

**HEARING TO RECEIVE TESTIMONY ON THE
HEALTH AND STATUS OF THE DEFENSE IN-
DUSTRIAL 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 at the beginning say that a vote has been scheduled at 3:30 today and, because of the nature of the vote, we have been asked to have the Senators actually sit in their 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 elements. These have been the subject of growing concern and will continue to be so as the Department of Defense 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a loss of skilled domestic expertise and manufacturing capability offshore; and the negative impacts from an outdated export control regime.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, key components of the science, technology, engineering, and math—better known as the “STEM”—workforce, not only in the industrial sector, but also within the Department of Defense as well.

Overall, science and technology is a key foundational basis for our National defense capabilities and the industrial base that produces them. Sustained research and development over the last decades has allowed the Department of Defense, 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 technical, 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, 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 science and technology, research and development, 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 the Department of Defense 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. 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 manufac-

turing, 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 science and technology 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 Acquisition, Technology, and Logistics, 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 the 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.

STATEMENT OF SENATOR JACK REED

Senator REED. Madam Chairman, 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 the corporate and the governmental, the most talented individuals, as we once did in the 50s, 60s, and 70s. And 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've got 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? And 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, Madam Chairman. 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 Lemnios, do you want to make your opening statement? I'm sorry. Secretary Kendall. Sorry.

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

Mr. KENDALL. Thank you, Madam Chairwoman. 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 Acquisition, Technology, and Logistics, 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 the U.S. Department of Defense 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 the Department 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. As you know, the Department of Defense 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 sub-system and component suppliers, and even their raw material suppliers, is constantly changing, constantly adapting to the Department'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 the Department, like industry itself, must adapt. The Department 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 the Department to find additional savings over the next 12 years. Secretary Gates is starting a comprehensive effort to carry out that task. The Department 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 the Department 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. The Department'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. The Department 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 the Department 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 the Department.

To be vigilant in this period of change, the Department has significantly increased its efforts to address the potential adjustments in industry. To begin with, the Department incorporated industrial base considerations into the Quadrennial Defense Review that was released last year. This was the first time the Department 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 draw-down 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, the Department does have responsibilities for investing taxpayers' money, preserving healthy competition, and managing across portfolios of defense systems. The Department 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. The Department's initiatives like Better Buying Power, the center by center, tier by tier assessment of the industrial base, and programs to promote science, technology, engineering and math 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 the Department'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 the Department's engagement with industry, affording the Department 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 prepared statement of Mr. Kendall follows:]

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. Chairwoman Hagan, Ranking Member Portman, members of the subcommittee: Thank you for this opportunity to discuss the Department'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 the Department with a wealth of ideas, research and engineering resources, and capabilities that give our men and women in uniform a decisive tactical edge. The Department 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 investments, which the Department 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 the Department's cooperative research and development agreements with industry have a successful track record of driving innovation and transitioning concepts to capabilities.

In fiscal year 2010, the Department awarded approximately 2,000 phase one and 900 phase two SBIR awards and has over 3,200 contract research and development agreements with small businesses across this Nation. This provides an entire avenue of critical technology capabilities.

The Department's laboratories are another source of innovation and they serve as the technical core of the Department. 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.

The Department'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 the Department. 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 the Department'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 the Department 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 the Department with a workforce of continuing education and opportunities 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 the Department 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 the Department. In fiscal year 2010 we used this authority to hire 114 first-rate staff in critically significant areas across our defense laboratories.

Our science, technology, engineering, and math, or STEM, programs are focused on growing the research and engineering talent for the Department's future. Our national defense education program is targeted to attract and develop new STEM talent. Through this program, 1750 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 the Department'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 the Department's investments in these STEM initiatives driving new areas for work in critical technology areas, we're strengthening the work of the Department, 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 our Department.

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 INDUS-
TRIAL BASE POLICY**

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

As Mr. Kendall noted, the Department of Defense 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 the Department 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, the Department'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 the Department 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 ongoing 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 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 the Department's Better Buying Power initiatives. For example, the Department 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 the Department's programs and across the services will improve our program management and help the Department'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 the Department'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 the Department 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 the Department's efficiency initiative, including the Better Buying Power, is already helping adapt both the Department 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, the Department 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 sub-systems to multiple players on a competitive basis.

