

**SECURING AMERICA'S FUTURE: REALIZING  
THE POTENTIAL OF THE DEPARTMENT OF  
ENERGY NATIONAL LABORATORIES**

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**WEDNESDAY, OCTOBER 28, 2015**

U.S. SENATE,  
SUBCOMMITTEE ON ENERGY AND WATER DEVELOPMENT,  
COMMITTEE ON APPROPRIATIONS,  
*Washington, DC.*

The subcommittee met at 2:33 p.m., in room SD-138, Dirksen Senate Office Building, Hon. Lamar Alexander (chairman) presiding.

Present: Senators Alexander, Hoeven, Lankford, Feinstein, Durbin, Udall, and Coons.

OPENING STATEMENT OF SENATOR LAMAR ALEXANDER

Senator ALEXANDER. The Subcommittee on Energy and Water Development will please come to order.

This afternoon we are having a hearing, which we have looked forward to, to discuss the findings and recommendations and the hard work and the final report of the Commission to Review the Effectiveness of the National Energy Laboratories.

Senator Feinstein and I will each have an opening statement, and then I will recognize each Senator for an opening statement if they would like to do that, in the order in which they arrived. And then we will hear from the witnesses, and then we will proceed into a conversation.

I would first like to thank our witnesses for being here today and also Senator Feinstein. This is Senator Feinstein's idea. When the Democrats were in the majority, she was the chairman of this committee, and she was as we considered the 2014 Appropriations Act, which was 2 years ago. And she thought it would be—and I agreed with her—a good idea to have an independent commission take a look at the effectiveness of our national laboratories. We have 17 of these laboratories. Ten included are Office of Science laboratories. Three are weapons labs managed by the National Nuclear Security Administration, and four applied energy laboratories—one each that does work for the Office of Energy Efficiency and Renewable Energy, the Office of Environmental Management, the Office of Fossil Energy, the Office of Nuclear Energy. All that is under the Department of Energy.

The national laboratories employ about 55,000 people. They received approximately \$11.7 billion in new funding from the Department of Energy in fiscal year 2014.

Our national laboratory system is critical to our Nation's competitiveness, national security and way of life. They are the engines that help create new cutting-edge technologies that can transform our economy.

For example, the development of unconventional gas was enabled in part by 3-D mapping at Sandia National Laboratory in New Mexico and the Department of Energy's large-scale demonstration project, which proved that the technology worked. Then our free enterprise system and our private system of ownership of mineral rights capitalized on this basic energy research by the Federal Government and created a natural gas boom that is shaping America's energy policy and reshaping as it appears it will do so for decades.

Another example: I was recently at the Oak Ridge National Laboratory, which is supported, in this case, by the Office of Energy Efficiency and Renewable Energy. Additive manufacturing. This is 3-D printing. In this case, they are printing everything from tooling machines to robotic arms, as well as airplane parts. I saw a whole car that had been printed by a 3-D printer. It is hard to imagine that.

Monday I was in Memphis at a medical device company, and they are using the 3-D printers to print the tools that are used for knee replacements. In other words, a physician needs a certain cut, so they were telling me, to be able to replace your knee. So if I were to have my knee replaced, they would use a 3-D printer and make the cut that fit exactly my knee. It is precision medicine using devices, apparently. And according to this medical device manufacturer, all our knee replacements could be done that way if doctors wished to do that. The advantage of it, of course, is it means the doctor does not make any kind of mistake in making the cut because the cut is tailored exactly to the needs of the patient.

So 3-D printing has a way of transforming our manufacturing in this country and around the world in the same way that unconventional gas has our energy policy. In both cases, this sort of basic research and development is done at our national laboratories.

The national laboratories develop and maintain our supercomputers, and one day, hopefully soon, we will achieve breakthroughs in exascale computing. Those computers will be capable of a thousand-fold increase in today's petascale computers, which have been operating since 2008.

The Commission has done a good job. Senator Feinstein and I had an interim report, which we appreciated, from the chairman. You did what we asked in that you made specific recommendations, 36 of them, for Congress, some for the Department of Energy and the administration to consider that could maximize the potential of our national laboratory system.

If we can ensure the labs are running as effectively as possible, then more money can be spent on research and development, and the national labs can work more easily with private industries to support our 21st century economy and create jobs.

I agree with a number of the recommendations in the report such as our laboratories should be provided the necessary resources to maintain their capabilities and facilities. Both Senator Feinstein and I, regardless of which one of us was chairman of this committee, have supported strong funding for the Office of Science and

for basic research. In the Senate Energy and Water appropriations bill that she and I reported out this year in a bipartisan way, we funded the Office of Science at the highest level ever.

Third party financing you suggested should be utilized for appropriate situations. I would like to talk more about that. I agree with it. At Oak Ridge National Laboratory, the Computational Sciences Building, the Energy Science Building, the Research Office Building, the Multi-program Research Facility are four examples of such success. In our experience, it saved money, it saved time, and it helped us move ahead more effectively.

Maintaining the facilities at the laboratories that are used by scientists, researchers, and manufacturers is also of critical importance for executing the science mission. For example, in fiscal year 2015 alone, the Spallation Neutron Source had 800 users. The High Flux Isotope Reactor had 450. The Oak Ridge Leadership Computing Facility had 1,000 scientists from all over the world use the supercomputing facilities, which is home to the Titan Supercomputer and several other advanced computing systems. Since approximately 2006, these user facilities at Oak Ridge have been host to 24,000 users, and that is just at one national laboratory.

These facilities turn research and development into jobs that support a 21st century economy.

The report highlights the importance of maintaining separate and independent facilities for our weapons labs.

I was also pleased to see a strong endorsement of laboratory-directed research and development programs. These give the directors in the laboratories some discretion in making decisions about how to spend the basic research money.

Ben Bernanke, our former Fed Chairman, wrote an op-ed in “The Wall Street Journal,” October 4th. He warned—he said monetary policy can be important in creating a stronger economy but monetary policy, the business of the Fed, certainly cannot do that alone. As a country, we need to do more to improve worker skills, he said, foster capital investment, and support research and development.

Supporting governmental sponsored basic research is one of the most important things our country can do to encourage innovation, help the free enterprise system create good jobs, and make America competitive in a global economy.

I look forward to discussing the commission’s recommendations on how to maximize the potential of our 17 national laboratories.

With that, I would like to recognize Senator Feinstein for her statement and thank her for her leadership and good idea of inviting and chartering this commission. Senator Feinstein.

[The statement follows:]

PREPARED STATEMENT OF SENATOR LAMAR ALEXANDER

The Subcommittee on Energy and Water Development will please come to order. This afternoon we are having a hearing to discuss the findings and recommendations in the final report of the Commission to Review the Effectiveness of the National Energy Laboratories.

Ranking Member Feinstein and I will each have an opening statement.

I will then recognize each senator for up to five minutes for an opening statement, alternating between the majority and minority, in the order in which they arrived.

We will then turn to the co-chairs of the commission to present the final report and their recommendations.

Our witnesses today include the two Commission Co-Chairs, Mr. TJ Glauthier and Dr. Jared Cohon.

I will then recognize senators for five minutes of questions each, alternating between the majority and minority in the order in which they arrived.

First, I would like to thank our witnesses for being here today, and also Senator Feinstein.

Under her leadership in the Consolidated Appropriations Act of 2014, she charged the Secretary of Energy with establishing an independent advisory commission to examine the effectiveness of the national laboratories, known as the Commission to Review the Effectiveness of the National Energy Laboratories.

We're here today to receive the commission's findings and discuss its recommendations. Its final report was approved on Friday after much discussion and public comment.

The 17 national laboratories include 10 Office of Science laboratories, three weapons labs managed by the National Nuclear Security Administration, and four applied energy laboratories—one each that does work for the Office of Energy Efficiency and Renewable Energy, the Office of Environmental Management, the Office of Fossil Energy, and the Office of Nuclear Energy.

The National Laboratories employ more than 55,000 people and received approximately \$11.7 billion in funding from the Department of Energy in fiscal year 2014.

Our national laboratory system is critical to our Nation's competitiveness, national security, and way of life. National laboratories are the engines that help create new, cutting-edge technologies that can transform our economy.

For example, the development of unconventional gas was enabled in part by 3-D mapping at Sandia National Laboratory in New Mexico, and the Department of Energy's large-scale demonstration project which proved the technology worked.

Then our free-enterprise system capitalized on the basic energy research supported by the Federal Government and created a natural gas boom that will shape America's energy policy for decades.

Another example is the Manufacturing Demonstration Facility at the Oak Ridge National Laboratory, which is supported by the Office of Energy Efficiency and Renewable Energy.

Additive manufacturing technologies have the opportunity to change manufacturing in the way that the discovery of unconventional ways to find oil and gas has changed our energy future.

They are 3-D printing everything from tooling machines to robotic arms, as well as airplane parts, whole cars and buildings. This technology is already transforming the auto industry and has the potential to do much more.

National laboratories also develop and maintain our Nation's advanced supercomputers, and one-day—hopefully soon—will achieve breakthroughs in exascale computing.

Exascale computers will be capable of a thousand-fold increase in sustained performance over today's petascale computers—which have been operating since 2008.

The commission has done a fine job and outlined 36 recommendations for Congress, the Department of Energy, and the administration to consider that could maximize the potential of the national laboratory system.

If we can ensure the labs are running as efficiently and effectively as possible, then more money can be spent on research and development and the national laboratories can work more easily with private industries to support our 21st century economy and create jobs.

I agree with a number of the recommendations included in this report, such as:

- Our laboratories should be provided the necessary resources to maintain their capabilities and facilities.
- Senator Feinstein and I both support robust funding for research and development.
- In the Senate Energy and Water Appropriations bill, we funded the Office of Science at the highest level ever in our appropriations bill.
- Third-party financing should be utilized for appropriate situations.
- At Oak Ridge National Laboratory, the Computational Sciences Building, Energy Science Building, Research Office Building, and the Multi-program Research Facility are four examples of such successes.
- Maintaining the facilities at the laboratories that are used by scientists, researchers, and manufacturers is also of critical importance for executing the science mission.
- For example, in fiscal year 2015 alone, the Spallation Neutron Source had 800 users, the High Flux Isotope Reactor had 450, and the Oak Ridge Leadership Computing facility had 1000 scientists from all over the world use the supercomputing facilities, which is home to the Titan supercomputer and several

other advanced computing systems. Since approximately 2006, those user facilities at Oak Ridge have been host to 24,000 users.

—These facilities turn research and development into jobs that support a 21st century economy.

—The report also highlights the importance of maintaining separate and independent facilities for our weapons labs.

—I also was pleased to see a strong endorsement of laboratory directed research and development programs.

In an October 4th Wall Street Journal op-ed, Ben Bernanke wrote, “As a country, we need to do more to improve worker skills, foster capital investment and support research and development.”

Supporting government-sponsored basic research is one of the most important things our country can do to encourage innovation, help our free-enterprise system create good jobs, and make America competitive in a global economy.

I look forward to discussing the commission’s recommendations to maximize the potential of our 17 national laboratories.

With that, I’d like to recognize Senator Feinstein, our subcommittee’s ranking member, for her opening statement.

