HEARING TO RECEIVE TESTIMONY ON THE HEALTH AND STATUS OF THE DEPARTMENT OF DEFENSE SCIENCE AND TECHNOLOGY LABORATORIES AND ENTERPRISE IN REVIEW OF THE DEFENSE AUTHORIZATION REQUEST FOR FISCAL YEAR 2013 AND THE FUTURE YEARS DEFENSE PROGRAM

TUESDAY, APRIL 17, 2012

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

The subcommittee met, pursuant to notice, at 2:35 p.m. in room SR–222, Russell Senate Office Building, Senator Kay R. Hagan (chairman of the subcommittee) presiding.

Committee members present: Senators Hagan, Shaheen, Gillibrand, 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, minority investigative counsel; and Michael J. Sistak, research assistant.

Staff assistants present: Kathleen A. Kulenkampff and Bradley S. Watson.

Committee members' assistants present: Patrick Day, assistant to Senator Shaheen; Elana Broitman, assistant to Senator Gillibrand; and Brent Bombach, assistant to Senator Portman.

OPENING STATEMENT OF SENATOR KAY R. HAGAN, CHAIRMAN

Senator HAGAN. We will go ahead and call this hearing to order.

I know that Senator Portman is on his way, but I thought we would go ahead and get started.

And I do appreciate all of our witnesses being here, and Secretary Lemnios, I believe this is your third time in a very short period of time. So thank you very much for coming back.

This afternoon, as part of our review of the defense authorization request for fiscal year 2013, the Emerging Threats and Capabilities Subcommittee meets to receive testimony on the health and status

of the Department of Defense laboratory and science and technology enterprise. This hearing will delve deeper into some of the important topics that we touched upon last year in our hearing on the health and status of the national defense industrial base and related science and technology elements. And as a key element of the Defense Department's roughly $12 billion per year science and technology portfolio, its laboratories contribute to a broad range of science and technology activities ranging from conducting Nobel Prize winning basic research to rapidly developing and fielding capabilities for the warfighter. The lab enterprise includes 62 organizations.

Senator Portman, we just got started.

This lab enterprise includes 62 organizations spread across 22 States, with a total workforce of about 60,000 employees, more than half of whom are degreed scientists and engineers. In certain critical national security-related areas, these organizations and, more importantly, the highly skilled scientists, engineers, and technicians in them I believe are truly our national assets.

The challenge facing the Department of Defense is to budget the resources needed to attract and retain a highly skilled technical workforce, conduct relevant and effective research and development to give our military the technology edge it needs while relying on tools and an infrastructure that are aging. And it must do all of this. DOD must do all of this in an area of increasing budgetary pressures on investments in our future.

In order to gain a better understanding of the health and status of the DOD laboratory and science and technology enterprise, there are several areas to explore. We would like to better understand the personnel and infrastructure challenges facing the lab enterprise, the relevance and effectiveness of its research and development portfolio, and its ability to transition technologies to the warfighter and transfer knowledge to industry. We are also aware that many technologies developed in the DOD labs have application to homeland security and the protection of our cyber infrastructure, as well as dual use for the commercial sector.

Furthermore, we are interested in how the DOD lab enterprise interacts with other Federal agencies such as the Department of Energy's national labs, with industry and academia, including federally funded research and development centers and university-affiliated research centers.

In order to explore these areas, we have to focus today on the mechanisms the labs have at their disposal to accomplish the following key tasks: recruit and retain the best and brightest scientists, engineers, and technicians; modernize aging infrastructure; rapidly develop, test, and help field innovative approaches to address threats in a complex, dynamic world; and coordinate and collaborate not only across the DOD lab enterprise, but also with other Federal agencies, industry, and academia to ensure that ultimately the DOD has the greatest possible access to sources of innovation.

We also would like to know whether improvements to these mechanisms I just related are necessary.

And we are pleased to have four expert witnesses to help understand these complex areas.

Mr. Zach Lemnios, as I said earlier, the Assistant Secretary of Defense for Research and Engineering. And in this position he oversees and coordinates the Department's broad science and technology portfolio across the services and DARPA. In addition, Mr. Lemnios oversees the Department's laboratory enterprise and serves as an advocate on behalf of the laboratories to his department's counterparts on personnel and infrastructure issues. The subcommittee looks forward to hearing about the DOD's overarching management strategy for the labs.

Mr. Lemnios, as I said earlier, it is great to see you again, and thank you for being here and what you do.

Dr. Marilyn Freeman is the Deputy Assistant Secretary of the Army for Research and Technology. In this position, she sets the goals and objectives of the Army's science and technology activities across the 22 Army laboratories and centers. These laboratories conduct research on topics ranging from better food for soldiers to the next generation of ground vehicles. Dr. Freeman is credited for focusing the Army's science and technology activities to be more soldier-centric through a set of well-defined technology-enabled capabilities.

And Ms. Mary Lacey is the Deputy Assistant Secretary of the Navy for Research, Development, Test, and Evaluation. In this capacity, she is the lead for the Navy's science and engineering capability, capacity, and infrastructure at its 15 laboratories and warfare system centers. The Navy labs conduct research from the latest autonomous undersea vehicles to futuristic electromagnetically driven rail guns for ships.

Dr. Steve Walker is the Deputy Assistant Secretary of the Air Force for Science, Technology, and Engineering where he is responsible for preparing policy, guidance, and advocacy for the Air Force's science and technology program that in part is executed by various directorates of the Air Force research laboratory. The Air Force research lab performs cutting-edge research from the next generation of directed energy weapons to the next generation of highly autonomous drones.

I 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, please keep your opening remarks to no more than 5 minutes, and we will certainly include your full written statements in the record.

And before we hear from our panel, I want to turn to my colleague and ranking member, Senator Portman, for any opening remarks you might have.

STATEMENT OF SENATOR ROB PORTMAN

Senator PORTMAN. Thank you, Madam Chair.

And thanks to the witnesses for being here. I look forward to hearing from each of you. We have a distinguished panel with a lot of background and experience, and we are looking for a candid conversation about the health and the status of the laboratory enterprise at the Department of Defense. I think it is particularly important we talk about this today as we are looking at downsizing our military, particularly the strategic realignment that the adminis-

tration is pursuing, and as priorities are adjusted, we want to be sure that we understand as a subcommittee exactly what the impact will be on the labs.

The chair has talked a little about the breadth of our labs and she has talked about the importance of the labs. The threats we face as a nation, unfortunately, are not diminishing based on our fiscal problems. So the global environment remains very challenging, and yet obviously, as we have seen with the sequester and before that, the changes to the budget proposals that were being made by the administration, notwithstanding the additional sequester, we are under a lot of fiscal constraints at a time when we have plenty of challenges globally.

We think the labs are a critical element to our ability to prepare for those threats, respond to those threats, and we certainly cannot afford any disruptions that could cause the lack of capabilities in these institutions that give our men and women in uniform a qualitative edge.

During the Cold War, we knew without a doubt that America was at the top of the heap. We were the most technologically advance nation in the world and we had the best research. Today that picture is a little less clear. The National Defense University released a report in February of this year on the topic of science and technology on a global scale, and the report stated that—and I quote them—the share of U.S. science and technology productivity will decline from about 26 percent in 2005 to about 18 percent by 2050.

So while we continuously invest precious resources to develop leap-ahead technologies, it is not as simple as it used to be. We are not facing, of course, the single threat of the Soviet empire. We are facing a more complicated, competitive environment. We cannot outspend and out- innovate all of these countries. The global scales are tipped. We are now competing with countries like China and other emerging economies.

In the President's budget request, I noticed, for fiscal year 2013, DOD asked for $11.9 billion to dedicate to basic, applied, and advance research, much of which, of course, is done inside your labs. This is a slight reduction from fiscal year 2012, but only a very slight one. It still shows a commitment and shows our seriousness of purpose I believe. Because these science and technology funding lines have been left largely untouched, you will have a responsibility, even more so than your colleagues who have had their budgets slashed, I think, to ensure that every one of your dollars is spent wisely. And I know you take that seriously.

I look forward to hearing about your plans to ensure that efforts across the entire Federal Government are coordinated—the chair just talked about that particularly with the DOE labs and others within the Federal Government—that we eliminate unnecessary duplications, that technologies are developed that we can use by industry as appropriate, and that we use best practices across the broad range of research and development that is being done.

I would also like to hear a little bit from you regarding this Defense Rapid Innovation program. Each of you have previously talked about this. I think you have, it is fair to say, talked about its necessity, and yet I notice that it is not in your budgets. To

date, I think $700 million has been dedicated to the program but it has never been in a budget request. So why? What do you think about it? Is it working? Is it a benefit to the warfighter or not?

I have more questions that I will be raising later, and again, I really appreciate you all being here to provide your expertise to us as a committee. I look forward to again to your frank assessment of our Nation's laboratory enterprise and science and technology efforts and how we can improve them.

Thank you, Madam Chair.

Senator HAGAN. Thank you, Senator Portman.

And I am pleased that Senator Shaheen and Senator Gillibrand have joined us.

Secretary Lemnios, if you will start with your opening comments and, once again, if we can leave them to 5 minutes and the rest will be on the record.

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

Mr. LEMNIOS. Absolutely.

Good afternoon, Chairwoman Hagan, Ranking Member Portman, and committee members.

I will ask that my testimony be entered into the record. I have a very short statement and welcome the opportunity to testify before you on the Department's laboratories.

The President's budget request for science and technology funding of $11.9 billion for fiscal year 2013 is structured around a solid foundation supported by the laboratories of the Department. These laboratories are comprised of dozens of facilities employing tens of thousands of public employees, military personnel, and contractors.

Throughout the years, the Department's laboratories have repeatedly proven themselves to be a vital component to the overall success of the Department's science and technology enterprise. The labs are uniquely suited to couple basic research concepts to early-use military applications and, most importantly, they connect to our warfighters and understand the challenges they face today and may face in tomorrow's conflicts.

Our laboratories serve three primary roles for the Department.

First is the development, rapid fielding, and deployment of systems to support our warfighters, our warfighters urgent operational needs, such as the many innovative systems that have been developed to counter improvised explosive devices.

