

FROM TRANSFORMATIVE SCIENCE TO TECHNOLOGICAL BREAKTHROUGHS: DOE'S NATIONAL LABORATORIES

HEARING BEFORE THE SUBCOMMITTEE ON ENERGY OF THE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY OF THE HOUSE OF REPRESENTATIVES ONE HUNDRED NINETEENTH CONGRESS

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**FROM TRANSFORMATIVE SCIENCE
TO TECHNOLOGICAL BREAKTHROUGHS:
DOE'S NATIONAL LABORATORIES**

WEDNESDAY, FEBRUARY 12, 2025

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Subcommittee met, pursuant to notice, at 10:02 a.m., in room 2318, Rayburn House Office Building, Hon. Randy Weber [Chairman of the Subcommittee] presiding.



SUBCOMMITTEE ON ENERGY

HEARING CHARTER

“From Transformative Science to Technological Breakthroughs: DOE’s National Laboratories”

Wednesday, February 12, 2025

10:00 a.m.

2318 Rayburn House Office Building

Purpose

The purpose of this hearing is to explore the U.S. Department of Energy’s (DOE) National Laboratories and their research, development, demonstration, and commercial application activities. This hearing will examine the National Laboratories’ response to hostile threats, progress of their large infrastructure projects and user facilities, and role in developing emerging technologies such as Quantum and Artificial Intelligence. These topics are instrumental to U.S. competitiveness and ensuring secure, affordable, and reliable energy through innovation.

Witnesses

- **Dr. John Wagner**, Director, Idaho National Laboratory
- **Dr. Thom Mason**, Director, Los Alamos National Laboratory
- **Dr. Paul Kearns**, Director, Argonne National Laboratory
- **Dr. Kimberly Budil**, Director, Lawrence Livermore National Laboratory

Overarching Questions

- What role do the National Laboratories play in the U.S. scientific enterprise and the development of innovative technologies? How do the National Laboratories partner with industry and how beneficial is this relationship to U.S. competitiveness?

- Given increased attempts by hostile nations to infiltrate the national labs, how has the recent congressionally authorized language included in the CHIPS and Science Act (DOE Risk Matrix) and National Defense Authorization Act (NDAA) for fiscal year (FY) 2025 improved research security? What vulnerabilities remain?
- What is the status of the large research experiments and user facilities reauthorized in the CHIPS and Science Act?
- With the emergence of transformative technologies such as AI and Quantum Information Sciences, are the national laboratories equipped to support the development of these new technologies while facing new challenges that they present to U.S. security?

BACKGROUND

During World War II, the U.S. military brought together the world's top scientists and tasked them to develop the first nuclear bomb. Known as the Manhattan Project, this effort led to the creation of the first national laboratories. In the post war period, the U.S. government created the Atomic Energy Commission (AEC) to manage these newly created laboratories where they continued to develop nuclear weapons. In the 1950s, President Eisenhower through his "Atoms for Peace" initiative sought to harness the power of the atom for commercial energy uses, which expanded the labs' focus to include nonmilitary nuclear research and development projects. In 1971, President Nixon established the Energy Research and Development Administration (ERDA) to support the AEC's research activities as well as the development of non-nuclear forms of energy. To consolidate the government's research activities, President Carter signed the Department of Energy Organization Act, which transformed the AEC into the Department of Energy (DOE).¹

Today, DOE employs over 14,000 federal employees, oversees 95,000 contractors, and operates 17 world-leading national laboratories that support cutting-edge research in a wider variety of scientific disciplines. Its mission is to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions.² With this mission, DOE is the largest federal sponsor of basic research in the physical sciences and plays a central role in the U.S. research enterprise, partnering with several other research agencies including the National Science Foundation (NSF), the National Institute of Standards and Technology (NIST), U.S. Geological Survey, and the National Aeronautics and Space Administration (NASA). In tandem, the Department is a leader in energy technology innovation pertaining to nuclear fission and fusion, geothermal technologies, petroleum and natural gas, and renewable energy.

Of the 17 facilities, 10 are managed by the Office of Science (SC) including Ames National Laboratory, Argonne National Laboratory, Brookhaven National Laboratory, Fermilab, Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, Princeton Plasma Physics Laboratory, SLAC National Accelerator Laboratory, and Thomas Jefferson National Accelerator Facility. Each national laboratory prioritizes one or more basic research programs including Advanced Scientific Computing Research (ASCR), Basic

¹ "History." *U.S. Department of Energy*, 4 Aug. 2020, www.energy.gov/lm/history.

² "Mission." *U.S. Department of Energy*, 3 Aug. 2011, www.energy.gov/mission.

Energy Sciences (BES), Biological and Environmental Research (BER), Fusion Energy Sciences (FES), High Energy Physics (HEP), Accelerator R&D and Production, Isotope R&D and Production, and Nuclear Physics (NP). In addition, these laboratories are home to world class user facilities, which accelerate scientific breakthroughs. Four of the seven remaining national laboratories are managed by the applied energy offices within DOE, which prioritize more mature energy technologies. These include Nuclear Energy (Idaho National Laboratory), Environmental Management (Savannah River National Laboratory), Energy Efficiency and Renewable Energy (National Renewable Energy Laboratory), and Fossil Energy (National Energy Technology Laboratory). Lastly, under the National Nuclear Security Administration (NNSA), DOE maintains the U.S. nuclear arsenal along with several other national security missions at Lawrence Livermore, Los Alamos, and Sandia.