#### STATEMENT OF SENATOR DIANNE FEINSTEIN

Senator FEINSTEIN. Well, thank you very much, Mr. Chairman. I think you know how much I really enjoy the relationship that we have and the comradery, the friendship, and also the diligence of both of our staffs. Hopefully, we will have this continuing in this new allocation that our committee will receive. It would be nice to have a few more dollars, and I look forward to working with you in that regard as well.

I would like to put my formal statement, if I may, gentlemen and Mr. Chairman, in the record.

And I would like to go right to a part of your report that I am most interested in, and it is chapter 3 in rebuilding trust. And let me just quickly read the top paragraph. Government and the contractor should work together as partners in a relationship with clearly understood roles. The Government is responsible for setting the “what” of strategic and program direction to meet the Nation’s needs, while contracted university and industry partners are responsible for determining precisely “how” to meet the technical and scientific challenges to carry out the programs.

However, over the years, the relationship between DOE and the labs has eroded. There is fault on both sides. The national laboratories, for their part, do not fully trust DOE and therefore maintain secrecy about some of their actions, including contacts with Congress and other agencies, not informing DOE of emerging problems in a timely manner and taking some actions below the radar to create new programs and compete for turf in new and emerging areas.

DOE, for its part, does not trust the laboratories to keep them fully informed about technical and financial progress or safety and security issues. As a result, DOE micromanages work at the labs with excessive milestones and budget limitations and other requirements about how work should be done. This chapter is focused on steps that could be taken to rebuild trust. And the chapter goes on.

And, Mr. Chairman, the thought occurs to me that this is an area where both of us might be able to be helpful. We both have great respect for Dr. Moniz, and we both have great respect for the labs. I had the privilege this past week in Intelligence of having a classified session with the lab directors, and I thought that was really very, very useful. But I think what is lacking is any kind of

ongoing communication with us so that when we see a project that comes in at \$400 million originally and ends up at \$4 billion—I pointed this out in Intelligence—it necessarily is deeply concerning to us.

So I would hope—this would just be an idea off the top of my head—that we could have some regular meetings with lab directors. I was very impressed when I heard some of the directors who are new and when I heard them give this classified briefing in the Intelligence Committee. And I really think there is a lot of it that could be in the public arena and that we in working could really benefit from.

So I will just put my set remarks in the record.

But I would hope that our two witnesses today would be able to comment on that and see whether they believe that would be helpful or not. I have not discussed this with them beforehand.

[The statement follows:]

PREPARED STATEMENT OF SENATOR DIANNE FEINSTEIN

Thank you, Mr. Chairman, for holding this hearing on the value of our Nation's laboratories.

Welcome Mr. Glauthier and Dr. Cohon. Thank you for your service leading the Commission to Review the Effectiveness of the National Energy Laboratories.

While not with us today, I'd also like to thank the other members of the Commission for their service.

The fundamental conclusion of your report is, and I quote, "The National Energy Laboratories provide great value to the Nation in their service to DOE's mission, the needs of the broader national science and technology community, and the security needs of the Nation as a whole."

I agree with you that the national laboratories present a "unique venue for the conduct of major, long-term, high-payoff/high-risk research."

However, you also note a number of challenges facing our laboratory system. These can be grouped around certain themes, including:

- Rebuilding the trust between the labs and the Department of Energy;
- Maintaining the quality of scientific research; and
- Improving the efficiency and effectiveness of laboratory management practices.

You make a number of recommendations for this Subcommittee, for the Department of Energy, and the national laboratories about how to make current system work better.

In the coming months, we will be looking closely at those recommendations to see how Chairman Alexander and I can implement them. We look forward to your continued support as we do that.

Mr. Chairman, I'd like to take just a few minutes to talk about some of the good work happening at the national labs in California.

Stanford University—my alma mater—is home to the world's most powerful X-ray laser. The Linac Coherent Light Source (the LCLS) is used to see matter at the atomic level. This facility hosts 500 to 600 outside users annually who have published hundreds of peer-reviewed papers.

The laser literally shines a bright light on the molecular structure of metals and the chemical reactions in photosynthesis.

This facility can look inside a human cell and see how proteins directly interact with cell structures.

LCLS has been used to reveal the detailed structure of an enzyme associated with transmission of African sleeping sickness, which is responsible for tens of thousands of deaths each year.

The disease is caused by a parasite carried by tsetse flies, and this parasite uses the enzyme to break down the tissues of its victims. Researchers used LCLS to determine the molecular structure of the enzyme—a step toward developing a new drug.

Scientists at the Lawrence Livermore National Laboratory, another national security laboratories, are conducting cutting-edge research in 3-D printing in order to improve the materials in our advanced munitions and the gear our warfighters use and wear.

As part of this effort, Livermore has designed and printed a soft plastic structure that acts as a cushioning material capable of better absorbing impacts in helmets, and thereby potentially reducing traumatic brain injuries in our servicemen and women.

These are just a few examples of the great work our labs are doing, Mr. Chairman.

Mr. Glauthier and Dr. Cohon, I look forward to discussing with you how we can strengthen the laboratory system to ensure we continue to enjoy the scientific and technical accomplishments we need to drive our economy and safeguard our national security.

Senator ALEXANDER. Thanks, Senator Feinstein.

I think Senator Feinstein and I have worked pretty hard to try to help the Energy Department take their big construction projects and get them under control. I think the Office of Science would want to point out that they do a pretty good job of that with the Office of Spallation, for example. But it is the NNSA that has been the bigger offender of the two.

But that is a very interesting idea about having more meetings with the lab directors.

Before we go to Mr. Glauthier, let us go to Senator Hoeven and then to Senator Coons and see if either of them have anything they would like to say before we hear from the commission members.

Senator HOEVEN. No. I would just like to thank the chairman for holding this hearing, and I look forward to the comments from our esteemed guests.

Senator ALEXANDER. Thanks, Senator Hoeven.

Senator Coons.

#### STATEMENT OF SENATOR CHRISTOPHER A. COONS

Senator COONS. I too would like to thank the chairman and ranking member for your foresight in putting in place this commission. I am eager to hear the recommendations, and I think we have already begun to get into the challenges that their recommendations will present to us in terms of follow-through and implementation. So I am excited to find ways to take these recommendations and support your continuing leadership, Mr. Chairman.

Senator ALEXANDER. Senator Hoeven and Senator Coons have both followed former Senator Baker's suggestion that Senators should occasionally enjoy the luxury of an unexpressed thought.

And I thank them for their succinctness.

Mr. Glauthier, who is Co-Chair of the commission, will be doing the reporting today. And instead of just taking the normal 5 minutes and summarizing, why do you not take 8 or 10 minutes because we would like for you to have enough time to tell us what you would like to tell us before we start asking you questions.

He has a distinguished background, two presidential appointments in the Clinton administration from the Office of Management and Budget, Deputy Secretary and COO of the Department of Energy. He was on the President's transition team in 2008, a member of the Congressional Advisory Panel on the Governance of Nuclear Security Enterprises, as well as a number of other things. So he knows his way around the Department of Energy and the Government very well.

Dr. Cohon is President Emeritus and university professor at Carnegie Mellon University. He was president there for 16 years, and

he came there from Yale. He has a distinguished academic background of publishing on a whole variety of things. He was named a distinguished member of the American Society of Civil Engineers and elected to the National Academy of Engineering, as well as his other honors.

So we are fortunate to have had such distinguished commission co-chairs, and we thank you for spending your time. And, Mr. Glauthier, why don't we turn to you.

**STATEMENT OF T.J. GLAUTHIER, CO-CHAIRMAN, COMMISSION TO REVIEW THE EFFECTIVENESS OF THE NATIONAL ENERGY LABORATORIES**

**ACCOMPANIED BY DR. JARED L. COHON, CO-CHAIRMAN, COMMISSION TO REVIEW THE EFFECTIVENESS OF THE NATIONAL ENERGY LABORATORIES**

Mr. GLAUTHIER. Thank you very much, Mr. Chairman, and thank you, Ranking Member Feinstein, Senators Coons and Hoeven. It is good to be here. We appreciate your opening statements and look forward to discussing those points further. I think you have got some very good ideas. You are on the track there. So we would like to pursue that.

Let me make our opening statement, if I can, to put things in perspective and then we will go on into these other areas.

We are pleased to be here today to present the final report of the commission. This was a commission that your subcommittee created in the Appropriations Act of 2014, as you noted. And we are pleased to have been able to work through this process over about the last 18 months.

Dr. Cohon and I have served as the co-chairs of the commission and have been privileged to serve with an outstanding group of seven other commissioners who have strong backgrounds in science and technology enterprise of the Nation. We are pleased that this is a consensus report of all nine of the commissioners. And we received excellent cooperation and support from the Department of Energy, all the relevant congressional committees, the White House, the national laboratories themselves, and many others.

During the course of our work, we did visit all 17 of the national laboratories. We heard from 85 witnesses in monthly public hearings that we had here and in the field, and we reviewed over 50 previous reports on this topic from the past 4 decades.

We have titled our report "Securing America's Future, Realizing the Potential of the National Laboratories."

Our overall finding is that the national laboratory system is a unique resource that brings great value to the country in the four mission areas of the Department of Energy: nuclear security, basic science R&D, energy technology R&D, and environmental management.

For example, the national labs, as you cited, have tremendous resources. They have four of the world's fastest supercomputers, which are helping keep the Nation—enabling the Nation to extend the lifetimes and safety of our nuclear warheads without nuclear testing. In basic science, the world-class particle accelerators, light sources, and other user facilities host over 30,000 researchers every year from our universities and industrial partners. And in energy

technology R&D, the labs have played an important role in helping to develop innovations that have led to the Nation's shale gas revolution, as the chairman mentioned, and the surge in wind and solar energy.

However, the national lab systems is not realizing its full potential. Our commission believes that can be changed. We provide 36 recommendations that we believe, if adopted, will help the labs to become more efficient and effective and have even greater impact, thereby helping to secure America's future in the four mission areas of the Department.

We would like to highlight a few of those major findings and recommendations and then to address other topics of interest to you.

Our most fundamental conclusion does come from the paragraph that Senator Feinstein read. It deals with the relationship between the Department of Energy and the national labs. We find that that trusted relationship that is supposed to exist between the Federal Government and the national labs is broken and is inhibiting performance. We note that the problems come from both sides, from the labs and from DOE.

We want to be clear that the situation is not uniform across all the labs. In particular, the labs that are overseen by the Office of Science generally have much better relationships with DOE than do those in the other program offices.

Many of our recommendations address the fundamental problem that I have just mentioned. We conclude that the roles need to be clarified and reinforced, going back to the formal role of the labs as federally funded research and development centers for the Department of Energy. Under this model, the two parties are supposed to operate as trusted partners in a special relationship with open communication.

DOE should be directing and overseeing its programs at a policy level, specifying what its programs should achieve. The labs, for their part, should be responsible for determining how to carry that out and then executing those plans. In doing so, the labs should have more flexibility than they do now to implement those programs without needing as many approvals from DOE along the way. In return, of course, the labs must operate with transparency and be fully accountable for their actions and results.

This flexibility in our view should be expanded significantly in areas such as the ability to manage budgets with fewer approval checkpoints; managing personnel compensation and benefits; entering into collaborations with private companies, including small businesses, without having each agreement individually approved and written into the lab's M&O contract; building office buildings on sites that are not nuclear, not high hazard, and not classified; conducting site assessments that are relied upon by the Department of Energy and others to minimize redundant assessments; and sending key personnel to professional conferences to maintain DOE's work in leading-edge science and for their professional development.