Second is the development of advanced concepts such as the high-speed strike weapon that will lead to future capabilities for our Nation.

And third is the transition of advanced technologies to the industrial base such as the adaptive versatile engine technology that will later be used in our acquisition programs.

And as we testified just a few weeks ago, key to the success of this enterprise is the talent base that it supports, and we have structured our STEM investments and we have leveraged our section 219 and other authorities that you provided us to train, attract, retain the needed scientists and researchers in these technical fields.

While our laboratories are positioned for success today, I believe it is important to challenge our existing practices and consider new business models to position our laboratories for success in the future in this environment of enormous global competition.

In coordination with my colleagues here today, the Department has launched an assessment of our laboratory enterprise to move in that direction. Our study will examine and compare existing models of research, development, and transition against emerging models that other organizations are using to rapidly develop and transition technologies into new products and operational capabilities across the private sector. A key element of this assessment will be to examine the balance between the service-specific responsibilities and the joint effectiveness of this enterprise. The insights that we gain from this study will support the development of new models to ensure that the Department's laboratories remain competitive and relevant today and into the future. And these results will be reflected in the annual strategic workforce plan directed by Congress.

Madam Chairwoman, thank you for the opportunity to present these brief remarks, and I look forward to questions from the committee.

[The prepared statement of Mr. Lemnios follows:]

Senator HAGAN. Thank you, Secretary Lemnios.

Dr. Freeman?

STATEMENT OF DR. MARILYN M. FREEMAN, DEPUTY ASSISTANT SECRETARY OF THE ARMY FOR RESEARCH AND TECHNOLOGY

Dr. FREEMAN. Thank you, Chairwoman Hagan and Ranking Member Portman and distinguished members of the subcommittee. I really do appreciate this opportunity to discuss the status and health of the Army's science and technology enterprise and the significant role of S&T in supporting the warfighter.

I have submitted a written statement and ask that it be put into the record.

I want to thank the members of the committee for your important role in supporting our soldiers who are at war and for your advocacy of the Army's S&T investments that will sustain technological preeminence to our future soldiers. Your continued support is vital to our success.

My vision for Army S&T is to invent, innovate, and demonstrate technology-enabled capabilities that empower, unburden, and protect our soldiers. I hear often from the soldiers themselves that technology saved their lives and was critical to their remarkable accomplishments. And for this reason I believe it is necessary for the Army to maintain a strong Army laboratory system.

Our current S&T enterprises comprise over 22 labs and centers spanning 5 commands and located throughout the United States. These labs and centers are home to 19,000 dedicated Federal civilians who are the core of the enterprise. By employing a world-class cadre of scientists and engineers, technicians, analysts, and administrative support and providing them with the facilities and infrastructures necessary to accomplish their mission, we can ensure

that the Army has the ability to address the specific challenges faced by our soldiers.

Now, it is my job as Deputy Assistant Secretary of the Army for Research and Technology to plan for the long-term health of Army S&T, and I believe that there are three critical areas to our long-term success. The first is people. The second is infrastructure and facilities, and the third is programs.

While I believe that we are generally well positioned to weather the current budget climate, I do have major concerns with the long-term health of our S&T enterprise. And I will briefly highlight some of these concerns.

People are the Army's most valuable resource. Without the skills and the dedication of the scientists, engineers, technicians, and support staff comprising our workforce, the Army R&D enterprise would be in serious trouble. We are grateful to Congress for making permanent the direct hire authority for people with advanced degrees. This, along with the Laboratory Personnel Demonstration Project, allows us to attract great new talent. Science, mathematics, and research for transformation, or the SMART, scholarship for service program also provides opportunities for us to improve the flow of new highly skilled technical labor into our DOD facilities and agencies to enhance the technical skills of the workforce already in place.

But as mentioned before, in the difficult budgetary times ahead, we will have to find ways to ensure that we can retain these new recruits, avoiding the tendency to employ last-in/first-out mentalities should we need to reduce manpower. We also need to find ways to bring in more veterans and others who may not have advanced degrees but have essential experience and skills needed for our workforce.

While I fully understand the reality of our budget situation, we must guard against using S&T as a bill payer. And I am concerned that S&T will take a disproportionate share of personnel cuts should we have to reduce manpower. Such a loss of talent could have devastating consequences for the Army.

Now, world-class scientists and engineers require better than adequate infrastructure and facilities to accomplish their mission. Within our S&T enterprise, we have roughly 2,000 facilities. Of these, 1,143 are within the continental United States. We do have a lot outside the continental United States. To give an indication of the extremes, we currently have one building that was constructed in 1828 to several buildings currently under construction. And approximately 72 percent of the facilities are over 25 years old and 48 percent are greater than 50 years old. It is also important to note that not only do our facilities support our Army researchers, but many of our facilities also are highly leveraged by industry.

While we have made some improvements to our infrastructure and lots of improvements in facilities through the BRAC process, congressional adds, and the minor military construction authorities provided by Congress, we do not have a good long-term solution to the problem of aging facilities. We have recently completed an inventory in the Army of our S&T facilities and are currently developing a plan to have facility experts inspect nearly 1,000 of our

buildings. This will allow us to develop a comprehensive priority list and hopefully help get construction resources to where they are most needed. And it is my intent—and I have talked with her about it—to work with the Assistant Secretary of the Army, Installations, Energy, and Environment, to find ways to address this and other infrastructure and facilities issues.

With respect to programs, I believe that the 2013 budget request submitted to the Congress provides correct levels of investment for our enterprise.

So in conclusion, these are exciting and challenging times for Army's S&T program. We are changing the S&T business model to be an enduring, sustainable, successful enterprise and aligning our strategic planning to the budget process to achieve efficient, top-down S&T leadership investment focus. And I look forward to working with Congress to ensure that we can maintain a world-class S&T workforce supported by world-class infrastructure.

And I would like thank you for the opportunity to testify before the subcommittee and for your support to our Army's science and technology investments. And I am proud to represent the efforts of over 19,000 dedicated Army civilians and employees to providing soldiers with world- class technology-enabled capabilities. And I am pleased to take your questions.

[The prepared statement of Dr. Freeman follows:]

Senator HAGAN. Thank you, Dr. Freeman.

Ms. Lacey?

STATEMENT OF MARY E. LACEY, DEPUTY ASSISTANT SECRETARY OF THE NAVY FOR RESEARCH, DEVELOPMENT, TEST, AND EVALUATION

Ms. LACEY. Madam Chair, Senator Portman, members of the subcommittee, it is an honor to appear here before you today to report on the overall health of the Department of the Navy laboratories and warfare centers.

The department relies heavily on the people, facilities, and capabilities in our labs and centers to sustain the current Navy, to acquire the next Navy, and to develop the Navy after next.

I want to thank the committee not only for your interest, but for your strong support of the many initiatives, investments, and flexibilities enabling those scientists and engineers to provide new warfighting capabilities and to sustain the technology leadership our sailors and marines enjoy.

The Navy's principal laboratory, the Naval Research Laboratory, was created by Congress in 1923. Over half the work NRL performs is fundamental science and technology, nearly all in partnership or collaboration with academia and researchers in other Government laboratories and activities.

The warfare centers, while being involved in basic science, play most strongly in technology and engineering often in partnership with industry and program offices. They too have long histories, some dating back to the 1800s, and were generally created to respond to a specific threat or technological challenge of the day.

The Navy labs and warfare centers maintain a diverse workforce of over 44,000 employees, over half of whom are scientists and en-

gineers. Among the scientists and engineers, 1,700 hold doctorates in science, engineering, or mathematics.

The Assistant Secretary of the Navy for Research, Development, and Acquisition has identified five strategic priorities for the Department of the Navy. Each of these works in harmony with the other to meet the current acquisition needs and future technology requirements of our sailors and marines. The five priorities are: get the requirement right, make every dollar count, raise the bar on performance, support the industrial base, and rebuild the acquisition workforce. It is here where the laboratories and warfare centers play most strongly as they make up over half of the department's technical acquisition workforce.

I would like to address the various flexibilities and hiring compensation and personnel movement you have given us from the China Lake demo back in the 1980s to the expansion of these authorities and eligible activities over the last few decades.

Section 852, the Defense Acquisition Workforce Fund, has contributed greatly to our expansion of our workforce. Our plan is to hire an additional 1,600 scientists and engineers under this authority, nearly half of which will be either permanently placed or rotated through our labs and warfare centers to accelerate their professional development.

The direct hiring authority, section 1108, provides for the appointment of qualified candidates possessing an advanced degree in science or engineering. Since 2009, we have hired more than 6,800 scientists and engineers in our laboratories and warfare centers and over 700 were brought in with this direct hiring authority. So thank you.

Section 219. Although the Department of the Navy has historically made deliberate and measured investments to ensure stability within our organic workforce, section 219 has been a big help. During this period of refreshing our workforce, it has proven beneficial to the health of the enterprise. Projections indicate the Navy labs and warfare centers will invest almost $90 million in fiscal year 2012, and furthermore, this program has sparked great enthusiasm on behalf of our scientists and engineers.

The authority for unspecified minor construction, up to $4 million, continues to hold significant potential for the revitalization of our laboratory and warfare facilities. As the program gains strength, we anticipate it will become a very valuable resource. In the likelihood MILCON funds decrease within our labs and warfare centers, this authority becomes even more important to revitalizing the technical infrastructure.

The scientific and technical workforce is the engine that drives our ability to maintain the technological superiority. Technical capabilities once lost may take decades to reestablish. Scientists and engineers require the hands-on experience. In fact, if you do not do it, you do not know it. Hands-on experience is essential to provide informed decisionmaking when setting requirements or overseeing contractor performance. Consequently, ASNRDA has directed program executive officers and program managers to look first at the in-house laboratories and warfare centers for pre-milestone B technical work.

So in summary, the Navy labs and warfare centers are critical components of today's Navy, the next Navy, and the Navy after next. The authorities that you have given us enable us to strengthen their intellectual and infrastructure capacity and capabilities. By increasing the hands-on work performed scientists and engineers, the Navy has energized the workforce.