In addition to guarding against constraints on competition within the existing base, the Department 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 the Department of Defense.

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 fiscal year 2011 NDAA 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, Madam Chair, 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. But 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.

So we have great challenges. As we've heard from the panel today, Madam Chair, 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 the Department of Defense with necessary funds in other areas that would compromise our security.

So 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. And 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, Madam Chair, 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.

So we have challenges we need to address. We need to ensure our competitive advantage is not reduced at this critical time. I re-

alize 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, Madam Chair, 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.

But 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 science, technology, engineering, and mathematics fields are now, many of them, non-U.S. citizens. In the past, many would remain in the U.S. 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. Madam Chairwoman, 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've got 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. Well, 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. Madam Chairwoman, I think there is some real potential there. I went to graduate school at Cal Tech in the 70s and about a third of the students with me in graduate school in aerospace engineering were foreign students. Almost to a person, they stayed in the U.S. 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 understand-

able. 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 Cal Tech. Good school.

Mr. KENDALL. Great.

Senator HAGAN. What we're going to do is take about 6- minute questions. Let me ask one more and then we'll move on. The secrecy that was essential to the success of the counterterrorism 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 the Department. 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 the Department 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 the Department 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, Madam Chair. 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 the Defense Department 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 9-11, 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 very, very 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 celebrate, but 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 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 the 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 and 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 the Department as a whole much less attractive for the Department.

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 the Department of Defense 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. We tend to work within—in our organization, 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 the Department.

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 the Department of Defense 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 the Department 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've got 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 over-emphasize 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 hamstrings 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, Madam Chair, 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 the Department of Defense'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's 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 the Defense Department 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.

One of—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 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.

Ranking Member Portman.

Senator PORTMAN. Thank you, Madam Chair.

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. As you know, 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? And 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 the Department 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, 3—

Mr. AUGUSTINE. 4.

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 the Department, 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. You know, 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:]

[SUBCOMMITTEE INSERT]

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 the Department 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. 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 recompetete when there's no base there to do it is distressing to me, and I wish the Secretary and the Department 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, the 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, Ohio, 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. And 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.]

Senator HAGAN. Well, 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.

So if we could go ahead and start with our opening testimony for this panel. Let's see. Panel two, Mr. Augustine.

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

Mr. AUGUSTINE. Thank you, Madam Chairman, members of the committee. 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 I've been associated with.

I would like to begin by asserting that in 21st century conflict that a strong defense industrial base is every bit as strong—as important; excuse me, as important—as 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 in 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 that 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, it's an unusual free enterprise system. It's a system characterized by a monopoly—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's now been 20 years since the so-called "last supper," at which the Department of Defense 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 the DOD had no intention to pay for overhead for a lot of companies with half-full factories and that didn't have money to invest in research and development; and that it would be up to those of us from industry to solve the problem, that the 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 participants and in six of them they could only afford one supplier or one participant. Shortly thereafter, 5 years later, 75 percent of the companies were gone and half the people in the industry, about three-quarters of a million people.

The question arises, was that a good thing? Certainly the question would be is it better to have 15 strong competitors in a sector

than 2? Unquestionably, in my view that's better. 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 those 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. Without that, they cannot modernize their facilities or run their businesses. There's no place in the Wall Street Journal listing where there's asterisks that say "This company is excused; it's a defense company."

Second and probably the most important is human capital, where our companies have to compete with other companies in the country, whether they're in the defense business or not, and in fact now have to compete with people all around the world, for people. Today 75 percent of the people who get Ph.D.'s in 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, and the DOD has these same issues in terms of building an industrial base and maintaining it as the economy as a whole has, except that the DOD and the defense contractors have to have clearable people, by and large, and that poses a major challenge.

Thirdly is knowledge capacity. Knowledge comes from basic research. There was a study released, a respected study, in the last 2 weeks by a company—by an organization in the U.K. 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, the manufacturing capability of this country. We now are down to 11 percent of the GDP 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 that.

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

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

[The prepared statement of Mr. Augustine follows:]
 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 changes 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 monopsony 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 trans-

formation 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.” And 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, etcetera—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 independent research and development 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 U.S. 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, the Department of Defense, with Congress's 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.