In your charge to us, you asked us to examine whether there was too much duplication among the national labs. We looked into this in detail and have included two recommendations in this area.

The first regards NNSA laboratories where, as you pointed out, we conclude that it is important to the Nation's nuclear security that the two design laboratories' capabilities continue to be maintained in separate and independent facilities.

The second recommendation in this area regards the way the Department manages through life cycle of R&D topics. In our view, they do a good job at encouraging multiple lines of inquiry in the early discovery stages of new subjects, and they are good at using expert panels and strategic reviews to manage mature programs. However, at the in-between stages, the Department needs to assert its strategic oversight role earlier and more forcefully to manage the laboratories as a system in order to achieve the most effective and efficient overall results.

We want to acknowledge the progress currently being made in some of these and other areas by the current Secretary of Energy and the current directors of the national laboratories. We encourage them to continue their efforts, and we encourage your subcommittee and others in Congress to support them and to support future administrations in this direction.

Let us turn to our recommendations for how we believe Congress can help improve the performance of the national labs. We would like to cite three specifically here in our opening statement.

First, we conclude that laboratory-directed research and development, or LDRD, is vitally important to the labs' ability to carry out their missions successfully, and we recommend that Congress restore the cap on LDRD funding to the functional level that it was historically up until 2006.

Second, there does seem to be a serious shortfall in funding for facilities and infrastructure at the national laboratories. However, the scope and severity of that shortfall are not well defined. We recommend that the Congress work closely with DOE and OMB to agree, first, upon the size and nature of this problem and then upon a long-term plan to resolve it, we think through a combination of additional funding, policy changes, and innovative financing.

And third, since continuing resolutions have become more frequent, although maybe there is going to be a return to regular order there—we will see—we recommend dropping provision 301(d) from your appropriations bill and returning to the restrictions that were in place prior to 2012 for operating under CR's. The previous requirements were already stringent, and the new ones have made operations at DOE and the national labs much more restrictive and inefficient.

In the interest of time, let us finish by highlighting our final recommendation. We found that in the past 4 decades there have been over 50 previous commissions, panels, and studies of the national laboratories. It is our view that Congress and the administration would be better served by some sort of standing body of experienced people who could provide perspective and advice on issues related to the national labs without having to create new commissions or studies every time. Such a group could potentially be housed at the National Academies or report to the President's Council of Advisors on Science and Technology or be somewhere else that would provide the independence that Congress requires.

On behalf of our nine commissioners, we want to thank you for this opportunity to serve the country on this important commission. We hope that our work will be helpful, and we are happy to answer questions and discuss our findings and recommendations.

[The statement follows:]

PREPARED STATEMENT OF TJ GLAUTHIER AND DR. JARED L. COHON

Good afternoon, Chairman Alexander, Ranking Member Feinstein, other Senators and staff of the subcommittee, and others interested in the National Energy Laboratories. We are pleased to be here to present the final report of the Commission to Review the Effectiveness of the National Energy Laboratories. Your subcommittee created the Commission in January of 2014, in the fiscal year 2014 Omnibus Appropriations Act.

The two of us have served as the co-chairs of the Commission for almost 18 months. We were privileged to serve with an outstanding group of seven other commissioners with strong backgrounds in the science and technology enterprise of the Nation. We are pleased that this is a consensus report. We received excellent cooperation and support from the Department of Energy, all the relevant Congressional committees, the White House, the National Laboratories themselves, and many others.

During the course of our work, we visited all 17 of the National Laboratories, heard from 85 witnesses in monthly public hearings in the field and here in Washington, DC, and reviewed over 50 previous reports on this topic from the past four decades.

We have titled our report, “Securing America’s Future, Realizing the Potential of the National Energy Laboratories.” Our overall finding is that the national laboratory system is a unique resource that brings great value to the country in the four mission areas of the Department of Energy: nuclear security, basic science R&D, energy technology R&D, and environmental management.

For example, the National Labs have four of the world’s fastest supercomputers, which are helping the Nation extend the lifetimes and safety of our nuclear warheads without nuclear testing. In basic science, their world-class particle accelerators, light sources and other user facilities host over 30,000 researchers every year from our universities and industrial partners. And in energy technology R&D, the labs have played an important role in helping to develop the innovations that have led to the Nation’s shale gas revolution and surge in wind and solar energy.

However, our National Lab system is not realizing its full potential. Our commission believes that can be changed. We provide 36 recommendations that we believe, if adopted, will help the labs to become more efficient and effective and have even greater impact, thereby helping secure America’s future in the four mission areas of the Department of Energy.

We’d like to highlight a few of our major findings and recommendations, and then would be happy to address any others of particular interest to you.

Our most fundamental conclusions deal with the relationship between the Department of Energy and the National Labs. We find that the trusted relationship that is supposed to exist between the Federal Government and its National Labs is broken and is inhibiting performance. We note that the problems come from both sides, the Labs and DOE.

We want to be clear that this situation is not uniform across all of the Labs. In particular, the Labs that are overseen by the Office of Science generally have much better relationships with the DOE than do those in the other program offices.

Many of our recommendations address this fundamental problem. We conclude that the roles need to be clarified and reinforced, going back to the formal role of the labs as federally Funded Research and Development Centers for the Department of Energy. Under this model, the two parties are supposed to operate as trusted partners in a special relationship with open communication.

DOE should be directing and overseeing its programs at a policy level, specifying “what” its programs should achieve. The Labs, for their part, should be responsible for determining “how” to carry them out, and then executing those plans. In doing so, the Labs should have more flexibility than they do now to implement those programs, without needing as many approvals from DOE along the way. In return, of course, the Labs must operate with transparency, and be fully accountable for their actions and results.

This flexibility, in our view, should be expanded significantly in areas such as:

- The ability to manage budgets with fewer approval checkpoints,
- Managing personnel compensation and benefits,

- Entering into collaborations with private companies, including small businesses, without having each agreement individually approved and written into the lab's M&O contract with DOE,
- Building office buildings on sites that are not nuclear, not high hazard, and not classified,
- Conducting site assessments that are relied upon by DOE and others to minimize redundant assessments, and
- Sending key personnel to professional conferences to maintain DOE's work in leading edge science and for their professional development.

In your charge to us, you asked us to examine whether there is too much duplication among the National Labs. We looked into this in detail, and have included two recommendations in this area. The first regards the NNSA laboratories, where we conclude that it is important to the Nation's nuclear security that the two design laboratories' capabilities continue to be maintained in separate and independent facilities.

The second recommendation in this area regards the way the Department manages through the life cycle of R&D topics. In our view, they do a good job at encouraging multiple lines of inquiry in the early, discovery stages of new subjects. And they are good at using expert panels and strategic reviews to manage mature programs. However, at the in-between stages, the Department needs to assert its strategic oversight role earlier and more forcefully to manage the laboratories as a system in order to achieve the most effective and efficient overall results.

We want to acknowledge the progress currently being made in some of these and other areas by the current Secretary of Energy and the current Directors of the National Laboratories. We encourage them to continue their efforts, and we encourage your Subcommittee and others in Congress to support them and future Administrations in this direction.

Let us turn to our recommendations for how we believe Congress can help to improve the performance of the National Labs. We would like to cite three here in our opening statement:

- First, we conclude that Laboratory-Directed Research and Development, LDRD, is vitally important to the labs' ability to carry out their missions successfully, and we recommend that Congress restore the cap on LDRD funding to the functional level that it was historically, up until 2006.
- Second, there does seem to be a serious shortfall in funding for facilities and infrastructure at the National Labs. However, the scope and severity of that shortfall are not well defined. We recommend that the Congress work closely with DOE and OMB to agree, first, upon the size and nature of this problem, and then, upon a long-term plan to resolve it, through a combination of additional funding, policy changes, and innovative financing.
- Third, since Continuing Resolutions have become more frequent, we recommend dropping provision 301(d) from your appropriations bill and returning to the restrictions that were in place prior to 2012 for operating under CRs. The previous requirements were already stringent, and the new ones have made operations at DOE and the National Labs much more restrictive and inefficient.

In the interest of time, let us finish by highlighting our final recommendation. We found that in the past four decades there have been over 50 previous commissions, panels, and studies on the National Labs. It is our view that Congress and the Administration would be better served by some sort of standing body of experienced people who could provide perspective and advice on issues relating to the National Laboratories, without having to create new commissions or studies every time. Such a group could potentially be housed at the National Academies, or report to the President's Council of Advisors on Science and Technology (PCAST), or be somewhere else that would provide the independence that Congress requires.

On behalf of our nine commissioners, we want to thank you for this opportunity to serve the country on this important commission. We hope our work will be helpful and we are happy to answer questions and to discuss our findings and recommendations.

Senator ALEXANDER. Thanks, Mr. Glauthier.

Dr. Cohon, do you want to add anything before we begin questions?

Dr. COHON. No, Mr. Chairman. Mr. Glauthier did a great job.

#### LABORATORY MANAGEMENT

Senator ALEXANDER. Thank you very much.

Thank you, Mr. Glauthier.

At the beginning of your comments, you mentioned the management relationships are better in the Office of Science—those 10 labs—you said than the others. Does that require some act of Congress to change that? Or is that something the Department can itself change?

Mr. GLAUTHIER. Most of the things we recommend are actually within the authority of the Department now. Certainly in these management areas, almost all of them—they have the authority to implement. It is just a question of willpower and actually going ahead and doing it.

Senator ALEXANDER. I mean, you are an experienced person in Government, as well as outside Government. Does it depend on the personality of the Secretary or are there changes that Secretary Moniz could make during his last year here that would likely carry over for other Secretaries? Well, maybe it is not his last year, but let us say in the remaining part of the Obama administration.

Mr. GLAUTHIER. That is right. Exactly.

Senator ALEXANDER. We like him.

Mr. GLAUTHIER. He is doing a good job and I think the relationship that he is establishing with the laboratories is healthier, and many of the things that he is doing now are consistent with the recommendations we are making. Some of those things he may be able to try to institutionalize or to put in place in a way that continues. But a lot of it depends upon the culture at the Department and between the Department and the labs. And that culture change is not something that can be legislated or can be changed overnight, and it requires work on both sides, at the laboratories and the Department. It is moving in the right direction. I think if it gets the reinforcement that your committee can provide, that will help a lot.

Senator ALEXANDER. You have made this report to him or will give it to him?

Mr. GLAUTHIER. We have. We have delivered it to him. We will be meeting with him in the coming weeks. We have met with him during the course of this work as well.

#### THIRD PARTY FINANCING

Senator ALEXANDER. Let me ask you about third party financing. You have been in the Department of Energy. You have been in the Office of Management and Budget. And I will just use the experience I know best. At the Oak Ridge National Laboratory, I mentioned earlier there are four major buildings there that have been done by what we call third party financing. And our experience was—I believe one of them was it made it possible for us to move on into supercomputing much more rapidly than we otherwise would have been able to as a Government. The cost of the buildings was roughly half of what it cost to build federally financed facilities, and the facilities were completed in about half the time.

Now, since 2007, there have been no approvals by the Office of Management and Budget of third party financing at our national laboratories. What is going on? You used to be in the Office of Management and Budget. Why are they not doing that?