Having grown up professionally and technically in this community, it has been a delight to return in a leadership position where I can influence their continued success. I greatly appreciate your continued support to our laboratories and warfare centers and assure you I will do my best to ensure they are postured to meet today's and tomorrow's challenges.

I would be happy to take any questions you might have.

[The prepared statement of Ms. Lacey follows:]

Senator HAGAN. Thank you, Ms. Lacey.

Dr. Walker? Thank you.

STATEMENT OF DR. STEVEN H. WALKER, DEPUTY ASSISTANT SECRETARY OF THE AIR FORCE FOR SCIENCE, TECHNOLOGY, AND ENGINEERING

Dr. WALKER. Thank you. Madam Chairwoman, Senator Portman, members of the subcommittee, and staff, I am pleased to have the opportunity to provide testimony on the Air Force science and technology program and on the status and the health of the Air Force Research Laboratory, our service's premiere research organization.

To protect our Nation amidst a myriad of current and future security challenges, the Air Force must be an agile, flexible, ready, and technologically advanced part of the joint team. Supported by the fiscal year 2013 President's budget request of approximately $2.2 billion for S&T, our program plays a vital role by creating the compelling air, space, and cyberspace capabilities for precise and reliable global vigilance, reach, and power.

As our single full-spectrum research organization, AFRL executes the Air Force's investment portfolio in basic research, applied research, and advanced technology development. AFRL is unique among the services, as all the Air Force efforts to discover, develop, and integrate affordable aerospace warfighting capabilities are housed in this one laboratory. Our single unified lab structure has brought Air Force S&T to a new level of efficiency collaboration and innovation.

Basic research is the foundation of the Air Force S&T program and the cornerstone of our future force. Through the scientists and engineers at the Air Force Office of Scientific Research, AFOSR, we actively engage the worldwide technical community, and the Air Force has been able to leverage significant investments made by other defense and Federal agencies as well as non-defense and international laboratories by doing this.

These long-term efforts have led to promising opportunities such as cold atoms which may enable development of an inertial navigation system on a chip that is jam-proof and highly accurate.

Through its Rapid Reaction and Innovation Process, the laboratory also supports the current fight. Since December 2010, Blue Devil Block 1, persistent intelligence, surveillance, and reconnaissance capability, has been instrumental in identifying a number of

high-value individuals and improvised explosive device emplacements in the CENTCOM area of responsibility.

AFRL actively collaborates at all levels with other service labs and DARPA. This engagement ranges from scientists and engineers sharing the very latest scientific and technological breakthroughs at conferences and symposiums to more formal efforts including disciplined joint planning, which accelerates technology maturation and ensures that taxpayer resources are best utilized.

The Air Force's relationship with DARPA has been critical over the years. Approximately one-third of the DARPA program is actually executed through AFRL due to our laboratory leadership and key technical areas, our unique facilities and strong ability to form world-class teams spanning industry, academia, and other Government laboratories.

To meet the S&T demands of the current and future warfighter, we must develop and maintain mission-ready facilities and infrastructure. AFRL is a world-class lab with more than 40 sites worldwide which includes AFOSR offices in Europe, Asia, South America; 539 primary facilities on 10 installations; and 11 million square feet of technical space. While the recently completed efforts from the BRAC 2005 provided the lab with several new state-of-the-art facilities, such as the Sensors Range Complex, we recognize that we must continue to be vigilant and upgrade our S&T infrastructure in a timely manner so that major research programs are not put at risk due to aging facilities.

Ensuring the Air Force continues to have world-winning technology requires the proactive management of our current STEM workforce and a deliberate effort to grow the lab scientists and engineers of the future. The Air Force Laboratory Personnel Demonstration Project adopted in 1997 has done much to ensure AFRL's ability to attract and retain personnel. This flexible system has helped to achieve the best workforce for the mission, adjust the workforce for change, and improve overall quality. We have also set outreach goals to aggressively pursue strategic partnerships and activities with our schools, universities, sister services, professional associations, and other Federal agencies in an effort to grow and develop future STEM talent.

Today's Air Force stands as the most powerful air, space, and cyberspace force in the world because of technological advances being transformed into revolutionary new capabilities. AFRL has and continues to provide innovation and critical support for the Air Force by balancing near-, mid-, and far-term research, leveraging efforts across academia, industry, and the other services; and maintaining an efficient and effective lab infrastructure; and finally, retaining and developing a world-class cadre of scientists and engineers.

Madam Chairwoman, Senator Portman, and the subcommittee, thank you again for the opportunity to testify today and thank you for your continued support of the Air Force S&T program and the Air Force Research Lab.

[The prepared statement of Dr. Walker follows:]

Senator HAGAN. Thank you all very much for your opening comments, your remarks, and certainly the depth and breadth of the research that is taking place in the DOD labs.

What I would like to do is ask the Senators—we will do a 7-minute round of questions.

Secretary Lemnios, prior to your confirmation hearing in 2009 in your advance policy questions, you were asked if you support significantly increased delegation of operating authority to the lab directors. And in your response you said I believe in aligning responsibility at the lowest possible level needed to execute. Consequently, I support in principle delegating increased operating authority to the lab directors. If confirmed, I will direct the Deputy Under Secretary for Laboratories and Basic Services to review personnel management, infrastructure recapitalization, and other lab issues and provide recommendations to address identified problems. I will then work towards developing the necessary authorities for lab directors based upon these recommendations.

Can you describe briefly over the last 3 years in developing these authorities and recommendations for the lab directors?

Mr. LEMNIOS. Senator, we are absolutely doing that. Much of that work is centered around the implementation of the 219 authorities to make sure that we understand each of the services that implemented those authorities differently for different purposes, still aligned with the legislation.

There are two things that we took on immediately after I came into the office. The first was standing up our executive committee which sort of aligns the services both in the laboratory sense but also the broader science and technology areas. And the second, more recently we have stood up a Department STEM executive board to help us understand across the Department where the skill set is lacking, and that certainly ties to the workforce model that is being developed by the Department.

So we have really centered on—we have looked at where the workforce is limiting and where we need to add to that, and then I work with the laboratory directors to implement those directly. I think it has got to be pushed to the lowest level, but it has to be coordinated, and that is the key.

Senator HAGAN. How about recommendations to address identified problems?

Mr. LEMNIOS. I hear problems every day. The issue is not identifying the problems. The issue is resourcing solutions to the problems and finding solutions that we can, in fact, adopt broadly.

I think as you read our testimony, as you read the testimony of the services, the challenge that we have across the Department in our laboratories is supporting the service-specific needs of each laboratory but then leveraging the broader context of how we can leverage this enterprise for joint use. And we are in the middle of that transition now. If you look at the science and technology priorities that we outlined last year we spoke about in the cyber hearing just a few weeks ago, all of those are cross-cuts. They are all cross-cutting technologies that are not owned by one laboratory or another, but we really have to integrate those efforts. So I guess I would say my desk is—the inbox is full and the outbox is being sourced by what we can afford to do and what makes sense to do across the Department.

Senator HAGAN. Secretary Lemnios, let me give you a statement. In 2009, the National Academies were asked to review the basic re-

search laboratory facilities of NASA. And in one of their findings, they stated—and this is a quote—based on the experience and expertise of its members, the committee believes that the equipment and facilities at NASA's basic research laboratories are inferior to those at comparable DOE laboratories, top-tier U.S. universities, and corporate research laboratories and are about the same as those at basic research laboratories of DOD.

Are you disturbed by the inference from this National Academies' report that the equipment and facilities of DOD's basic research labs are inferior to those of comparable Department of Energy labs and then the top-tier universities and corporate research labs?

Mr. LEMNIOS. I am concerned about that. I have spoken with the lab directors about that issue. But the devil is in the details. So as we look at each of these technology areas, whether it is electronic warfare or cyber or autonomy—the Navy just recently opened up a world-class robotics laboratory not too far from here. I can point to places where the Department in fact has a leadership role, but that leadership role has to include not only the facilities but the personnel and the projects. Dr. Freeman mentioned that in her opening comments, and I absolutely agree that that is the way we have got to structure it.

Senator HAGAN. Talking about the differences and the MILCON request, when services prioritize their military construction request, in many cases it seems that laboratory infrastructure sometimes does not get the top attention. It is obviously competing against runways, piers, hospitals, gyms, barracks, and roads and other elements of the base infrastructure. Historically it appears to some of us that laboratories are at or near the bottom of these MILCON requests, and consequently, aside from the benefits from some of the last BRAC moves, the aging DOD laboratory infrastructure needs attention. I was sort of astounded when Dr. Freeman stated that one of the buildings was an 1828.

But for Dr. Freeman, Ms. Lacey, and Dr. Walker, what is your service doing to address the infrastructure and military construction needs of your laboratories? Dr. Freeman, if you want to start.

Dr. FREEMAN. So, ma?am, what we are doing is as I mentioned. We are trying to, first of all, do a survey and trying to look at what the real state of our facilities are. So the first thing was to identify how many facilities we really have. The second is to go out and actually look at the infrastructure and categorize and understand what the condition is of those different buildings. Then what we are going to do is we are going to look at those and identify, first of all, what the major sort of worst things that we have to take care of are that are keeping us from doing our mission-essential tasks, and then we are going to go down that next level of what we need to improve and what do we need to improve.

Up to this point, those kinds of improvements are made at the individual laboratory level, and they never actually bubble up to the corporate level, even to my level, of what needs to be done. And so the first thing we are doing is shedding light on it. And after we shed light on it and understand those things, then we can go work with the commands and help figure out what we can do to improve our competition for capabilities in the military construction field.

That is why it really is important that Assistant Secretary Hammack and I work together on this, that we can actually figure out what we can do to get commands to put the laboratories on a different scale than where we are.

Senator HAGAN. I guess I am surprised you do not have that list already.

Dr. FREEMAN. Right. We do not.

Senator HAGAN. And when will you get it? When will the survey be done?

Dr. FREEMAN. The survey of just identifying all the facilities and the infrastructure that we own, because it is in so many different places, so many different installations—that is complete.