So in my prepared remarks I also discuss the other workforce concern, which is science and technology 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:]

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, Madam Chairperson. First of all, let me say thank you for holding this hearing. This is a very important issue that seldom gets attention before the Congress, so I think this is a great step forward. It struck me as an excellent example of what Eisenhower used to call "absolutely critical, but not urgent, issues." People know how important it is, but they never quite get around to looking at it. So thank you for doing this.

I'm going to try to take a bit of a different tack in my comments. My prepared statement agrees with many of the things they've said, so let me just look at it in a little different light. First, the health of the defense industry today. Actually, the traditional aerospace-defense companies are in very good condition right now. They have strong earnings, cash flow is excellent, their debts are low, they have very solid credit ratings.

Another thing that's sort of surprising is over the past decade they've been able to attract some very capable people, both college graduates and some experienced people, because of the economic situation in particular, although September 11 might have had an impact as well.

On the other end, because of the recession, experienced people are not leaving as early as they often did, so they have gotten a short-term step up in the capability of their workforce. Longer term, it's a different issue and there really still is a sort of a bathtub in their experience base. They hired nobody in the 1990s, essentially, so they have an area there of people who would be 10, 15, 20 years of experience that are simply not in that workforce. So you've got a real gap there, made up in part 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 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, and the stocks had done very badly throughout the 1990s. They also had an aging workforce and at that time great difficulty in recruiting capable technical talent, either new graduates or experienced people.

All is not well, however, 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, the dramatic impact on the industrial base, really hurt them badly,

and this has had a flow-through effect on the Department of Defense.

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 2008. As contrast, most of the rest of the stock market has improved dramatically, and they have declined a good bit during that period of time. That makes it harder to both 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 so important to most important defense capabilities. Let me talk about this because it's one of special concern. Many critical defense capabilities rely heavily on the commercial sector, which leads, in fact often dominates, cutting edge technologies in computers, software, communications, things of that area.

The policy and regulatory changes made in the 1990s, which Jacques will recall, helped facilitate DOD's access to the commercial world, but unfortunately these have been seriously eroded over the past decade. There are other barriers as well: the slow, complicated acquisition process and the multiple 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.

One of the nuances in export controls, let me mention, is if you're a high-technology American company with some really interesting technology and opportunities to sell worldwide, you don't want to get involved with the Department of Defense. 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 the Department of Defense because of that risk.

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

Now, 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 provide special new capabilities, maybe some additional incremental revenue, you'll see that and you're already seeing that. 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 very successful in the past. Also, increased efforts to sell products internationally, especially the Middle East and Asian markets, where there's a lot of procurement going on. Export controls are an issue there, obviously, and I think the recent issue on sales of fighter aircraft to India is an interesting case study of some of the problems that this can create.

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

Now, 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 effort it can to maintain some competition on those platforms that will be of continued importance in the future, not all major platforms, but some will clearly be important for a long period into the future.

Even more critical is good competition, strong competition, for the next level down, large component sub-systems, such things as radar, aircraft fire control systems, fire control systems for ships, aircraft engines, and things of this type. You must have competition there if at all possible.

It will also be important for DOD 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 a choice 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, by the nature of their funding, their ability to be flexibly cut back and to maintain profits and cash flow, but 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 compliment again the committee for addressing these issues. I know DOD is addressing them and your interest and support will help the Department 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:]

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.

So I will just go ahead and start with some questions. In last year's Quadrennial Defense Review it called for a consistent, realistic, and long-term strategy for shaping the structure and capabili-

ties 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 just 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 them credit that there's probably more attention being given to the defense industrial base in the DOD today than there has been in a long time, and I think that's important.

There are many things that could be done for 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 are 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, one of the keystones, should be to adopt—to reinvigorate the prototyping program, with the intention not of deploying them, but simply of maintaining the state of the art, advancing the state of the art, and maintaining the knowledge base, 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 sup-

plemental 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 Joint Strike Fighter, 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 think 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, their IR&D programs, and the Pentagon spending on its labs. You have to go out to the broader technology base of the country, which is huge by comparison to the amount of money spent within DOD or by its suppliers.