Mr. GLAUTHIER. Mr. Chairman, I think your example is a very good one. There are three different forms of financing that were used in those buildings. Those three do illustrate the differences that you just cited. One of them was funded completely by Department of Energy funding. One was funded by the State, and one was funded by private sector funding. And the results were that the alternative financing approaches were much better.

The reason it is not being done right now is partly a set of rules that the Office of Management and Budget has adopted in the interest of trying to protect the Federal Treasury. It is true that the borrowing rates for the Federal Government are lower than they are for the private sector, but if that is all you look at, then you are missing the bigger part of the picture. If you can build a building overall for less cost, then the borrowing costs are also going to be substantially lower, and the net overall—

Senator ALEXANDER. Some people think that every time the private sector gets involved, that is a bad thing. I am on the other side of that argument. I mean, we had three or four examples down there, and generally speaking, the savings was half the time and half the cost. So one would think that protects the taxpayers' pocketbook.

Mr. GLAUTHIER. And our recommendation in the report is that OMB ought to—and everyone in Government ought to be able to do a straightforward cash flow comparison of building a project one way, building it the opposite way, and look at that and be able to make a decision that is in the best interest of the Government but not to have, what we see in some cases, sort of arbitrary rules.

Now, there are some of the rules that we do not understand the rationale for them. Our recommendation is that your committee, its staff, the Department of Energy, and OMB ought to work together and see if we can agree upon what the situations ought to be in which innovative financing would be appropriate and what the procedures or what the rules would be for how you do that.

Senator ALEXANDER. Well, Senator Feinstein, I think we ought to follow up on that recommendation and see if there are appropriate instances where we can save the taxpayers money—I mean, half the time and half the dollars—then we ought to consider that.

I had a meeting with the Office of Management and Budget the other day on another matter. I found Shaun Donovan to be very open and receptive. Are you planning to give your recommendations to the Office of Management and Budget?

Mr. GLAUTHIER. Yes, we are. We have met with them during the course of this, and we will be meeting with them again. We are trying to get them to understand the rationale for our recommendations so that they, we would hope, would adopt them and look into them more deeply.

Senator ALEXANDER. Well, I would appreciate your doing that, and after you do that, perhaps we can follow up.

Senator Feinstein.

#### LABORATORY MANAGEMENT

Senator FEINSTEIN. I wanted to ask you a question about the oversight part of your report. You called for streamlined oversight of the labs by DOE, and you say “DOE should give the laboratories

and management and operating contractors the authority to operate with more discretion whenever possible.”

Well, that is the way it has been. At UAP uranium lab, we have gone from \$4.2 billion to \$6.5 billion and completion in 2025. So, none of the dates have been met. And I mentioned the plutonium building at Los Alamos, and it is kind of the same thing. In this case, the roof was initially too low and had to be changed so that the original estimate and the year complete went from \$3.7 billion to \$5.9 billion, completion in 2024. And then, of course, a big problem with the MO<sub>x</sub> facility. The original estimate, \$4.8 billion and completion in 2016. It is \$10 billion to \$13 billion, completion in 2027 and 2031.

And I will give you a specific, and the distinguished Senator from New Mexico is in the room. But I know when I heard this, I was very concerned. When you talk about use a risk-based model ensuring the level of control is commensurate with the potential risk, I think of the incident 18 months ago at WIPP. Here was a case of the best and the brightest at Los Alamos contracting out to a contractor who made a basic chemistry error by packaging a drum using the wrong absorbent, organic versus inorganic kitty litter. The result was an exploding drum of waste, contamination of WIPP, release of radioactive material, and hundreds of millions in recovery costs.

So when we saw all these estimates that start out rather low for various things and end up very high, what we did is asked the Department of Energy to put somebody in charge from the very beginning and before construction, to also extend the period for consideration up front of costs so that you had as robust an estimate of cost as one can. Then we began to hold—I do not know. I guess every 6 months, every year Department of Energy came in and brought in the person that was in charge of the facility. And in a way what it did was kind of cement a relationship that you knew who was overseeing the project and the Secretary knew. So there was closer oversight.

If I read this report right, you are asking for less oversight. And that is a problem when you have billions in estimates that are underestimated.

Mr. GLAUTHIER. You have identified two sets of problems that are very serious problems there.

And the construction projects that lead to these very big costs are a whole topic that we addressed in one chapter of the report, and we went through a lot of examination there. And our feeling is that the Department has a lot of rules on the books for the way you manage these projects that are not being followed or they are being followed in form and not in substance.

For example, these big projects should have all the engineering design work done before they actually begin to start implementing these things and start to build things. And that is where you start to incur the big costs. And they do not do that adequately enough. They do not have enough red team reviews. They do not have enough of the real rigorous peer review of the design and engineering work up front before they get to their CD-2 decision in their vernacular.

And so the recommendations of this commission and of the Augustine-Mies commission are to strengthen that kind of capability in the program offices and overall to the Department. I think there needs to be a stronger capability of people who report directly to the Secretary in their oversight role, as well as in the program offices.

The Office of Science, as I think you cited earlier, has done a better job building the Spallation Neutron Source or some of the other facilities, and that is partly because they had a much stronger program office managing that process, the engineering work, the design work before they would give you an estimate, and that they were able to hold people accountable for those things. The periodic reviews are an important part of that. So I think of the whole big project cost, there are solutions in place that actually do not need any new authorities, but they do need the discipline to put in place and have the Secretary and the other management team with the Department pay attention to it and really enforce that.

Senator FEINSTEIN. Thank you. That is what we tried to do. You might want to make a comment.

Senator ALEXANDER. Dr. Cohon, I think wanted to add. Dr. Cohon.

Dr. COHON. Yes, if I could just add to that. TJ gave a very good response.

And I think that the process you describe, Senator, and the relationship that evolved that you described between the Congress, the Senate in this case, and the lab and DOE is just right. I think that is the right level of oversight on such an important aspect.

When we talk about building trust and having less oversight, what we are reacting to is an overall tendency for the relationship between DOE and the labs to become compliance-focused. The question becomes are you complying with our requirements as opposed to whether you are accomplishing your mission. This has not happened across the entire Department, as TJ mentioned in our opening statement, but it does happen within some labs. And that is not healthy. The exclusively compliance-oriented relationship breeds a bad kind of behavior in my view. Trust, on the other hand, I think breeds the kind of behavior you want.

You cite the WIPP incident, which is a very regrettable and important one. Things will go wrong. Fifty-five thousand people in 17 laboratories spread across the country—things will go wrong. I think, though, that things will go wrong with lower probability if there is this sense of trust and people are brought into the mission of the laboratory and they understand what the mission is, that they are not simply checking a box or responding to some kind of compliance requirement. That is what we are talking about.

The other aspect of this—and this involves Congress, a sensitive topic I think. Things have gone wrong and will go wrong. And I think it is very important that we all respond appropriately when they do. There has been a tendency, when if something goes wrong in one place, to apply the solution across all 17 labs, and sometimes those solutions are very strict and it is probably an overreaction to the incident that occurred. So it is complicated. It depends, I think, on what we are talking about. But trust I think will take us a long way.

Senator FEINSTEIN. Thank you, Mr. Chairman.

Senator ALEXANDER. Thank you, Senator Feinstein.

Thank you, Dr. Cohon.

Senator Feinstein asked me to comment on what she said. I will do it very quickly.

We applied a very simple principle of oversight on those big construction projects, starting with the uranium facility, and did, Mr. Glauthier, really what you suggested. We insisted that there be a budget number, which is \$6.5 billion, that there be a date for completion, which is 2025, and that 90 percent of the design work be completed before it was done. And then we asked that there be a red team appointed, which in this case was headed by Dr. Mason, head of the laboratory, and in a few weeks, they came back with some recommendations that produced that result with some very commonsense suggestions, and they are on that path now. In the meantime, we are meeting at least every 6 months giving them a chance to say we are on course or we are not on course and here is why and here is what we can do about it. We know they may run into some problems, but so far, so good.

And we have done the same thing with the MO<sub>x</sub> facility and a second red team has come back with a set of recommendations to us.

So that is the kind of oversight this subcommittee has been exercising, and so far it has been helpful.

Senator Hoeven.

#### COOPERATIVE AGREEMENTS

Senator HOEVEN. Thank you, Mr. Chairman.

I would like to explore the topic of cooperative agreements with both of you gentlemen and get your recommendations on how we can do more with cooperative agreements.

In North Dakota, we have at the University of North Dakota the EERC, Energy and Environmental Research Center, and we have a cooperative agreement with the National Energy Technology Laboratory. And what we are really focused on is how do we make carbon capture and storage commercially viable because people like to talk all the time about capturing and storing CO<sub>2</sub> from coal-fired electric plants and the technology is there to do it. It is just doing it in a commercially viable way. And the EERC is doing some amazing things. That is a partnership that we need to build with DOE's National Energy Technology Laboratory.

Another example is at North Dakota State University, we have supercomputing, and we have a partnership with Lawrence Livermore, our national laboratory, to use supercomputing to come up with new ways to develop energy, to drill more cost effectively in shale formations, to do things with battery storage and advanced technologies related unmanned aircraft, those kinds of things.

So I think these are a very productive way to take technology from the laboratory and out to commercial development.

So we need to do more with these cooperative agreements. And I worked with our chairman and ranking member to put more funding in the energy and water appropriations bill for cooperative agreements.

But how do we build those cooperative agreements. You know, people talk about these technologies they want out in the field, and they know they are technically viable but we have got to make them commercially viable. So, talk about what we can do with cooperative agreements, how we really build on that relationship between the national labs and the universities that are leading the charge in all of these different areas.

Mr. GLAUTHIER. Good, Senator. That is very important, and I will make a couple comments, and then Dr. Cohon I think will want to add to that as well.

The cooperative agreements I think are a great vehicle for work with the university community and the Department of Energy's laboratories and programs, and those are I think very successful and they are relatively easy to get underway. We would like to encourage the Department to do everything they can to make them even easier.

The more complicated area is with the private sector. The agreements where industry is working, whether it is a big company or small businesses—it requires every time to be reviewed and approved by the Department of Energy and incorporated as an amendment into their contract at the laboratory. Now, that seems to be unnecessarily complicated to us. If there is an understanding that the laboratory is going to be doing work in this area, that is with the scope and nature of work with the private sector is a certain amount, then they should be able to go ahead and carry that out and do that unless it is something really new. And that area is one that we do think can be improved substantially, and there may be some area where legislation is helpful in the future.

Senator HOEVEN. Dr. Cohon.

Dr. COHON. I would just add to what Mr. Glauthier said. I think laboratory leadership added towards technology commercialization matters greatly. I think at those laboratories where the leadership really is committed to it, I think it happens more easily and in greater quantity. But it does take commitment. It is not easy. I speak from the perspective of a former university leader, and I know what the barriers are culturally, et cetera. But it can be done, but it takes commitment.

This Secretary has indicated his support for technology commercialization system-wide, but the actual commitment I think varies greatly from lab to lab. So having the commitment joined with a less bureaucratic approach to issuing agreements, I think progress could be made.

Senator HOEVEN. Well, one of the challenges we have is the regulatory environment is always trying to push these issues. We have funding in DOE for things like CCS, but we still have not brought it together in a way that makes it commercially viable. So it seems to me the universities, because they have partners—for example, EERC with their Northern Plains CO<sub>2</sub> Sequestration Project has 80 partners. A lot of those are the private sector companies you are talking about. So how do we really drive that and bring some of the other funding into the equation and put it on top of those cooperative agreements and actually get something done?