The second thing is by the end of October, I should be able to have the result of the rest of that, which is have these engineers go out and look at these facilities and categorize what needs to be done for them. So by October is when I am looking.

And again, part of this is because this is——

Senator HAGAN. Ms. Lacey, if you can go ahead and then Dr. Walker. Thank you.

Ms. LACEY. Ma'am, I am not too proud to say the Army is ahead of the Navy in this domain. We have not gone out and tried to analyze the capacity and capability that we have in our facilities and infrastructure. While every technical director at every location of every center knows that inside and out, at the institutional level, we have not looked across the warfare centers and the Naval Research Laboratory. They, however, are looked at inside their system command to which they are assigned. So the aviation community looks very closely at the capability and capacity that they have in their facilities for aviation. The surface warriors look at that for what they have in the surface warrior community, submarine, et cetera. But I have not done the integration across the enterprise to take a look at that.

Senator HAGAN. Are you planning to?

Ms. LACEY. I am.

Senator HAGAN. And when will that be done.

Ms. LACEY. Ma'am, I am sure that is at least a year off before we will have the results.

Senator HAGAN. Dr. Walker?

Dr. WALKER. Yes. In my opening statement, I mentioned one of the benefits of having one lab with multiple tech directorates in different locations as efficiencies. And so one of the things we have been able to do by the one lab concept is look across the lab and see what are our needs. So we have a list of 10 things that we want to do.

As you mentioned, oftentimes those are not judged just on—you know, the MAJCOM's do not look just at research value. They look at safety and runways and other things. I would say over the last 10 years, the MILCON that has been approved by the Air Force is roughly in the $40 million range. One of the reasons for that is we had this BRAC in 2005 that provided about $450 million to upgrade AFRL facilities in different locations.

And so I feel like right now AFRL is in pretty good shape in terms of facilities and infrastructure. We can always do more. The thing on our top 10 list right now is putting a fence around the

Rome information directorate which does not have a fence around it, and that is where we do cyber work.

Senator HAGAN. That is very important.

Dr. WALKER. That is on our top 10.

Senator HAGAN. You mentioned 539 in your opening comments.

Dr. WALKER. 539 facilities at 10 different installations. Those are buildings at 10 different installations.

Senator HAGAN. Thank you.

Secretary Lemnios, it appears to me that—well, my time is up and I will come back. But what I want to direct is I guess I am surprised that we do not know the depth and breadth of the laboratories that are under your purview. Do you want to comment?

Mr. LEMNIOS. Let me just briefly comment. Asking a very simple question, not getting a simple answer is a frustration for everybody. And we should have that and we simply do not. And the reason for that is that the operating models are different. A warfare center looks a little bit different than a basic research laboratory, looks a little bit different than an engineering center. So some of this is driven by what is the function of those facilities and how do we structure that, which goes precisely to the challenge that Congress gave us in terms of building a workforce model and a strategic plan for our workforce so we really understand where the core competencies are. You know, I can take a building number and I can map it to a ZIP code and I can map it to a functional element, but at the end of the day, I have got to also make sure that I have got the right workforce in that environment. So some of this is driven by buildings and a lot of it, I think, is driven by personnel.

It is a daunting challenge. The Department has—

Senator HAGAN. It seems like we need an integrated approach to what is it that we need, how is it helping the warfighter, and what our long-term research and development goals are and looking at it at an integrated level.

Mr. LEMNIOS. Ma'am, you are exactly right.

Senator HAGAN. Senator Portman?

Senator PORTMAN. Thank you very much, Madam Chair.

I was just remembering being out at AFRL at Wright-Pat and seeing some of the Wright brothers wind tunnel projects there. So it is not 1828 buildings, but some of the facilities there are also, as you know, in need of some modernization. But you have done a terrific job and I appreciate your support of the lab.

I would like to ask a general question first, if I could, and it really, I guess, is directed to you, Secretary Lemnios, which is about sequestration. We are talking about $492 billion in sequestration that is on the books. It is slated to happen January 1st next year. That is about $55 billion in fiscal year 2013. What I would like to hear from you is how would that impact the labs, one? And two, what contingency plans do you have in place to deal with it?

Mr. LEMNIOS. Senator Portman, it would be absolutely devastating. We have no plans right now for that. But I will tell you, as the Secretary has testified, that that would be a devastating effect on the Department and certainly on the Nation.

Senator PORTMAN. And you say you have no plans to deal with it. Do you have any contingency plans to try to deal with, as you call it, devastating impact of the sequestration reductions?

Mr. LEMNIOS. The effect is so severe that until we get to a point where we understand what the parameters are, we could be looking at pluses and minuses of very large numbers, and we simply have not gone through that exercise yet. We are hoping that that will be resolved on the Hill, that in fact we will see a solution that does not get us to that edge of the cliff.

Senator PORTMAN. Do you think that it would endanger our national security and specifically put our warfighters in danger not to have the level of funding you think is necessary at our labs?

Mr. LEMNIOS. I think the Secretary has testified that the effect would be serious and the impact, sort of following that thread back to the laboratories—I have not done that assessment, but the Secretary's testimony has been that this would be a serious impact.

Senator PORTMAN. He has used the word ?devastating.? He has also said it would hollow out the force. We will work with you, as you know, to try to avoid this. But I do think that you ought to make your initial assessment at least and let it be known to this subcommittee and others within the Department so that we can be more effective in making our arguments as to why sequestration would be so damaging to our labs and our research and to the warfighters ultimately.

I have to ask about the Defense Rapid Innovation Program. You heard me talk about it a minute ago. 700 million bucks received so far. Never been in the Department's core budget. Why have you not ever asked for funding for it? Do you think it is not important? Do you think it is something that is not on a priority list?

Mr. LEMNIOS. Senator, this came to the table at a time when we were collapsing the budget through the Budget Control Act. We had submitted PBR–13 at a time when this came up—PBR–12 at a time when this came up. At the same time, we were trying to balance the issues that we had on the table. This was passed in fiscal year 2011. There was $500 million that was appropriated. We had four broad agency announcements that were put out. We are, in fact, evaluating those now. We are going through source selection, and we are about to award efforts on those.

The good news is the legislation is well structured with clarify of effect; that is, once a contract is let, within 2 years we will know whether we have a capability that supports either our warfighter or supports an acquisition program where we can measure the effectiveness. And as we go through the first round of Rapid Innovation Program funding, we want to see what those effects are. Did we, in fact, get the impact that was postulated when the legislation was written? We hope we will, and we will know once those contracts end.

And I think the question as to why it was not in the base budget, it was simply a time when we were looking at what our base efforts were going to be, let alone trying to add $500 million into the budget. And in fact, we took the leadership from the Hill on that.

Senator PORTMAN. Does the Defense Rapid Innovation Program benefit the labs?

Mr. LEMNIOS. The Rapid Innovation Program certainly uses technologies that come out of the labs. To date, we have received 3,600 white papers. Not all will end up in contract awards. Many of those use technologies that came out of our labs, were submitted through

contract research and development agreements or other efforts. So in many cases, the ideas are seeded across the defense industrial base.

Senator PORTMAN. You talked about the importance of human capital—all of you did—the importance of your people and having a trained workforce and the need for us to continue to focus on some of these core disciplines. I think you would all agree that without the scientists and engineers being world-class, we cannot have a world-class program and that there is an important relationship between the DOD graduate school programs and the officers that end up in your labs. Certainly I have seen that with AFIT and AFRL. As a whole, DOD's laboratory budgets have fared pretty well as I said earlier.

In some cases, these service graduate programs have served to kind of pay the bill, I think, for some other parts of DOD's budget including the labs. As an example, in the Air Force, Dr. Walker, as you know, AFIT, which is your graduate school—and it is not just for the Air Force, as you know. It is used service-wide, very important for developing those scientists and engineers. But AFIT will lose in your fiscal year 2013 budget 25 percent of its manpower. Is that right?

Dr. WALKER. Sir, I would have to check on that for you. It is not part of my portfolio. It is not part of the S&T portfolio.

Senator PORTMAN. Well, I will assert it then and maybe instead ask you what you think about that. Given these planned reductions, are you concerned about the impact it is going to have on your laboratories? futures, the scientist and engineer talent pool that you rely on?

Dr. WALKER. That would be a concern. I think AFIT does a great job at educating military, Air Force, and other folks especially at the master's degree level, and it is really a center of some of our cyber training that we give our folks. But that is actually a different budget.

Senator PORTMAN. It is a different budget, but it impacts your lab and it impacts all of your labs, I would assert although the Navy has its own graduate program, as I understand it. So I would hope that you all would speak up about that and work with us to try to ensure that we are not making decisions that short-term seem to be necessary for budget savings but longer-term are going to create the very problems you talked about in all of your testimonies which is having the kind of human capital to have a cutting-edge research program for our warfighters. So we appreciate your giving us whatever input you can on the impact of that proposed reduction of 25 percent in AFIT on your labs, particularly the Air Force Research Lab.

The final question that I have really relates to this infrastructure question. If you can give us more detail as to what capabilities specifically we are in danger of losing because of outdated facilities, that is very helpful to us. In this budget climate, we need to know specifically which of your facilities, if not updated, will result in a capability being lost. Are we losing any quality researchers because of it? You have made general points about the need to attract the best and the brightest. And is there an aging facility within your

ambit that is causing you to either not be able to attract or retain the best people?

And then, of course, how much, as the chair talked earlier, does this relate to our competitive position vis-a- vis other countries, particularly China, but other countries that are moving ahead with updated, modern laboratory facilities? Ms. Lacey, I think you might have some comments on that right now. We are happy to hear from you now, but also anything specific you can give us would be very helpful.

Ms. LACEY. Sir, I would prefer to take that for the record.

[The information referred to follows:]

[SUBCOMMITTEE INSERT]

Ms. LACEY. We have a wide variety of technologies that we work on in our laboratories, and as Mr. Lemnios pointed out, you have got to take a look at the context for each and every one of them. But we do have some areas where we are concerned.

Senator PORTMAN. Thank you.

