirements process, the Vice Chairman of the Joint Chiefs of Staff has undertaken a major review and revamping of the process. He feels the process is broken and requires fundamental change. This effort is ongoing and I am not privy to the status of the review or the changes under consideration. This would be an appropriate question to the Vice Chairman when he appears before the committee.

52. Senator PORTMAN. Mr. Odeen, have they done so successfully and what still needs to be done?

Mr. ODEEN. See response to question #51.

[Whereupon, at 5:16 p.m., the subcommittee adjourned.]