Dr. COHON. So you have put your finger what I think is a great model or potentially great model, which is, as you point out, uni-

versities already work with a lot of companies, and here we have an excellent example in the EERC with many companies involved. That could act as a great sort of go-between for the laboratories, which find it more difficult for a variety of reasons to work directly with the companies. They do but there is more process involved. If they worked with and through universities more, I think they could get a lot more done.

I will just say commercializing technology is hard because it starts with an idea and even when it is well developed in a laboratory or university, it still has a long way to go to get to the market. Let us not make it harder by weighting it down with the kind of bureaucratic issues we have.

Senator HOEVEN. Thank you.

Senator ALEXANDER. Thank you, Senator Hoeven.

Senator Coons.

#### COMMERCIALIZATION OF NEW TECHNOLOGIES

Senator COONS. Thank you, Senator Alexander. And I would like to thank you, Mr. Chairman and Ranking Member Feinstein, again for convening this great hearing, and both of our witnesses today for your leadership of this important commission to review more thoroughly some vital issues. And you have a rich menu of 36 different recommendations. A number of the important ones have already been addressed.

But I would like to turn to your recommendation, I believe, number 25, that DOE give the labs more authority and flexibility to decide how they will achieve their overall program goals.

I have introduced earlier in this Congress bipartisan legislation with Senator Durbin, as well as Senators Rubio and Kirk. It is called the America INNOVATES Act. It is S. 1187 that would specifically delegate more authority to the labs to enter into agreements with the private sector to facilitate commercialization of new technologies. These ideas, which are hardly groundbreaking—they have been brought up in previous studies. They have been discussed previously. They have been endorsed by a group that ranges from the Heritage Foundation to the Bipartisan Policy Center to ITIF to the Center for American Progress.

Do you believe Congress can play a helpful role in facilitating ideas getting to market through more specific legislative direction that implements some of your recommendations? And what are your specific thoughts about how we can give the labs more tools to meaningfully improve opportunities for tech transfer in public-private partnerships?

Mr. GLAUCHIER. Yes. I think your legislation is very much in the direction that we endorse. We refrained from endorsing any specific bills in our report. But the changes that you have in that legislation are exactly the right sorts of things. Laboratories ought to be freer to enter into agreements with private industry. Especially small businesses are really hampered by not being able to do that easily. And to have a set of criteria which make it easy to be able to say for contracts or projects of less than \$1 million, for ones that are involved with U.S. companies—we are not dealing with foreign companies—it ought to be straightforward and be able to do it. So I think that is the kind of thing that is very helpful, very powerful.

There are lots of companies out there who want to work with the laboratories, but it is time-consuming and cumbersome.

Dr. COHON. I would like to add just two thoughts, Senator. And thank you for your bill. I think it is excellent leadership and it is very much in line with the views of our commission.

We observe in our report that over the years, over the decades, the pendulum has swung back and forth with regard to the attitude towards commercialization. It is viewed variously as essential and that the labs are not doing enough or as corporate welfare and they are doing too much. So they have gotten mixed messages and they have changed over time. So a consistent message strongly in favor of it I think is very important. It would go a long way towards moving it forward.

The other thing is I know again from my own experience that university researchers in this respect are a lot like lab researchers. Their job is not commercialization per se, and we do not want it to be because we want them to discover the next great idea. But we need to make it easier—and universities have largely figured out a way to do that—for faculty researchers to be involved in the commercialization process without giving up their birthright or in some way destroying their role as a faculty member. We have not overcome that in the labs at all. It is a very difficult thing for a lab researcher to do. And people experienced in technology transfer will often say—they use various phrases, but usually they will say it is a contact sport, that it is about people, and people have to be involved in the commercialization and transfer of technology. It is still too difficult for lab researchers to be involved in that process.

#### PROPOSED TRAVEL RESTRICTIONS

Senator COONS. Well, thank you. I appreciate both of your kind comments on the legislation. And I hope to have a chance to work with my colleagues. I strongly feel that we need to strengthen the tech transfer and commercialization function of our national labs. These are unique national treasures. And I do think that clear, consistent signals from Congress, from the administration will help strengthen it. I agree that discovery science requires scientists who are focused on fundamental science, not on commercialization, but we should not make commercialization difficult. It should be easy. Tech transfer, spinning out some of the amazing inventions and innovations at the labs should be easy.

Let me just briefly ask you about recommendation 18, which is that we reduce some of the travel restrictions to enable conference participation. I fully understand why there was travel restrictions put on, given a scandal in a Federal agency, a different function. But I view the ability to travel and participate in scientific conferences as absolutely essential both to the advancement of the careers of research scientists and also the advancement of the work of science.

Tell us a little bit more, if you would, about how you think this travel restriction has been affecting the labs and whether labs are able to perform their cutting-edge research mission while their leading scientists are barred from traveling to meaningful conferences and participating in them.

Dr. COHON. I would be happy to.

As we note in our report, we visited all 17 labs. In every laboratory in our meetings with especially younger scientists, this issue came up and came up as number one. It is a very serious constraint on their ability to be effective, as you point out, Senator.

Being effective when you are involved in research means interacting with people who are at the frontiers of your area of science. If you cannot go to conferences, to meetings of such people, you are really deprived.

Now, they often could go but the delays in getting approval, the steps they had to go through really were a very big burden.

I will say this is a great example of a bad thing happening someplace in Government and the reaction being to penalize everybody.

Mr. GLAUTHIER. If I could add to that. I think this is also an example where people were beginning to figure out a way to make the system work, figure out a way to get approvals and all, when the fundamental question ought to be asked, why do you have the approvals in the first place? The laboratories ought to be given the responsibility to carry this out in an appropriate way. They are responsible and accountable for how well they do both support their researchers and make sure that the program is in balance with the other priorities that they have.

So the Department has recently made some changes. The Secretary has made changes to improve this. We are hopeful that that is going to be effective in making this work, but we also think it needs to be watched continually and to make sure that right balance exists. I think it is a very good example of the sort of thing that Senator Feinstein was referring to earlier about how much flexibility or independence do you give the laboratory. This is an area that we ought to be able to make those decisions and then be held accountable for how well they do it.

Senator COONS. Well, I appreciate both your strong statements on this. In visiting national labs, I have heard exactly the same thing, particularly for sort of early or mid-career scientists. They feel they are being treated like children in terms of the hoops they have to jump through, the forms they have to fill, the restrictions on their careers. And I think this is being pennywise and pound foolish. It is a significant barrier to successful careers in science to put these shackles on participation in scientific conferences. I know this is a very small budgetary issue, but I am concerned about its big impact on careers.

Thank you for tolerating my long second question, Mr. Chairman.

Senator ALEXANDER. Thank you, Senator Coons.  
Senator Lankford.

#### THEFT & LABORATORY MANAGEMENT

Senator LANKFORD. Thank you.

Gentlemen, thank you for all your work and the research that goes into this. Just going back through 50 different reports over 4 decades alone, much less getting all the labs and all the interviews and everything, I appreciate all the work and research that went into it.

Let me give you the flip side of this, and it is the challenge that we face on this dais on accountability and trust. It is entirely ap-

propriate to pour trust out and to allow people to be able to run and be able to hold people accountable in it.

Last week, as you know, the FBI reported the theft of tools that had radioactive materials from Los Alamos on them. In that search warrant that came out, it was discovered that there had been 76 times this year that there has been a report of theft by employees at Los Alamos of some type of materials or products.

How do we handle and how do we balance the “I trust you, I want you to run with this” and dealing with something as big as tools that were stolen with radioactive material and being able to monitor and understanding this has happened 76 times just this year in some level? Help us to balance that because you want to instill trust with people that are doing an excellent job, but the administration has got to actually carry the ball.

Mr. GLAUCHIER. Senator, I think that is a good example of a complex situation where the consequences can be serious, but the Department of Energy—the Federal employees are not going to be there to check people’s toolboxes every day to see what goes out of the facility. So the key is holding the accountability at the right level. The laboratory management has to be accountable for how well this is carried out and then has to push that down through the organization. And there needs to be a way to hold them accountable and have some consequences when things do not go right.

Senator LANKFORD. So saying that, is it your perception that DOE is trying to do all of that accountability from D.C. for lack of a better term and there is not enough accountability that is applied to individuals or they do not have the authority to apply the accountability at the lab level?

Mr. GLAUCHIER. I think there is the site office in between. I think the problem is that a lot of people at the site office are following a checklist approach to compliance or to how they are overseeing the laboratory. So they will do their inspections. They will check things that are—do they have their plan in place? Have they carried out an inspection of this site or that site in the last week? And check the box rather than stepping back and looking at what are we really trying to accomplish here.

We talked about making the requirements risk-based. I think that it is a very good example here when the risks could be serious so that there needs to be more dialogue really of, okay, how is the laboratory managing this kind of risk. And it ought to be at that level rather than, oh, we have got a prescription. We have got a set of things you have to do, and as long as you do those, you will be okay.

What has happened when there are too many requirements, people get relaxed and they think, well, if I met all those requirements, it is all going to be okay. I think that is somewhat like the problem that happened at Y12 a couple years ago where we had the security incident where people had been checking the box on things and not stepping back and looking at what is the need here to make sure that this is a secure facility and that people are doing it right.

Senator LANKFORD. So ultimately, accountability needs to lie as close as it can to have direct oversight. Is your recommendation,

your sense at this point, that the oversight is too far away and that the people that are there do not have the authority, as well as the responsibility? They may have the responsibility but not the authority to actually do real oversight. They need to have both closer.

Mr. GLAUTHIER. I am not sure I understand exactly the—

Senator LANKFORD. If the sense is, for instance, this tool illustration—when it is radioactive tools, that is a different level I understand, whether it is other things. But when you have got that much theft and that many reports in one location, obviously, we are not checking inventory. Something is not being managed well. We do not see that in other locations everywhere.

So the question is do the people on site have both the authority and the responsibility to carry out, or do you feel like they have the responsibility but the authority for oversight is somewhere far away?

Mr. GLAUTHIER. I think that authority and responsibility is mixed up right now. It is not clear enough. These roles and responsibilities need to be clarified and that people at the laboratory need to understand exactly that they are responsible for that and then they are accountable for it.

Senator LANKFORD. Right, because the accountability has to fall there.

Mr. GLAUTHIER. Absolutely.

#### DUPLICATION

Senator LANKFORD. Let me ask for clarification as well on the duplication side that this committee asked you to do on that—you had two recommendations. One recommendation is you looked at NNSA and you basically determined, no, it is duplication, but we should have duplication. It is redundancy and it is right.

The second one seemed to be a very carefully worded statement of, yes, when these projects are getting started, we are seeing duplication, but eventually it works out. As they progress, somebody takes it, but at the beginning we all seem to be working on similar things at the beginning. We need greater sense of accountability. You have got this lane. You have got this lane. Am I reading that correctly?

Mr. GLAUTHIER. Yes, but we are also saying the Department is not stepping in early enough in these programs to assert that responsibility and to work out in a systematic way—and I use the word “system” very, very carefully—look at the system of labs, where should the leadership or the centers of excellence be on the—

Senator LANKFORD. Is that because the labs do not have a clearly defined “this is your lane,” and there is enough overlap where there are three labs that have a little bit of overlap and they are all competing in that one space? And so DOE or the labs need to work out who has got what lane and to run it well. Is that your recommendation?