Thank you, Madam Chair.

Senator HAGAN. Senator Shaheen?

Senator SHAHEEN. Thank you, Madam Chair, and Senator Portman. And thank you both for holding this hearing this afternoon.

Thank you all for your testimony. Please share with us our appreciation for the work of the dedicated scientists and engineers who work at all of our Nation's laboratories. As you all may know, I represent New Hampshire where the Cold Regions Lab is located in Hanover, New Hampshire. And Dr. Freeman, I was there last year when they celebrated their 50th anniversary. So I can appreciate the facilities challenges that you are raising. I think they have had some rehab done there, but clearly that is an issue that a lot of our facilities have.

Secretary Lemnios, I want to follow up on the issues that Senator Portman was raising about workforce because all of you, as he said and as you said so eloquently in your testimonies, talked about the importance of a workforce educated in the STEM subjects who can be the scientists and engineers that we need to do the research in our laboratories. And right now over 57 percent of Federal employees in DOD science and technology labs are over the age of 45. So clearly making sure that we can recruit the next generation at a time when we are not turning out the number of scientists and engineers and STEM graduates that we need in this country is challenging. So I wonder, Secretary Lemnios, if you could talk a little bit about the strategies that you are using to recruit those folks.

And I would really also like to very much hear from Ms. Lacey—you talked about the number of engineers and scientists that you have hired since 2009—to also add to that, if you would, some of the things that you are doing to recruit those folks.

So, Secretary?

Mr. LEMNIOS. Senator, let me start by providing some insight on a couple things. It is not all doom. There is some great points of light here that we ought to recognize.

This summer we have over 400 students, SMART students from our STEM program, entering the Department's laboratories. These

are first-rate undergraduates that are providing a year of service in our laboratories for each year of scholarship that we provide them. It is a remarkably effective program, and it is a program that couples us with rising stars in their freshman and sophomore years, and in many cases we have hired those students as laboratory employees. That is a great thing.

In fact, in my career path, I will tell you—it is not in the testimony, but I will tell you that my graduate work was partially sponsored by the Office of Naval Research. In fact, a good friend of mine, Max Yoder, was one of my peers, one of my mentors, and provided me tremendous insight very early in my career and helped me along the way.

Senator SHAHEEN. Can I just how you recruit those students?

Mr. LEMNIOS. It is an open call. We have a website, a STEM website, where we announce this. The submissions have just been completed for the fall 2012 semester. It is very similar to a college application. It is a terrific program for students. We offer undergraduate students $25,000 a year plus tuition, plus $1,000 for books and health insurance and a guaranteed position in one of the Department's laboratories. So beyond the money, which sounds great, it is the ability to work side by side with a researcher on a Department challenge that few people would see. So I look at that as really an important subject.

The other part of this, of course, is the connections that the laboratories have built with academia. Our Department request for basic research—that is, the most fundamental research in our portfolio—is about $2 billion a year. Much of that is executed through our Department's laboratories and most of that is actually executed in academia side by side with a researcher in our laboratories.

Just very quickly. Last fall I had an opportunity to visit many of the Department's laboratories, and I spoke with the lab bench researchers, people that I like to hang out with. We have several hundred post docs, post doctoral researchers, in our laboratories. By all measure, that is a great indicator. The laboratories today are receiving patents from the U.S. Patent and Trademark Office at just shy of 600 a year, almost two a day. This is on par with best-in-class world companies around the world.

So while I challenge our laboratory infrastructure internally and get these guys, you know, let us think, you know, how do we drive faster, how do we make transitions happen more quickly, the numbers that I am seeing give me a sense—there is a remarkable sense of horsepower here. And I would challenge that we are in second place. We are not in second place.

Senator SHAHEEN. That is good to hear.

Ms. Lacey, are you all doing anything that is different?

Ms. LACEY. Ma?am, we are doing much of the same. We are taking great advantage of the OSD SMART program, the scholarships. About a third of those are actually in Navy working with Navy doing summer internships at our Navy laboratories and warfare centers.

But at the end of the day, recruiting is a contact sport, and we need to have our supervisors develop relationships with those universities, whether it is in conducting that research or collaborating on that research or making sure that the professors are aware of

the needs of the laboratory because the students listen to them more so than they listen to the recruiters or listen to us. So we found those relationships particularly important.

To that end, for example, we have established a system engineering graduate curriculum at Tuskegee. We have formed consortiums with the University of Michigan and other universities in naval engineering, which is, of course, particularly important to us. With the 219 program, we have actually sponsored graduate fellowships at our Naval Research Laboratory that are called the Karle Fellows named after our Nobel Prize winner, Dr. Jerome Karle and his wife who was also there.

So there is a wide variety of activities that are going on. Most of our warfare centers and laboratories also have unique relationships with the universities that they tend to recruit from located close by because students, once they graduate, tend to not move real far.

Senator SHAHEEN. Let me just point out the University of New Hampshire has a very good engineering school.

Ms. LACEY. Yes, ma'am. And we hire in our Newport laboratory from the University of New Hampshire.

Senator SHAHEEN. Thank you.

Now, can you talk about how—I do not know who would like to address this, but talk about how these labs interact with private industry and how they aid technology transfer? And also specifically can you talk about whether or not you make use of the SBIR program in helping you with some of the work that you are doing? Dr. Freeman?

Dr. FREEMAN. If I may, let me start with that.

You know, the first thing that we do is that the money that is in the core budget, in our S&T core budget, pays for people in the laboratories, as well as facilities, but also a large portion, particularly of the 6–3 dollars, goes out to industry to actually build the prototypes, someone to help us get the hardware and really do the research to make it real. And in other places we have small business, as well as large companies, involved in that.

We use the SBIR program and we use the Rapid Innovation funds as well to try to focus and then line up even more this connection with these technology-enabled capability demonstrations that we have been doing in the Army. We are trying to get the Rapid Innovation fund proposals tied up with those efforts that are going on internal to the laboratory, many of which will actually go out and have proposals in order to build the hardware that is going to be demonstrated in large industries but also bringing these smaller companies and these nontraditional folks in through the Rapid Innovation fund and the SBIR process in to be able to compete and/or participate in those programs and those demonstrations. So a lot of our efforts are done through industry.

And a couple of the things that I wanted to focus on with transition. We have a number of programs and efforts that do transition and have transitioned recently. And most of those transitions are where industry has taken something—we have either written a specification, we have written a tech data package, or they have been performers on the S&T program, and then when those things went into acquisition, those are the people who actually then either

compete for the things that we specified or indeed then are the performers on those acquisition contracts.

So a large number of things. We have affordable seeker programs that are being competed where industry is trying to build some seekers for S&T so that they can be affordable, and that can only be done in industry, working on those things.

Similarly we had software code being worked. Then we worked that and we transitioned that to industry so that they can compete and/or use that in their communications program. So we have a number of mechanisms both using the core dollars and then transitioning either directly or through industry to get those things out into acquisition programs and eventually out to the warfighter.

Senator SHAHEEN. Thank you. My time has expired, but Madam Chair, I have to go preside. Can I ask one more question before I leave?

Senator HAGAN. Certainly.

Senator SHAHEEN. This is for Ms. Lacey. And I know that both the Army and the Air Force are working on this, but I know a little bit more about what the Navy is doing. I know that Secretary Mabus had set a very ambitious goal for moving to energy efficiency and renewable and alternative technologies for your energy use. And I wonder if you could speak to the role that the labs are playing and how you are moving on energy issues in a way to make us more energy independent.

Ms. LACEY. Ma'am, we have been involved in certain energy issues for a long, long time, and the fuel requirements for ship and aircraft has always been a big deal to us. Back in the 1990s and early 2000s, we were working on technologies in our ship hull design, for example, to reduce drag which has the side effect of increasing fuel efficiency, the stern flap, if you have ever heard that.

Senator SHAHEEN. I have. I was on the USS *Kearsarge* and I saw that demonstrated very clearly.

Ms. LACEY. Right.

Hull coatings that reduce the adhesion of barnacles go a long way to reducing that friction and things like that.

So we have been in that world for a long, long time. Now, of course, the game is kicked up a few notches here, and we are in that part of the business where there is a military-unique requirement that we need to understand, but at the end of the day, many of these technologies are going to be scaled up by our industry partners to make them viable to meet the Navy needs.

Senator SHAHEEN. Thank you.

Anything that the Army or Air Force is doing in this area that you think is worth noting?

Dr. FREEMAN. Yes, absolutely, ma?am. We have across all of our portfolios, whether it be the soldier portfolio or the ground portfolio or the air portfolio or the C3I portfolio—we maintain a focus on power and energy. In fact, in our 2013 budget request, we have $161 million associated with efforts to look at improving power and energy, looking at the efficiency efforts, looking at not only components but power management, looking at how to get alternative fuels into engines for those things, alternative battery technologies. So we actually have been doing this also for quite a long time and are moving very much into getting it into the Army lexicon as well,

along with Ms. Hammack, the Secretary for IE&E. We are working those things particularly on operational energy. Our focus is looking at operational energy. So S&T is really, really into this in the Army.

Senator SHAHEEN. I am hoping we can get it into the lexicon of all of our Federal agencies.

Dr. WALKER. And in the Air Force, ma'am, we are heavily invested in turbine engine technologies to reduce fuel consumption 25 percent over state-of-the-art engines today. So we have a new program starting up to look at technology options for future engine programs.

Senator SHAHEEN. Thank you all very much.

Thank you, Madam Chair.

Senator HAGAN. Thank you, Senator Shaheen.

I wanted to go back to the Rapid Innovation Program. Secretary Lemnios, you had an opportunity to speak and then, Dr. Freeman, you mentioned it a little bit in your answer a few minutes ago.

But, you know, we established this program 2 years ago to help fund the rapid transition of innovative technologies largely from the small business community to the warfighter. I also serve on the Small Business Committee, and last year data was presented that showed that while the small business community receives only 4 percent of Federal R&D dollars, the small businesses actually produce 38 percent of the patents granted.

So, Dr. Freeman, Ms. Lacey, and Dr. Walker, what are your views on the Rapid Innovation Program, and do you find the program useful to meet time-sensitive DOD needs in a responsive manner?