So I think that ought to be a key element of the strategy, getting out there, reaching out, finding ways to simplify the acquisition process, get rid of these barriers that keep companies from wanting to play. I think that's important and should be a key part of the strategy as well.

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, I would guess. They came across it and—

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. I mean, 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 the Department 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 programs and regulations.

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

Senator HAGAN. Well, 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 U.S. only people and, as Norm pointed out, most of the Ph.D.’s today coming out of our universities are not U.S. 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 science and technology 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, which is good for the United States and has various foldbacks to the Department of Defense. So we should not—if there are issues, they don’t all have to go to work for Lockheed Martin or a company like that. They can go into other companies that will be providing technology and developments that will help the country more broadly, but can really apply to defense needs as well. So 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 require-

ments 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 just 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 awards. 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 even at this point.

You go from there to the fact that when I graduated from college, and maybe my colleagues, if you wanted to work at the leading edge of the state of the art, the place was to be either at 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, but the point is that there are options. There are a lot more options. When the students look at the bureaucracy at 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 science or engineering, hard sciences or engineering, that they be given 1 year to gain a, quote, "permanent" job and when they do gain that 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. Northrop Grumman, I was on the board for a number of years, and they now give 90 percent of their charitable contributions, which are substantial, to STEM-type programs. So the golf outings are gone, the symphony orchestras and operas are getting hit, I'm sure, 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've got 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 some, as distinguished from process. 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 so the DOD is going to have to pick up a bigger load for this low-rate, highly flexible effort.

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 independent research and development activities and resurrect a more meaningful interaction with industry on communicating future research and development 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 in a fashion 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 because it drives up your overall cost of your product in a very highly competitive situation.

So there's a tough dilemma in the intensely competitive world we're in right now. They need to find ways to permit companies to spend reasonable amounts of money on that. They also need to reach out, and I think they're beginning to do that, reach out more to take advantage of the technology. It often is not really searched out by the services to see how they can use it. So the companies invest in it usually trying to aim at the next big 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 independent research and development. 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 independent research and development 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 basically what Jacques just did, that the "I" stands for independent. So you have a double-edged sword when the government says, we're going to get involved and help you. The government, I think well-meaning, believes that if they tell an industry bidder 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 Acquisition, Technology, and Logistics 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 problems 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 the 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, that our company, the company I used to work for, operated several 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. 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, because 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 created. The first couple years, we started about 15 companies—I say “we” did; the people who ran them started them—with the technology that 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 the business any more, we don’t want anything to do with it.

So here’s a case of a really well-meaning rule, but as it was applied I think it hurt everybody. So I think that 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 think 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 at all.

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, with the position I had 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 Frankford Arsenal that at the time I don’t think it contributed anything since 1776, and it took us 4 years and many people say it may have cost the President his job in reelection.

So I think the government has to play an important role and the role is to do high-risk, high-payoff, long-term work. When they begin doing other things, I think they hurt 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 I think probably 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.

The small businesses don't have deep pockets. Just as when the government has a budget problem, it pushes it down onto the prime contractors, well, the prime contractors do exactly the same thing to the small companies, and the small companies are the ones who suffer the most. So 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 and 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 Jacques' comment, some years ago I was running our 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 this company. They were one of our suppliers of 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.

Well, 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 import—excuse me, 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 what "horses at sea" are on the export list for, but they're there. So that would be a second.

Gosh, it's hard to narrow it 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. Well, 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 U.S. 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, Talis comes here, AIA comes down here—go down the list of all the foreign companies that are now investing in the U.S. 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 kind of hard to add any after those three, but I think the latter one, the job issue. If you look at the Northrop Grumman-EADS bid and I think the 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 this thing. So it wasn't really a jobs issue.

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 BA 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. I believe in about 2001 I took a look at the senior leadership of the defense industry and I took 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 the Department of Defense at some point in time, like a Norm Augustine, I think 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, and you bring a lot of knowledge to the government. So those exchanges I think are critical.

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 BAAs, broad area announcements, that ask for people to come in with creative ideas to solve military capability needs. That's another way to draw in ideas, then have some bakeoffs or have competition. But again, low level, not costly, but 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.

But thank you. We will certainly take note of all of your great ideas and hopefully take action on them.

This subcommittee is adjourned.

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