Mr. GLAUTHIER. Yes, that that needs to happen sooner, and at the very early stage where something new is being explored, it is a really good idea. And I would not call it duplication as much as exploring a lot of different avenues.

Senator LANKFORD. Sure. It is the competition of a different angle to the same goal. I get that.

Mr. GLAUTHIER. That is right. And then at some stage, it really is important for the Department to say, all right, we have got a bunch of people looking at this. Let us come together, get the experts in our labs and in the universities and industry to sit down together and agree what is the Federal role here.

Senator LANKFORD. But that should be at DOE level.

Mr. GLAUTHIER. Yes.

Senator LANKFORD. That is at a larger level.

So greater accountability and responsibility and authority at the local level for carrying out the task. We are back to your earlier statement of the "what" and the "when" from the larger level, the "how" at the local level, but also the accountability there. But somebody has got to manage, no, you cannot do that project. They are working on it. They are farther along than we are and they are being successful. Lay off of that one and go to this.

Mr. GLAUTHIER. And there we think the process the Office of Science is using is the best one that does bring together the experts in that subject area to have that discussion and help inform that so it is not just a more arbitrary decision.

Senator LANKFORD. Thank you.

Senator ALEXANDER. Thank you, Senator Lankford.

Senator Udall.

#### LABORATORY DIRECTED RESEARCH & DEVELOPMENT

Senator UDALL. Thank you, Senator Alexander, and thank you for having these witnesses in. I think these are very important reports that you have made, and the Augustine report I guess was done first. But I think they really help our national laboratories focus on what is important.

I wanted to focus again on some of the questions that were asked about LDRD. You know, while most people know the history of nuclear weapons work at these labs, many do not realize this work is supported by research into basic science. Professionals at the labs have made substantial progress to solve some of the world's most vexing problems. Fortunately, lab directors have been able to leverage cooperative research and development agreements, laboratory-directed research and development, LDRD, and other methods to spearhead projects that may be outside the normal weapons or national security research which directly supports scientific progress and retention of top researchers.

As this report concluded, many laboratories also depend on LDRD to support the recruitment and retention of qualified staff. It is no secret that the LDRD program has been under attack in some quarters. The commission recommended the unburdened cap of 6 percent and noted this would primarily impact the NNSA labs.

Why is this important for recruitment and retention, and how in your opinion does the LDRD program benefit the overall mission of the NNSA labs. And what unique achievements in your opinion are directly related to the LDRD program?

Dr. COHON. I will take that one, Senator.

Senator UDALL. Thank you.

Dr. COHON. Thank you for the question. It is a very important topic, and we agree with your characterization of it.

LDRD is especially important for the weapons labs for the reasons you said. They depend very much on basic science, and it is the LDRD funding that allows them to explore new areas. It is especially important for the weapons labs in the recruitment and retention of leading scientists. As you know well, Senator, we do not teach weapons science in universities. There is only three places where weapons science is developed and taught, and that is at the three weapons labs, as it must be. It is very important, therefore, that these laboratories have a way to bring in, on board, if you will, Ph.D.-level scientists who come without that kind of weapons background.

The LDRD funding is often the way they do this. They are very dependent on postdoctoral workers. I have forgotten the percentages. They are in our report. But it is well over half of their post docs come in with this kind of funding and well over half of those post docs are retained as new Ph.D. scientists for the laboratories. Without that funding, I do not think they could sustain the workforce that they must have.

And the reductions or the effective reduction, because of the burdening and then the lowering of the cap, has had an impact on those three laboratories in their ability in the numbers and their ability to recruit and retain these scientists. So it is very important.

Senator UDALL. One of the things that I have noticed that happens is many times, even at the National Security labs, the NNSA labs, if they diversify some into other areas, which they have, non-weapons work, they are able with these post docs to be able to attract them to the laboratory and have them work in both areas, both weapons and non-weapons. And it provides, I think, a very fertile ground for basic scientific research. I think you were going to comment on that, Mr. Glauthier.

Mr. GLAUTHIER. Yes. I agree with that. And I think that one of challenges for the recruiting of really strong people into these weapons labs is that weapons research is not as attractive an area for a lot of people. So having the fastest supercomputers in the country at these labs, having other areas of basic science and exploration available to them is really helpful.

One of the interesting things, in addition to how many of the post docs are supported by LDRD, is the percentage of them that decide to stay at the labs. And it is around 70 percent, something like that, of those who come. But they are not sure, when they first sign up, whether they are going to or not. And having this richer set of work to do is a very important element of that.

Dr. COHON. There is also a practical consideration that we have not mentioned, which is that these scientists must receive clearances, of course, before they can do their weapons work. This often takes many months, a year, and being able to support them with LDRD funds on this more basic research until they get their clearances is also important for these laboratories.

Senator UDALL. Thank you very much.

Thank you, Mr. Chairman.

Senator ALEXANDER. Thanks, Senator Udall.  
Senator Durbin.

LABORATORY MANAGEMENT

Senator DURBIN. Thanks, Mr. Chairman, and thank you for your testimony here today.

It was just last week when Senator Risch and I, who co-chair a labs caucus, were able to walk through a room in this building and see some of the exhibits of the work that is being done at the national labs. What struck me, following up on Senator Udall's line of questioning, was the important role which the Department of Energy and these labs play when it came to this nuclear agreement with Iran. They were an essential part of it and I think brought more credibility, scientific credibility, to this process than we otherwise could have achieved. So I would hope that that is an incentive for us to explore use of the labs, to verify our political aims in a scientific manner in the future.

As I read this, I was struck by several things. The first three recommendations: the labs need more money, more authority, more freedom. Those are the first three things that you recommended. And more and more the recommendations came down to analyzing the relationship between the labs and the Department of Energy.

And I guess I read near the end of this report, quote, "In the past 4 decades, over 50 commissions, panels were used and studies of the national labs have been conducted." That is more than one per year by my rough liberal arts math calculation. The basic question is can this marriage be saved. I mean, if we have to go to counseling so often with the same basic conclusions, then we ought to raise some basic questions. So I want to get down to something that is even more basic. You alluded to it, but I would like to hear your comments.

How many of these problems associated with this relationship between the labs and DOE are the result of statute or regulation? How much is the fault of an ongoing—I will use "bureaucracy" in a positive way—bureaucracy? How much is the result of political change, different administrations coming in, different goals, different people? How would you assess that in terms of the current situation between the labs and the DOE?

Dr. COHON. We agreed that TJ would take all the hardest questions.

I think he wants to answer this one.

Mr. GLAUTHIER. Senator, I am not sure that is the hardest, but I think it is a very good question.

I guess I would start with the fact that we do not see this as a partisan issue at all. This is not a Republican or Democratic set of issues. It is more a function in some cases maybe the individual who is the Secretary of Energy, but it is not because one party or the other. It is this relationship that I think has grown up over time.

And the way that we described it earlier, the section that Senator Feinstein read from our report earlier—and I think it might have been before you arrived—had to do with the fact that the laboratories and the Department both are responsible for this. The laboratories operate often in some degree of secrecy. They are try-

ing to establish their role in different areas. They come up and talk to Members here on this side and the other side of the Hill as well, trying to get support for their programs. And they are not sharing as openly with the Department what they are doing in those cases until they can secure some support. And that behavior then elicits a behavior on the Department side who want to know more about what they are doing and start to impose more requirements. That is kind of a cycle that reinforces itself and just gets worse so that the Department does not trust the labs totally, and they are asking for more information, and the labs do not trust what the Department will do with the information, and so they hold it back a little.

We think this Secretary and this set of directors of the labs are actually making good progress in restoring that and rebuilding that trust and confidence. So our recommendations are very much in the direction of trying to take some steps to give the laboratories some more flexibility but hold them accountable. And the accountability side is crucial. This is not just to give them more flexibility to go off and do things on their own, but to try to do that in some of these areas.

We talked about some areas, for example, the whole human resources area, just compensation and benefits. We think that the laboratories and their M&O contractors have been hired to manage these facilities because they are institutions that have solid backgrounds and reputations. They ought to be free to go ahead and carry that out, consistent with requirements for what compensation and benefits you expect in a laboratory. But right now there is an awful lot of approval process negotiating it out ahead of time every year. And that is sort of a simple area. But every company, every university, every other organization in the country goes through a compensation and benefits analysis every year. They ought to be able to just sort of define what we expect of that, have them do it, and have them continue to report and be accountable.

Senator DURBIN. I am over by a couple seconds here, but I just close by saying I encouraged our scientific research community through our Government to tell their stories. I do not believe they do enough. I do not think the average person, average voter, average taxpayer, average Congressman, or average Senator know what is going on. And when we are asked to fund many of these projects, there is skepticism. What is the difference? Who cares? And they should care because important things are happening. I think those who are in the scientific field need to have some friends in the marketing field.

Thank you, Mr. Chairman.

Mr. GLAUTHIER. If I could, Mr. Chairman, can I just add one more?

Senator ALEXANDER. Sure.

Mr. GLAUTHIER. I think that there is a really important role for the laboratories that we see in this, and that is from universities doing a lot of exploring of ideas and the like, but sort of individual project people running projects and then the commercial sector when things really become well developed and are able to be commercialized, there is a whole in-between area where projects are complex, require multidisciplinary inputs, large numbers of people participating in them, and that is an area that the labs can play

a very unique role. But the public and Members of these bodies do not understand that very well.

Senator DURBIN. Mr. Chairman, if I could have 20 seconds. I beg your indulgence.

Senator ALEXANDER. Whatever.

Senator DURBIN. A classic example. I spoke to Secretary Moniz about the need for more money in biomedical research, and I mentioned Alzheimer's, one diagnosis every 67 seconds, a recent "Fortune" magazine article that showed some imaging finally of the progress of Alzheimer's that used to only be determined by a post-mortem. Now they can determine—and he said to me, where do you think that came from? Well, it came from the Office of Science in the Department of Energy. They were developing this technology. There is a story every American family understands.

#### NATIONAL ENERGY TECHNOLOGY LABORATORY

Senator ALEXANDER. Thanks, Senator Durbin.

Would you like to say anything about your recommendations about reorganizing the National Energy Technology Laboratory in West Virginia?

Dr. COHON. Yes, I would on behalf of TJ and the commission.

It is very important for people to recognize at least a couple things with regard to this recommendation.

First of all, the National Energy Technology Laboratory is a very important resource for the Department and for the Nation. It is the Fossil Energy Laboratory, and fossil fuels will be with us, must be with us for many decades to come. And to continue to do research on that, what we heard about from Senator Hoeven, is really very important.

The other thing is we have two recommendations, and they are separable and it is important to recognize that.

The first one that we offered was to reorganize the National Energy Technology Laboratory. The National Energy Technology Laboratory is unique among the 17 labs not only because it is a GOGO, Government-owned/Government-operated, but also because it has, in effect, a large service center which operates on behalf of the fossil energy program of DOE collocated with the laboratory but actually inside the laboratory. So the director of NETL is responsible for this large service center as well as the research and development function. In fact, the research and development function is only about \$50 million or so out of an annual expenditure of \$600 million to \$800 million. So in a way it is the tail wagging the dog.