Dr. FREEMAN. Let me start and I will try to be as brief as possible. I believe this new initiative really has been a boon to the Army, and the value that it has had for us is opening up more collaborative opportunities with both small business and nontraditional suppliers to the Government. And these processes by which we have put out these BAAs—and we had an Army BAA that went out—we got over 1,000 responses, and then we were able to sort through those. We did put them up against our priorities in S&T, those technology-enabled capability demonstrations. We have selected those. They were totally competitive. It was a very, very tough competition. We had not just the laboratories involved, but we had the program managers involved who would be receiving these technologies, et cetera. It was a very, very rigid process by which we worked through and rated these things. Then we picked over 10 percent to actually fund with the fiscal year 2011 available funds. So that is a pretty good return on investment for everybody doing it.

Having said that, we also then scrubbed that list again and said, hey, there are some really neat things that did not exactly fit in with these tech Ds. We may want to pursue these out of our core budget as well. And so part of that was we got information that we would have gotten no other way about innovative small business and nontraditional folks, and we got it in and we have coupled it with our program managers in S&T really trying to give them opportunities then to use these and have the companies demonstrate their technologies so everybody can see them.

Senator HAGAN. Ms. Lacey?

Ms. LACEY. I will just add to that. We see some of the same benefits. We also see that many of these companies have proposed teaming up with our laboratories and warfare centers to then actually test, try out, and analyze the products that they make because they do not come to the table with a full understanding from the warfighting point of view. So that is a good thing that I see happening.

The other thing is we too saw that "aha" from some of our program managers where they looked at something and said it did not quite fit the ground rules but they liked it and they have started collaborations with the companies.

So we are cautiously optimistic that we are going to see results. We have only let two contracts so far, but we are in negotiations with almost 5 dozen as we speak.

Dr. WALKER. I will just pile onto the comments already there. I am cautiously optimistic. I think we are seeing the value in that our product centers are much more engaged with looking at small business because of the RIF program and seeing how what they offer can feed into their programs of record. And so that has been a good thing. We specifically looked at small businesses that had technologies that were at about a tech readiness level of 7. So they were ready. With a little bit more money, they could be transitioned into our programs of record. And so we are not only working with the product centers with RIF but also having meetings with the larger companies saying if these smaller companies are successful, how are you going to team with them and bring this into the programs.

Senator HAGAN. That sounds positive to me.

Let me move to the Laboratory Quality Improvement program. The DOD Laboratory Quality Improvement Program, established in 1993, seeks to improve the efficiency of the labs by streamlining their business practices and granting the heads of the labs increased authority to operate their organizations in a business-like fashion.

One of the outcomes of the LQIP was the creation of a panel to provide recommendations on DOD lab personnel issues.

Secretary Lemnios, currently the panel for personnel falls under your oversight, and what has this panel recently accomplished?

Mr. LEMNIOS. Senator, I have looked at the LQIP, the organization, and sort of what has happened. I asked a very simple question. When is the last three times you guys met and what did you actually produce? And there was a long pause.

As I have looked at it, you challenged us, the Congress challenged us, through 10 U.S.C. 1115 to build a functional capability set of managers around a workforce model that the Department can use much more broadly. And we are looking at how we take what was being done under LQIP or what should have been done under LQIP and apply it to a workforce model for the Department at large; that is, understand where we have strength, where we have gaps in our workforce broadly to include our engineering functional areas and our S&T functional areas. The S&T functional manager is actually a new element of this enterprise. And so working with the services, we are looking at how we fit this strategic

model and really capture not only what exists now but what needs to exist in our laboratories going forward.

Senator HAGAN. We have heard that the DOD is considering moving this panel out from under your oversight to the Under Secretary of Defense for Personnel and Readiness. Would it be beneficial to the labs to do that?

Mr. LEMNIOS. I am not sure. I am not sure how we are going to go on that candidly. I think there are arguments that I have heard—well, there are arguments that I have heard both ways on this. Again, I want to go back and look at how this work ties to the broader charge that the U.S. Code has given us to sort of lay out a workforce, a functional management activity for the Department.

Senator HAGAN. Our other witnesses, what are your views on the effectiveness of the Laboratory Quality Improvement Program, and do you feel that it should stay under the Secretary or potentially shift to the Under Secretary of Defense for Personnel and Readiness? And should there be other panels, for instance, laboratory infrastructure?

Ms. LACEY. Ma'am, if I could. First of all, I believe that the LQIP has done tremendous work over the years, and "over the years" is the important thing here. They took a lot of the lessons that we learned with the China Lake demo in the 1980s and translated that into some of the flexibilities that the Congress granted us around the science and technology reinvention laboratories. And we have had a fair amount of authorities, and we have not really needed much. The panel, as Mr. Lemnios said, sort of slowed down.

Now, that said, I do think that an infrastructure panel, which was originally envisioned under the legislation, should be activated, number one.

Number two, you asked about where does it belong. In AT&L or underneath P&R? I feel strongly it belongs under AT&L, but there needs to be a partnership with P&R. And over the years, that has been stronger and weaker.

Dr. FREEMAN. And let me add on to that. So this is very much the same thought process. I believe that the intent of having a group of people from across the services who understand what the laboratory systems are, how they operate, and what they need is really, really an important body to have. Whether we actually had the right people after everything got restructured over the years on the panels, that could be part of why they did not, in the last couple of years, operate as much as they should have. So I believe we really do need to review, restructure, and reconstitute some kind of a group like the LQIP to be able to provide advice and recommendation to both the senior service leads and to ASDR&E.

I do believe that if you put it in and move it to the personnel side only, you are actually probably not doing a great service in that because I believe it is much broader than just personnel issues. I believe that the effectiveness and the efficiency of such a group deals with much more than policy and personnel. Therefore, the Army has not been supportive at all of moving it over to P&R.

Senator HAGAN. Dr. Walker?

Dr. WALKER. The Air Force agrees with the Army and the Navy.

Senator HAGAN. Thank you.

I think Senator Shaheen was asking about personnel, and obviously our personnel I think is our national assets. And we want to be sure that we have the engineers and scientists coming up through the educational areas throughout our country to be sure that we can fill these very, very important STEM jobs that will be so necessary not only now but in the future.

I know the Army has a program called Military Accessions Vital to the National Interest which grants rapid U.S. citizenship to non-U.S. citizens that enlist with medical or cultural and linguistics expertise. What are your views on expanding this program to gain access to non- U.S. citizens that graduate with advanced technical degrees from our U.S. universities and then could become DOD civilians?

Dr. FREEMAN. And since the Army has the program, I will start and then let everybody else talk.

I believe that the concept of making offers to people who have got the kind of education we need, who want to be in this country—I believe that that is a really good and positive thing if they want to be part of what we do. And so I am supportive of the program that you mentioned that the Army has started.

I have raised issues and questions about that as we have been talking about expanding that or where we are going to go with that. And I think we really need to study it a good bit more because I think there are second and third order effects that we really need to think about.

The real solution here I believe wholeheartedly is to really get more U.S. citizens into our schools through STEM education and into getting the degrees and the advanced degrees in the fields that we need them whether they be the traditional STEM type things or some of the other talents that we are going to need in the future which includes some of the softer sciences. Particularly in the Army, we really need some of the softer science type capabilities like sociology and so on and so forth that are not traditionally considered STEM in many places.

So I am supportive but I am saying and I am telling my leaders that I think we need to look at it a little bit more before we extend it sort of without a lot more study. The real solution is getting folks in our universities in our organizations and young people engaged in getting the advanced degrees, getting the degrees in STEM.

Senator HAGAN. Secretary, any comments?

Mr. LEMNIOS. Ma'am, I would agree. I think the challenge here is that we are competing globally for talent. We are competing with the private sector for the same talent. In my role as the Department's chief technology officer, I am absolutely concerned and committed to make sure we have a talent base within our laboratories, but I also need to make sure we have a talent base within our industrial base because at the end of the day, the Department is acquiring systems and those systems are built by a workforce, some of which might be within our laboratories, much of which is in the defense industrial base. There is going to be a stream of ideas that we see offshore that we want to pounce on and elevate and make happen, and we do that. The pace of this train is moving faster every day and the complexity of it is growing every single day.

So as I step back and look at the subject of the Department's laboratories, yes, we really do need to make sure that we have got our A game on with regard to workforce. And there is a huge challenge with regard to the infrastructure and making sure we have got the bricks and the mortar and glass and everything in the right place and the laboratories in the right place. At the end of the day, it is about driving innovation and transitioning those concepts with the warfighter. And some of that occurs eloquently and every day in the laboratories that you visited, ones that we are a part of, and much of that occurs within the defense industrial base. All of that is fed by talent that we see in all sectors.

So when we talk about workforce, I think broader than just how many additional billets do we need at this lab or that lab. I am thinking about how does this enterprise actually operate and how do we build a defense industrial base model that replicates the efficiency, the cost, and the genius that we see in the private sector.

Senator HAGAN. Thank you.

Ms. Lacey?

Ms. LACEY. The Navy has looked at the authority that the Army has and frankly we are still studying it. As Dr. Freeman pointed out, the second and third order effects of such an authority we are concerned about, and we would like to have a better understanding of what they might be and how they might impact us.

Dr. WALKER. We are looking at something called Citizenship for Service, which would be like a pilot program that we could run in the labs, similar to the Army's. We have not instituted that yet.

I agree with Dr. Freeman's comment about getting more U.S. citizens in the pipeline. One idea we had is the LQIP. And this committee has supported expedited hiring authority for those folks with master's degrees.

One thing that could help us get more U.S. students in the pipeline is expedited hiring authority for just undergraduates, speeding that hiring authority up for very qualified S&Es so that we can hire them in 25 days not over a period of 120 days which sometimes is what it takes. And so if there is some authority like that for the laboratories, that might help us get more U.S. citizen students into the pipeline.

Senator HAGAN. We can certainly work on that. And I know I have spoken quite often with Secretary Lemnios on this issue.