What we have recommended is that the resource function be pulled out separately, that that be the National Energy Technology Laboratory, giving that function the focus and attention we think it deserves.

That is quite separate from the other part of our recommendation, which is to study the potential conversion of the NETL to being a GOCO, a Government-owned/contractor-operated, like the other 16 laboratories.

We should not confuse the two. We think that the first one could be pursued without, we believe, a great deal of cost or impact on the operations of that laboratory.

The second one, the conversion to being an FFRDC—that may be more expensive and more difficult, but that is a separate issue.

Mr. GLAUTHIER. May I add one note?

Senator ALEXANDER. Sure.

Mr. GLAUTHIER. We know that the unions and others in the regional governments are quite concerned about this. I want to make it clear that that first recommendation that Jerry just described would still have all those people be Federal employees. They would still be located in the same places. They would not change any of that. What it would change is organizationally just this very clear focus and attention on the research functions versus the others that are a service center and other sorts of functions.

Senator ALEXANDER. I am correct, am I not, that of the 17 laboratories, it is the only one that is not run by the model of hiring a company who is a contractor to manage the laboratory? That is the way 16 of them are run. Right?

Dr. COHON. That is correct, Mr. Chairman.

Senator ALEXANDER. And this one is run just by the Government.

Dr. COHON. That is right. Everybody there is a Government employee.

Senator ALEXANDER. And generally speaking, do you think the model of hiring a company to provide the management for the national laboratories at those 16 laboratories is a good one?

Dr. COHON. We support that model. This Congress created many decades ago this unusual and unique model of an FFRDC, and I think it has served us extremely well and I think these other 16 labs are the examples of that.

Mr. GLAUTHIER. We said in the report we think that there is a greater degree of consistently high quality research at those other laboratories and that the research at NETL does have some very good research but it is not consistently as high quality as the other labs.

#### CLOSING REMARKS

Senator ALEXANDER. Well, what I have heard today is a number of interesting recommendations, and we will certainly take them into account. I hope you will pursue the recommendations with the Secretary because he is a good Secretary and I think he is interested in these recommendations, as we will be. I hope you will pursue them with the Office of Management and Budget because, for example, with the third party financing and maybe you can remind them of some things that they overlooked on this. They may have not thought it all the way through and may welcome that.

I would like for us to pursue the third party management. I would like for us to pursue the point that Senator Udall talked about, which is the full use of the 6 percent, especially by the weapons laboratories where it seems to be more valuable.

I thought it was interesting—Senator Coons' comments. And perhaps one of you said—I guess you did, Dr. Cohon—that what the laboratories need on commercialization is just a clear statement from us about whether it is corporate welfare or something they ought to be doing because I know from my own background, I have tried it as a university president, as a Governor. I have tried it from every angle. It is not easy to do.

And one of the things that I have noticed—I was talking to the former chief of staff of our State's Department of Economic Development. He thinks the private companies are not very aggressive in trying to dredge out ideas from the laboratories. He puts the fault there. One company moved into Tennessee and was particularly aggressive and went over to Oak Ridge and found a lot of materials research that is interesting.

I suggested to Fred Smith, the founder and CEO of FedEx, he ought to spend a day at Oak Ridge, and he wandered through and was looking for one thing and he found something in the materials research they were doing he thinks will save hundreds of millions of dollars in the weight of his containers that FedEx flies all over the world.

I was at a medical device company on Monday, and they are using, as I mentioned earlier, 3-D printing on the tools for knee replacements. Someone from that company had visited the additive manufacturing at Oak Ridge, but what we are finding is at Oak Ridge, that now a manufacturer in Indiana might be putting an employee or two in Oak Ridge to keep up with the research and development so that they can transfer it to their manufacturing plant in Indiana.

And another interesting idea was that the Governor of our State has created State vouchers which he will give to companies that they can spend at the laboratory. In other words, if the medical device company wants to go to the Oak Ridge Lab and look at their computers or their additive manufacturing, the State will provide an incentive for that.

So I guess one thing we need to think about is whether we have enough of a consensus here to send a clear message to the various labs that it is important for them to try to move the technology out of the lab and into the private sector. Sandia, in my experience, I think had done a pretty good job of that, better than some other laboratories have. But it is not easy. It is pretty complicated. And that is an area that we can focus on.

So I do not have any further comment. I will ask Senator Feinstein if she has a further comment, and then I will ask each of you if you have a final word you would like to say to us and we will conclude the hearing. Senator Feinstein.

Senator FEINSTEIN. No further comment. I think I made my concerns known.

I do want to thank you both, and I want to thank everybody that participated in making this report. I think it is up to us that we make the most of it, and we will try to do so.

The question of trust that you raise is one that is very interesting to me, and I am not quite satisfied by that because particularly with the nuclear part of this, it is so expensive and it takes up so much of our budgets, that you really cannot afford to have waste in it because the numbers are so big.

We have a unique problem because for many—and I am one of them—the Army Corps of Engineers is the only infrastructure program we really have in this country. And so you have these competing forces, the Army Corps, the DOE, and then you have half of the assignment which is the nuclear stuff, and that is huge and costly.

I am one that would like to see the world without nuclear weapons. I was a small child when Hiroshima and Nagasaki happened, and I have never gotten over it in my lifetime. And the pictures and people burning in the streets, just horrible. Yet, we make these huge nuclear weapons, and it is a problem. So I do not want to see any waste. I am one that supports the downsizing of them and one that supports START II and the Comprehensive Test Ban Treaty and all of those things that become so controversial in the world we live in.

And I would like to see the labs do more in areas of human endeavor. We have got so many people that need help and opportunity and all of those things, that it is very hard.

And the Senator and I—and I could not have a better partner, incidentally—have been trying for 4 years to get a nuclear policy for this country. We have none. And we spent 4 years and the chairmanship of the authorizing committee has changed, and we are hopeful we will be able to move a bill. But it takes time.

I am just sort of going on, but I want to say this. I have two big nuclear reactors in southern California in Southern California Edison, 2,200 megawatts that are being decommissioned. They are on a cliff on a beach, 3,300 very hot plutonium rods and a spent fuel pool and 6 million people living just across the freeway and reading in the newspaper about updates of high probability of an earthquake in the area of southern California. So I think to some extent the world I guess directs some of these priorities, but we ought to be able from our history to direct others. I do not know why I am getting into all of this.

But I do want to thank you. You came in. You gave us some very good ideas. It is really up to us to follow up and we will. I hope you will make yourselves available for questions or to sit down with us in the future.

Senator ALEXANDER. Mr. Glauthier, Dr. Cohon, any final words?

Mr. GLAUTHIER. Yes. I would like to add a couple of thoughts. One is that whatever the missions are the Department of Energy has been given, which is another set of people beyond us, our recommendations are focused on how to make sure those are effectively carried out and efficient. And we hope that you will be able to work with the Department of Energy and the labs to do that.

One part of this that we think will be very important and how you can help is to make it clear what your expectations are of the Department and the labs and to follow up. As you described earlier, your follow-up on these new facilities is a very good example of where twice a year you are asking them to come in and explain how they are doing. I think that is really important that they understand you are watching and that you care.

We would hope that you would think about that in terms of our final recommendation, which was trying to create some sort of standing body where it might be small—it might be three or five people that you appoint to this thing on a temporary basis, sort of like our commissioners who only serve for a while, but that you would have experienced people that you could turn to when you have questions like this. And maybe twice a year you ask them to come in and tell you how are these changes going. Are people in fact making these changes, or are they just going through the mo-

tions and they are not really doing it? If you get people who have served in the laboratories and in the Department of Energy, or whatever, they could do that without a great amount of effort, whatnot, but give you an insight into how well this is all being carried out.

Senator FEINSTEIN. Thank you.

Senator ALEXANDER. Dr. Cohon.

Dr. COHON. I would like to thank you both for creating this commission, giving us the opportunity to serve the Congress and the Nation and DOE in this way.

I would also like to acknowledge the outstanding support this commission received from our staff affiliated with the Science Technology Policy Institute of the Institute for Defense Analyses. And we have the two senior leaders sitting behind us here, Mark Taylor and Susannah Howieson, and I would like to acknowledge them for the record. They did a wonderful job as did the rest of their colleagues. So thank you, colleagues. And thank you.

Senator ALEXANDER. Thank you for the suggestions. I think a good way to end the hearing might be I was visited by Bill Gates the other day. He would not mind me saying this, I am sure, because he said publicly his passion for energy research. And while he is spending a lot of his own money investing in a variety of things, he is also interested in doubling energy research, a goal that I would like to support. And one reason he is willing to do it is because he thinks the national labs would spend it pretty well in terms of their management by the Office of Science.

So while we are looking for ways to improve the laboratories, I think it is important to acknowledge that every other country in the world would give their right arm to have these 17 labs as an engine of economic growth and national defense and ways of improving the quality of life and health for the people in their countries. In many ways they are our secret weapon in a world that is increasingly competitive.

#### ADDITIONAL COMMITTEE QUESTIONS

So the hearing record will remain open for 10 days. Members may submit additional information for the record within that time, if they would like, or questions. The subcommittee requests all responses to questions for the record be provided within 30 days of receipt.

[The following questions were submitted to the Department, but the questions were not answered by press time:]

#### QUESTIONS SUBMITTED TO MR. TJ GLAUTHIER

##### QUESTIONS SUBMITTED BY SENATOR SHELLEY MOORE CAPITO

*Question.* As a strong supporter of our national labs, particularly the National Energy Technology Lab, NETL, which has a major location in Morgantown, West Virginia, I would like to request clarification on Recommendation Five of your report, which seems to contradict previous statements by Secretary Moniz that the current model of operation for the facility is acceptable. Will you shed some light on the Committee's intentions in drafting Recommendation Five, and any additional details that can give us insight into this recommendation?

*Question.* Was a cost benefit analysis of government versus contractor operated labs completed and considered by the commission?

*Question.* What is the estimated cost of implementation of this recommendation #5? Where will the funding come from?

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QUESTIONS SUBMITTED TO DR. JARED L. COHON

*Question.* As a strong supporter of our national labs, particularly the National Energy Technology Lab, NETL, which has a major location in Morgantown, West Virginia, I would like to request clarification on Recommendation Five of your report, which seems to contradict previous statements by Secretary Moniz that the current model of operation for the facility is acceptable. Will you shed some light on the Committee's intentions in drafting Recommendation Five, and any additional details that can give us insight into this recommendation?

*Question.* Was a cost benefit analysis of government versus contractor operated labs completed and considered by the commission?

*Question.* What is the estimated cost of implementation of this recommendation #5? Where will the funding come from?

ADDITIONAL STATEMENT

The following statement was received subsequent to the hearing for inclusion in the record.  
[The statement follows:]

PREPARED STATEMENT OF PROFESSOR VENKATESH NARAYANAMURTI, PROFESSOR LAURA DIAZ ANADON, PROFESSOR GABRIEL CHAN, AND DR. AMITAI Y. BIN-NUN

Dear Chairman Alexander, Ranking Member Feinstein, and distinguished Members of the Subcommittee: Thank you for offering us the opportunity to submit testimony to the subcommittee. We would also like to thank Senator Coons for his continued leadership in the area of National Lab policy and for engaging our group.