I certainly echo everybody's concern that we have got to have more science, technology, engineering, and math students coming up through middle school, high school, obviously our universities and graduate schools. It is imperative I think for the safety and security of our country.

I think Senator Portman is coming back sometime in the next few minutes but I will keep on asking a couple of questions.

The DOD has, more or less, preserved its top line funding for science and technology, and in part this is due to increases in basic research at the expense of more applied research and technology development. While increased basic research obviously is important, there are concerns over decreases in more applied research funding than for activities that can help transition technologies across what has classically been labeled the "valley of death," the gap between the labs and the military users.

If you could respond to the question. Do you feel that balance between basic research, applied research, and advanced technology development is right? Dr. Walker, why do we not start with you?

Dr. WALKER. I do feel like we have been skewed a bit too much towards basic research in the last few years. One of the things we are trying to do in AFRL is transition technologies that our warfighters care about. In order to do that, you have to have a balanced 6.1, 6.2, 6.3 program and have enough money in the 6.3 budget to do integrated demonstrations and experiments of a variety of technologies to show the warfighter that there is a capability here that they should be interested in.

So I think our 6.1 budget has grown quite a bit over the last few years, and it is now the largest piece of the budget that AFRL has. So I would be in favor of balancing that a bit more across the 6.1, 6.2, 6.3 spectrum.

Senator HAGAN. Ms. Lacey?

Ms. LACEY. I am of a similar mind, that I would like to see more of an investment in our BA–3 and BA–4 accounts that can help us transition across the valley of death, as you have heard it referred to. To that end, Rear Admiral Klunder and I—the Chief of Naval Research—have joined together to take a good, hard look at how do we navigate that 6.3–6.4 continuum to ensure that we are getting those investments through that portal.

Senator HAGAN. When you say "navigate," if you can explain that to me, being in the Navy.

Ms. LACEY. So inside the Navy, the Chief of Naval Research has oversight of the 6.1 through the 6.3 accounts, but the programs, the PEOs, and program managers generally are the 6.4 and above. And so to navigate that portal, we have to get the people together and make sure that our processes involve both sides of that portal. So that is the divide we are trying to navigate and ensure that we have got things tied together. We have quite a bit of investment in the 6.1, 6.2, 6.3 world that if program managers knew about it, they would want it. And the reason they do not know about it sometimes is because they do not have time to listen. So we have got to do a better job to make sure that we provide them the information they need and the motivation to take advantage of those science and technology developments.

Senator HAGAN. Certainly.

Secretary?

Mr. LEMNIOS. Senator, as we spoke maybe a month ago, I briefed you and your staff on a comprehensive review that we did late last year. Again in my role, I have the responsibility of providing the Under Secretary and the Secretary with some assurance that the Department's portfolio is well structured both in the basic research side but also in applied side. And we have got to cover both avenues with sufficient resources and ideas.

And I was looking for two things when we did that assessment last fall. Is the budget in the right location? That is, are we investing the right dollars? But more importantly, I was really trying to understand what are the ideas that we are investing in, what are those concepts, what are the technical ideas, what is the core of the concepts that we are investing in. And through a series of dialogues with the services late last year, in fact we made some ad-

justments. We added funding in hypersonics. We added funding in advanced imagers. We put some funding in for some special programs with the Navy. We took ideas out that we thought were either duplicative or were far past the maturity that were being done elsewhere in Government.

And at the end of the day, we presented a President's budget just short of $12 billion that is in fact shaped by our bets in the future and our needs for today. And we can sit down and go through it, but that is how we looked at it. And in fact, it has got to be a balance. We have got to have those space shots and ideas that are going to be those for the Nation that we see 5 and 10 years are going to be the coin of the realm that we will need not within the Department but within our defense industrial base.

Senator HAGAN. Thank you.

Dr. FREEMAN. I feel pretty strongly about this, and I would agree with my comrades here with respect to I do think we have got a little imbalance at this point. One of my things when I came in the job about a year and a half ago, almost 2 years ago now, was—one of my goals was to try to figure out what the right balance is across the entire portfolio. The first thing with basic research is just like we did in the 6.3 portion where we have focused our 6.3 portion now on some very specific problems and challenges, not all of it, but a portion of our 6.3 that are focused on improving the warfighters? capabilities at the small unit and the soldier level, I need to do that in the rest of the portfolio.

And I really appreciate the comment that you made at the beginning, that we really have done a lot of work in trying to refocus our efforts on capabilities for soldiers. So thank you for that.

But now that we have done that for our portion of 6.3 that we have problems and challenges that we are focusing our programs on, now I am taking that to the rest of the 6.3 and the 6.2 portion to figure out what are the problems and the challenges we should focus on in the time frame of 2020 to 2028 which is kind of where that investment would start paying off.

And I have also got an effort going on to try to figure out for 6.1 what are the sets of problems and challenges that we should be focusing our research efforts to help soldiers in the 2030 and beyond time frame, which is where that research starts to pay off.

So we actually have some workshops started that are going to happen early in May. The basic research one is happening the 1st and 2nd of May to try to get a community of people together to try to project into that time period what is it that we need to do. Once we know what we need to do, then we can go back and say here is the right amount of money to put into it.

Now, that does not say we are not going to have innovation and invention and disruptive technologies. What it does say is that I believe, as I think my colleagues believe, that in the services our main job in the 6.1, 6.2, and 6.3 is to focus it on what our services really need. And then as Mr. Lemnios said, then we can focus on what we need to do together to complement one another.

So I really am in the process of trying to figure out what is the right amount of 6.1 to solve our problems and where do, if any, we need to shift to be able to do what we need to do for the Army in those time periods when those funds would pay off.

Senator HAGAN. Thank you.

Senator Portman?

Senator PORTMAN. Thank you very much. I am sorry I had to step out for a moment, but I understand you all covered a lot but not everything. So I look forward to just asking a couple more questions. And thank you again for all your help today.

Globalization of S&T. This is a challenging area because, after all, we are in world of defense policy and we have to be sure that the classified nature of much of what you do is maintained. But we also know that while I would agree with Secretary Lemnios that the United States is still in the lead, the rest of the world is catching up and there is a lot of research being done globally that we could benefit from.

I was on the plane the other day late last week going back to Dayton because I was unable to get a flight into Cincinnati flying into Dayton, Delta Airlines. And I was on with some of the AFRL scientists. One had come here on a visa and has a green card now, but there are a lot of folks who you all have benefitted from who have been trained at least in their undergraduate training in other countries and then come here often to get a graduate degree and then stay and help us.

It also is true that each of you, Dr. Freeman, Ms. Lacey, Dr. Walker, have global outreach. You have offices in Europe, Asia, and South America, as I understand it. So the globalization is already happening both in terms of folks coming here and you all reaching out. And I just wonder how that is working. Are you able to leverage some of this international research that we wish was being done here on our shores but is not to be able to help our warfighters? And is that appropriate to do more of that? How do you balance this need for having confidentiality and classified research with the need for us to take advantage of the most cutting-edge research globally?

And then finally, is it economically or even under statute feasible for us to open satellite research laboratories in areas of the world where there is a high degree of scientific research going on? I think of parts of India, for instance. And is it possible to have our researchers working side by side with foreign researchers in some of these areas that have defense implications?

So if you could just, the three of you—and Dr. Lemnios jump in too, but give me your thoughts on that.

Dr. FREEMAN. All right. I will start.

We do in the Army. We have what we call ITC's, or international technology centers, located in several places around the world. Each one of those is operated through and primarily through RDECOM, and we have a senior, GS–15, or a colonel who is in charge of that area. And then we send researchers over in certain fields and certain areas that we have identified in those regions to spend a year or two participating and looking for opportunities both from industries in those regions but also from universities and from local military research laboratories. And so that is one way we have done that. Usually what happens then is that they identify a technology or they identify a product and because of their knowledge, they call back to a laboratory or a center and to a colleague in the laboratory or center who is an expert in that area or field,

and then they work together to get those people to talk to one another and/or to get those products evaluated and looked at.

Another opportunity that we have, in addition to that, is I think everybody here—we participate in what we call roundtables with other countries. And recently I just got back from Israel, and I have a meeting coming up with five countries, Canada, Australia, New Zealand, the U.S., and the UK, where we get together and talk about technologies and talk about what we are doing not only in the laboratories but what the opportunities are in those countries to see technologies and we share those technologies as well and bring them into our research programs and/or into solutions in our acquisition side. So we have those fora and we have those opportunities to do that.

One of the things I just did with these tech D's, these challenges, these problems and challenges—I offered to every one of the countries that we were working with in Germany and lots of others. I said here are the things we are working on. Here are our priorities. What do you have? What do you know about that is in your region or your area that you can come back and tell us about that we can look at that might help us to solve these problems?

The last piece that I would recommend is that we have scientists and engineers who attend international conferences all the time, and they make these determinations of figuring out what is out there and they bring it back to their own laboratory. And that is useful because in many cases—actually I do not have it on hand, but we have many examples of where we have taken some of these foreign either company products and/or technologies and we have incorporated them either in our own research projects or gotten them into some systems.

Now, of course, there is a lot of challenge with that because you have ITAR regulations that you have to be careful of. You have classification issues. We have got ?buy American? issues. And so it is complex. But we do a lot already and continue to do a lot to understand what is out there in the global economy and make use of it the best we can.

Senator PORTMAN. I want to hear, if I could, from the other two service S&T folks. But let me just also add another question, I guess, that any recommendations you have ranging from immigration policy where I assume you have some thoughts to ways in which we should change any either statutory or regulatory constraints on what Dr. Freeman just talked about, which is this more free flow. The four countries you mentioned happen to be four of our strongest allies in the world and ones with which we have an unusually strong military relationship and an information sharing relationship. I do not know as much about New Zealand, but it certainly is true with Australia and Canada and the UK. So thoughts on that. Ms. Lacey?

Ms. LACEY. The Department of the Navy has many of the same kinds of activities underway that Dr. Freeman talked to. We do them through our O&R, we call it, global organization, and I would be happy to provide you for the record additional information, all the details on the activities that we have underway.