It is an honor to be able to offer our perspective on a topic that is of great importance to the national interest; the topic of "realizing the potential of the Department of Energy National Laboratories" is of enormous professional and personal significance to me.

My name is Venkatesh Narayanamurti. I am currently the Benjamin Peirce Research Professor of Technology and Public Policy and Research Professor of Physics at Harvard University. I was formerly the Dean of the Harvard John A. Paulson School of Engineering and Applied Sciences and Dean of Physical Sciences at Harvard.

Previously, I served as the head of the Semiconductor Electronics Research Department and then as Director of the Solid State Electronics Research Laboratory at AT&T's Bell Laboratories. From 1987 to 1992, I was Vice President of Research at Sandia National Laboratories.

It was in these roles that I came to understand some of the key principles that underlie my testimony. Namely, that innovation is fostered when control over the research agenda resides as close as possible to the researchers in the lab. Management should support the judgment of scientists to the greatest extent possible. Additionally, it has become very clear to me that the traditional "linear model" of innovation that bifurcates research into "basic" and "applied" varieties hinders innovation.

My testimony stems from research I led as the Co-Principal Investigator of the Energy Technology Innovation Project (ETIP) at the Harvard Kennedy School (HKS) with Professor Laura Diaz Anadon (also at HKS). Our group has led research on supporting decisions about the optimal levels of DOE R&D investments in various energy technologies considering technology uncertainty, the structure and management of research institutions, and the linkage between DOE and the private sector. As part of the research at HKS in energy innovation over the past 7 years, together with Professor Gabriel Chan and Dr. Amitai Bin-Nun, we have investigated management issues at the National Labs in detail. We have a manuscript under consideration on this topic at an academic journal and will soon be releasing a report containing our findings. This testimony outlines some of our most important findings and recommendations.

I would also like to thank TJ Glauthier and Jared Cohon for their testimony and service to the Nation by leading the Commission to Review the Effectiveness of the National Energy Laboratories (CRENEL). Their report has done an excellent job of highlighting the vital role of the Labs and has captured the importance of shifting investment controls from DOE, where much of current authority currently lies, to scientific management at the Labs.

What follows is the testimony of my own experience, research, and personal views and that of my colleagues Professor Laura Diaz Anadon, Professor Gabriel Chan, and Dr. Amitai Bin-Nun. Our research contrasts with that of CRENEL in that we specifically focus on DOE's energy transformation mission. While the DOE's nuclear security, environmental management, and fundamental science missions are also worthy of independent study, we feel that focusing on one particular mission and integrating academic scholarship brings forth recommendations additional to those in CRENEL, which we largely support. We are also able to bring to bear our collective decades of research experience in the process of energy technology innovation and innovation systems and policy, a perspective that has been missing from the debate around the future of the National Labs. In this way, our testimony complements the CRENEL report by extending some of their recommendations as well as offering several new ideas and perspectives.

#### *A Holistic View of the National Lab System*

We would like to briefly address the question of whether the size of the Lab system is appropriate for its energy technology mission. This mission is crucial for the long-term fortune of our Nation; energy innovation has the potential to reduce national expenditures on energy and related trade deficits, reduce the threat and impact of climate change, and contribute to economic growth and national security through the development of new technologies.

The Federal Government has many tools at its disposal to advance energy technology innovation. It can signal markets, for example, through energy tax and regulatory policy ("market pull"), and it can advance research, development, and deployment of energy technologies ("technology push"). Both of these kinds of tools can be effective, but the most effective policy portfolio balances a combination of these policies.

According to the Congressional Research Service, Federal tax-related support for the energy sector was \$23.3 billion in 2013. For the same year, our group at Harvard calculated that DOE invested \$5.3 billion in energy technology research, development and demonstration. DOE's R&D investments are key to achieving the Nation's long-term goals of reducing carbon emissions, enhancing energy security, and growing the U.S. economy, but our research finds that current levels of Federal energy R&D support are insufficient to reach those goals. We argue that greater investment in energy R&D through the Labs and other programs could help meet long-term national energy goals. Further, variability and unpredictability in DOE energy research budgets from year to year erode the effectiveness of Federal R&D investments and should be minimized to the greatest extent possible. Reducing volatility in funding could be achieved by following a multi-year high-level strategy, along the lines of those suggested by the recent Quadrennial Technology Review. This does not mean that programs should continue indefinitely in the name of stability; it should be possible to cut non-performing programs after careful deliberation as new information becomes available, as is currently the norm in agencies such as ARPA-E.

We recommend expanding Federal investment in energy R&D through a gradual increase in funds targeted to technology areas through a process informed by external experts and guided by a long-term focus on energy system transformation.

The National Labs serve as a key anchor in the national innovation system with their \$14 billion budget (which covers several missions, including advancing fundamental science, stewarding the nuclear stockpile, and energy innovation), 50,000+ staff, and 17 Labs. Structurally, the Labs are unique in that Federal ownership can insulate the R&D mission of the Labs from the short-term pressures faced by R&D organizations in the private sector. Industrial R&D, shaped by short-term pressures, is heavily focused on creating commercializable inventions, whereas the Labs can have a longer horizon.

Reforming key areas of National Lab operations and interaction with DOE is necessary to improve the capability of the Labs to deliver on DOE's energy innovation mission. However, reforms should be mindful of protecting the unique role that the Labs play in the national innovation system.

We recommend that the outcome of any reform process should preserve the current high-level framework for Lab management, including DOE stewardship and the government-owned, contractor-operated (GOCO) model.

#### *Role of Private Sector Engagement*

Contemporary research into technological innovation has moved past the once dominant "linear model" of innovation, in which basic research is thought to lead to applied research, which in turn creates opportunities for new invention. Contemporary research into technological innovation favors a "connected R&D" model,

where innovation is not separated into “basic” and “applied” activities, but rather is one continuous activity-space, where activities normally classified as “applied” and “basic” are mutually reinforcing and chronologically sequenced in a variety of ways. This connected model emphasizes the knowledge feedback that develops when technologies are put into practical application. Under this new paradigm, new inventions in the domain of Engineering enable deeper understanding in the domain of Science with a comparable frequency to the reverse direction of influence.

In our view, the boundary between “basic” and “applied” research is usually arbitrary and counterproductive to research management. For this reason, the Labs’ ability to innovate is likely degraded by the “stovepiping” of basic and applied research funding streams separately administered by the Office of Science and the “applied energy” offices. Congress should encourage DOE to support energy research efforts that engage a broad scope of innovation-related activities (e.g., exploration, device design, simulations, etc.) without regard to whether the project is at an “applied energy” or “science” Lab. This requires seamless integration of the basic and applied research funding streams aimed at energy innovation.

We strongly support the appointment of a single Under Secretary for Energy and Science. Congress should make this position permanent.

One manifestation of the linear model view has been an effort to focus greater government involvement in the research enterprise on “basic” research activities, with the idea that the private sector is better positioned to pick up at the “applied” stage or that Lab activities in “basic” research should be kept separate from more “applied” projects. However, this separation of activities across institutions into basic and applied research have led to “siloes” where there should instead be greater integration. In the context of the Labs, this has resulted in an important disconnect between the Labs and the private sector. Some view this as intentional element of the Lab system resulting from the linear model view. Instead, we view engagement between the Labs and the ultimate users of technology as an essential component of DOE’s mission of transforming the Nation’s energy system. As an example, DARPA has applied the “connected R&D” model and has benefited from interacting with the users of its technology output.

In the energy context, the private sector holds the majority of the Nation’s energy infrastructure and conducts the majority of R&D, as is the case for many non-defense technology areas. Therefore transforming the energy system implies that the Labs must support the private acquisition of technology alternatives developed by the Labs. We find it difficult to imagine how this acquisition from the public Labs to the private sector can be accomplished without the Labs closely working with private firms in some capacity. In fact, correctly done, engagement with the private sector is also beneficial in advancing the fundamental science mission of the Labs. The connected R&D model implies that both the Labs and private firms have much to gain from the cross-fertilization of their “invention” and “discovery” activities.

Accordingly, Congress has charged the Labs with a technology transfer mission. This mission does not imply that Labs should conduct R&D that exclusively meets private sector needs. Labs should work to meet government missions, but when those missions have direct implications for private sector activity, Labs should embrace private sector engagement to the extent necessary to cost-effectively fulfill those government missions.

Our research indicates that since 1997, there has been a consistent downward trend in the technology transfer metrics used by DOE to assess Lab-private sector engagement. Our view is that the Labs are responding to mixed policy messages from DOE and Congress. Reduced engagement with the private sector represents not just missed opportunities to advance the mission the Labs have been charged with, but it also degrades the ability of the Labs to spur technological innovation. In fact, our research demonstrates that technology licenses that transfer technologies from the Labs to the private sector result in significantly increased follow-on innovation in private firms, acting as an impact-multiplier for Federal R&D funds and for private R&D.

DOE should design technology licensing agreements and collaborative R&D agreements to best leverage DOE funding into follow-on innovation in the private sector.

#### *Laboratory-Directed Research and Development (LDRD)*

We recognize that the appropriate utilization of Laboratory-directed research and development (LDRD) has been addressed by this committee in the recent past. We understand the need to balance the positive impacts of LDRD on Lab culture with the need for Labs to fulfill their core mission efficiently and with proper Federal oversight. In our studies of the Lab system, however, we have uncovered new information that we hope the Committee will use to recalibrate what, in its judgment, is the optimal level of LDRD at the Labs.

LDRD is often seen as a personnel recruitment and retention tool, particularly at the NNSA Labs. Indeed, delivering on the Labs' missions is dependent on the retention of quality scientific personnel. However, our studies of measurable innovation output from the Labs find that LDRD plays a key role in driving new patent filings and invention disclosures at the Labs. From 2007–2012, DOE disclosed a new invention for approximately every \$5 million in R&D invested at the Labs. Yet, for Lab investment allocated under LDRD, inventions were reported at nearly four times this rate. Similarly, on a dollar to dollar basis, more than two times as many patents resulted from LDRD relative to the broader pool of DOE funding. While a number of assumptions are embedded in our calculations, these results show that, on average, LDRD funds result in a greater rate of new inventions and patents than DOE-allocated funds. Congress should assist DOE in moving towards a view that holds LDRD as a key part of the Lab innovation portfolio.

This finding parallels the increasing recognition of the power of “bottom-up” innovation, which supports using ideas stemming directly from researchers to complement a research agenda driven by centralized management. Some private firms have created programs that solicit input from researchers and employees at the front lines of innovation, often dedicating considerable funds and/or personnel time to these ideas.

We argue that LDRD should be seen as the National Lab equivalent of these private sector programs. In our view, LDRD funds are not a diversion from the Labs' core mission, but an integral element of the Labs' research portfolio and a way to more effectively capitalize on the investment the Labs have already made in attracting some of the world's best scientific talent to the National Labs.

We recommend that approval for LDRD projects should be limited to Lab directorates without need for prior approval by DOE Site Offices, a recommendation also suggested by CRENEL as a pilot initiative.

Congress should also encourage the increased utilization of LDRD at the Labs with an energy mission to reach the existing statutory limits.

#### CONCLUSION OF HEARING

Senator ALEXANDER. Thank you for being here.

The subcommittee will stand adjourned.

[Whereupon, at 4:04 p.m., Wednesday, October 28, the hearing was concluded, and the subcommittee was recessed, to reconvene subject to the call of the Chair.]

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