One thing, though, that we have had discussions with the Office of Naval Research about is that activity tends to focus very much

on the science and technology side of the house and miss the opportunities that perhaps are there on the industrial side of the house. So I want to see a greater connection between the S&T view of the world and the industrial sector view of the world and our warfare centers. So we have started those discussions.

Senator PORTMAN. Dr. Walker?

Dr. WALKER. We have a spectrum of activities at AFRL from basic research to even classified work going on with international partners. We have the offices you mentioned, EOARD in London and then AOARD in Tokyo. We have offices now in the South America region as well.

In the late 1990s/early 200s, I was at AFOSR working a project with the Russians on the plasma physics and hypersonics activities. It was 6.1 It was basic research. And so we were able to have that communication and dialogue. They were the best in the business in terms of plasma physics.

As I mentioned, we have this other spectrum of activity, even classified work, with partners like Australia and others that we carry on all the time.

AFRL is building a relationship with Singapore which is in a vital part of the world. I was just there with Joe Sciabica, the executive director, looking at even increasing our activity there at a fundamental science and applied science level.

In terms of regulations, we mentioned, when you were out, an idea for our pilot project in terms of Citizenship for Service. The lab is interested in looking at how can we take foreign nationals that are in our universities that are really outstanding who want to work for us and bring them into the lab for a couple years and get them on a fast track to a green card status and make them one of our employees. So we are interested in a pilot project on that. I will have to get back to you on what regulation changes we would need to do that.

Senator HAGAN. Mr. Secretary, anything?

Mr. LEMNIOS. I would just simply add two comments. Actually right after this meeting, I am headed to San Diego to meet with my counterpart from Australia. Part of that discussion is our joint science and technology areas that we have structured with the Australians.

The foreign S&T engagements that we have are really quite broad. They are across the full scope of the 6.1 funding, and they even, in some cases, move into the acquisition programs. A very important part of the Department's portfolio.

But one thing that has changed over the past several years—and you have seen this in the private sector and we are starting to address it within the Department—research is no longer sequential. It is no longer that you go from basic research through the next stage 2, stage 3, stage 4. All of this stuff is occurring simultaneously. You will see a researcher at AFRL or at the Army Research Laboratory that is absolutely at the leading edge on some physical concept that nobody else has seen that is thinking about the application of that concept and is coupling with a partner elsewhere in the laboratory to quickly transition it. So the sequential model for basic research has changed.

The other thing that has changed, to your point, the teams that actually come together to do research are—it is seldom that a single investigator is developing the lead concept. It really does take a team of people, and in most cases—and the laboratories are great examples of this—that team has to include a user. It has to include somebody that understands the application of that concept in the user space. And that is what is really unique about the laboratories.

Senator PORTMAN. Well, thank you all. My time has expired, but I appreciate you being here.

Well, let me just piggyback on what you were saying about working with industry then if I could for a second because the chair has given me a little bit more time.

Joe Sciabica came to an aerospace conference we had week before last at a GE facility outside of Cincinnati. We brought in people from all over the State. And it was a great example of where some of the work you are doing can be commercialized in a way that helps to create jobs, economic growth in our States, but also helps you to be able to perform your mission because you are taking, as Ms. Lacey said, information from the industry as well as them benefitting from some of your basic research. So I did not want to miss that opportunity, since you mentioned Joe, to say he is doing a very good job I think reaching out and working with some of the OEM's and some of the suppliers who are unable to do the basic research but can provide some of the more application, I guess, research you would call it that is helpful to you all.

The final question that I have has to do with your priorities. Last year Secretary Gates listed seven of them: cyber, electronic warfare, data decisions, engineered resilient systems, counter WMD, autonomy, and human systems. I am not sure what autonomy means. So if you could explain that to me, that would be helpful.

But with regard to these seven, as Secretary Lemnios has indicated, things are moving rapidly at the speed of something, light, sound, maybe quicker. Are these still your priorities? And if not, which ones can you tell the subcommittee are missing from this list of seven or are some of these now a lower priority than they would have been even early last year?

Mr. LEMNIOS. Senator, we developed those almost 2 years ago now, and they actually all apply to the space that the Department has moved into on the strategic plan that was issued January of this year. And in fact, the President's budget request for 2013 reflects that. And as we went back and looked at the projects that we had planned last fall and as we were building our budget for PBR–13, we in fact referenced the strength that we had in each of those areas. Some of those we had to strengthen and that is what is really on the Hill right now for deliberation.

As far as autonomy, think robotics. Think robotics without people. Think about a PackBot that can operate without a joy stick. Think about a car that could operate because you are in the driver's seat and maybe a disabled person can think about driving and the car drives. So we are on that path. In the commercial sector, you see Google making a big investment in that area. In fact, the State of Nevada has now authorized autonomous vehicles to operate on their roads. Interesting commentary. But we are headed in

that direction. You see it with cars that can self-park in a very, very simple way. But I think in the not too distant future you will see vehicles and other systems that interoperate with humans in very natural ways, almost conversationally. Sort of think SIRI on steroids. Think of a system that understands you and understands what your needs are a day from now, 2 days from now, say, for travel or something and then presents that information to you without sort of you having to ask for it.

Senator PORTMAN. Thank you. Do you think there is any danger of replacing elected representatives? [Laughter.]

Mr. LEMNIOS. No. The complexity is too great. It is just not going to happen.

Senator PORTMAN. It is complex.

Thank you all very much.

Dr. FREEMAN. Could I just add one thing to the last comment? I think we all would say—so what Mr. Lemnios was talking about were the seven are the cross-cutting for all of DOD, and as he mentioned before, those are the priorities that we have agreed that affect each and every one of us. Every one of us also then has our own service priorities of the things that we have to do with the rest of the budget that we have to meet our own priorities, and we are in the process in the Army of better establishing, better advertising, and better articulating to everybody what those priorities are for Army S&T and getting leadership to agree to those for that service-specific part of the portfolio as well.

Senator HAGAN. I have two quick questions and then we will adjourn.

One of the greatest challenges facing DOD today is the increased cost of its weapons systems. And the DOD S&T enterprise historically has done a laudable job of increasing the performance of these weapons systems but with little consideration for cost. In today's budget constrained environment, affordability is now a key driver for weapons systems. As an example, commercial electronics continue to increase in performance and yet decrease in cost. The same can hardly be said for any DOD major defense acquisition program.

What are you specifically doing in your S&T enterprise to address the development of technologies and design methodologies and manufacturing technologies to improve affordability? Mr. Secretary?

Mr. LEMNIOS. Sure. Senator, there are several areas that directly address that. The first is the work that the Department has done on risk assessments, technical risk assessments, to really understand well before milestone A and actually before milestone B, and in some cases even before milestone A, what the technical readiness level is of the given technology in the architecture it is going to be used in.

Senator HAGAN. How long has that been in effect?

Mr. LEMNIOS. Well, this was part of the Weapons Systems Acquisition Reform Act of 2009 that you passed unanimously and the President signed May 2009. We are implementing that with great effect. And in fact two elements of that that have been absolutely central are the technology assessments and the systems engineering work that is being done well ahead of a commitment to go and

acquire a system. The impact of those your committee has heard about and certainly others have in terms of identifying problems very early where we can make an engineering change well before we are into production.

The other piece of this that I think is going to be critical—and each of the services is addressing it—is an increased focus on modeling and simulation. That is building greater fidelity tools that allow us to model a very costly experiment in a new domain—pick hypersonics. Actually pick your ADVENT system, the high performance engine. Much of that work was simulated well before we cut the first metal. And now we are at a point where not only is the first metal matching simulation, but we are able to then move into what will be an acquisition phase with much higher confidence that the technology is in fact ready. So getting that early stage risk assessment done, strong modeling and software is absolutely critical.

Senator HAGAN. I had one last question. Here it is. Thank you.

One of the criticisms of DOD is the slow pace of its acquisition process and the role of the DOD laboratories in order to rapidly take technologies to the field. And I think we spoke a little bit about—one prime example was the need for the creation of GIDO to handle the IED threats. What are you doing to increase the speed and the agility of the laboratories to help deploy the systems to the warfighter, and how are you ensuring that the labs can quickly respond to rapidly emerging threats or the urgent needs of our combatant commanders? Mr. Secretary?

Mr. LEMNIOS. Senator, I will give you the counter example that everybody knows well and that is the MRAP story, the mine resistant protection vehicle story, that went from a request from theater in September 2009 to the first vehicles being delivered in theater less than 3 months later. That has now been the vehicle of choice. It has saved thousands—you know, that has saved hundreds of lives clearly in theater.

And the reason that that worked is because we had core competency at the TARDEC laboratory in Warren, Michigan, and we had ballistic effects understood at Aberdeen. We had a set of contractors that understood it. We also had a SECDEF, as the current SecDef is, very much behind it. Secretary Gates was very much behind this. And in fact, we were able to move that very rapidly in the span of months from a concept to a capability delivered to theater.

And in fact, the persistent ground surveillance system is another example. It came out of our joint capability technology demonstration program, coupled with the service laboratories to make sure we had the technology right. In fact, the sensors were commercial sensors but the integration was done in our service lab, quickly deployed to theater.

The efforts that we have put in place to deliver capabilities to the fight previously in Iraq, currently in Afghanistan, have taught us the value of production integration facilities in our Department's laboratories. That probably would not have been done by the private sector alone. The private sector simply did not have the context, the operational context and, in some cases, in fact with Aberdeen, did not have the ballistic models to understand what the

threat looked like. And so the fact that we were able to couple those two domains so effectively, in fact, provided immediate support to the warfighters. And that is the path we are on.

Senator HAGAN. And we certainly had an urgent reason to do so.

Mr. LEMNIOS. And we had a very urgent reason to do so.

Senator HAGAN. Well, on behalf of the committee, I thank you each and every one of you for your testimony today and, in particular, your service to our country. And I think we all will be looking forward to seeing the results of the survey, once it is completed, on the labs and the aging infrastructure and moving forward. So thank you.

The meeting is adjourned.

[Whereupon, at 4:30 p.m., the subcommittee adjourned.]