The House Committee on Science, Space, and Technology has jurisdiction over DOE's civilian research, development, demonstration, and commercial application programs. In total, the Committee oversees and authorizes over \$17 billion in DOE activities, approximately one third of the Department's annual budget. In FY24, the national laboratories in the Committee's jurisdiction received \$10.5 billion.³

Research Security

With the rise of hostile powers such as the Chinese Communist Party (CCP), the United States research enterprise has been subject to foreign interference. These malign actors have sought to secure sensitive technologies through various means. For instance, the CCP recruited researchers at leading universities through its Thousand Talents plan.⁴ As a response, Congress passed provisions in the CHIPS and Science Act to protect U.S. research from these types of tactics. In addition, Congress directed DOE to develop and implement a risk matrix to protect intellectual property and reduce research risks posed by national security threats and entities of concern. DOE has implemented this congressional directive, but threats continue to advance. In the National Defense Authorization Act FY2024, Congress further directed DOE to restrict access to foreign individuals from countries of risk to protect research activities at the National Laboratories. Despite these newly enacted measures, hostile actors have evolved their tactics to gain access to DOE researchers, government-funded technologies, and federal dollars through contracts and grants.⁵ The CCP is also investing billions of dollars in key emerging technology areas in hopes to supplant the leadership of United States research and development. Their hope is over the next few decades to have world leading science facilities that will attract researchers from around the world to China.⁶

³ *Department of Energy FY 2025 Laboratory Tables*, 9 Mar. 2024, www.energy.gov/sites/default/files/2024-03/doc-fy-2025-budget-lab-table.pdf.

⁴ Robinson, Tilly R., and Neil H. Shah. "After Conviction for Lying About China Ties, Ex-Harvard Chemist Gets Approval to Visit Beijing." *The Harvard Crimson*, 30 Oct. 2024, www.thecrimson.com/article/2024/10/30/lieber-approval-china-visit/.

⁵ "Strategic Environment." *National Security Agency*, 3 May 2016, www.nsa.gov/About/Strategic-Environment/.

⁶ Atkinson, Robert D. "China Is Rapidly Becoming a Leading Innovator in Advanced Industries." *Information Technology and Innovation Foundation | ITIF*, 16 Sept. 2024, itif.org/publications/2024/09/16/china-is-rapidly-becoming-a-leading-innovator-in-advanced-industries/.

Infrastructure and Large Experimental Research Facilities

The national laboratories are home to world-class research experiments and user facilities where each laboratory specializes in important research topics. Argonne National Laboratory specializes in BES and ASCR where it manages the Advanced Photon Source (APS-U) and Aurora, a supercomputer, at the Argonne Leadership Computing Facility (ALCF). Brookhaven National Laboratory prioritizes Nuclear Physics and Isotope R&D and Production where it is home to the Accelerator Test Facility (ATF), Realistic Heavy Ion Collider (RHIC), and National Synchrotron Light Source II (NSLS-II). Fermilab specializes in HEP where it manages the Accelerator Complex and is currently constructing the Long Baseline Neutrino Facility (LBNF) to support the Deep Underground Neutrino Experiment (DUNE). Idaho National Laboratory, an applied sciences lab, focuses on nuclear technologies and is home to the Advanced Test Reactor. Lawrence Berkeley National Laboratory has a broad portfolio of programs but oversees the National Energy Research Scientific Computing Center (NERSC), Advanced Light Source (ALS-U), and the Human Genome Project. Princeton Plasma Physics Laboratory specializes in fusion energy sciences and manages the National Spherical Torus Experiment (NSTX-U). Thomas Jefferson focuses on Accelerator R&D and Production where it is home to the Continuous Electron Beam Accelerator Facility (CEBAF). The National Renewable Energy Laboratory, an applied energy laboratory, supports the Energy Systems Integration Facility (ESIF). Pacific Northwest National Laboratory specializes in BER where it oversees the Environmental Molecular Science Laboratory (EMSL), assists the Environmental Management work conducted at the Hanford Superfund site, and operates the Sequim marine research facility. Oak Ridge has a broad portfolio of programs but manages the High Flux Isotope Reactor (HFIR), Spallation Neutron Source (SNS), and the Frontier supercomputer housed at the Oak Ridge Leadership Computing Facility.

Over the last few years, DOE has sought to improve and upgrade existing research facilities and establish new research facilities. Congress authorized improvements and upgrades in the CHIPS and Science Act, including the Second Target Station for the SNS at Oak Ridge, ALS-U at Lawrence Berkeley, and Matters in Extreme Conditions (MEC) end station and Linac Coherent Light Source II (LCLS-II) at SLAC. In addition, DOE is building new facilities such as the Electron Ion Collider (EIC) at Brookhaven and DUNE at Fermilab. With the completion of these projects over the next decade, the U.S. will continue to be at the forefront of scientific discovery and achievement. Along with these large projects, DOE manages offices and infrastructure to support its research and development activities.

Critical and Emerging Technologies

Throughout their history, the National Labs have been vital for the U.S. to remain at the frontier of critical and emerging technologies. From powering various National Aeronautics and Space Administration (NASA) spacecraft to jumpstarting the shale gas revolution, the National Labs have played critical roles in not only scientific discovery but improving people's quality of life.⁷ Of the numerous technologies the National Labs are working on, artificial intelligence (AI), quantum information sciences (QIS), semiconductors and microelectronics, and fusion are poised to be leading sources of discovery and breakthroughs that are key to ensuring our economic prosperity and national security.

⁷ “75 Breakthroughs by America’s National Laboratories.” U.S. *Department of Energy*, 14 Feb. 2018, www.energy.gov/articles/75-breakthroughs-americas-national-laboratories-0.

Artificial Intelligence (AI)

Due to DOE's computing infrastructure and access to terabytes of data, the National Laboratories are playing a significant role in the development of AI. Through the ASCR program, the National Labs are home to several of the fastest supercomputers in the world, many of which power AI models.⁸ In the Top500, El Capitan at Lawrence Livermore is ranked first; Frontier at Oak Ridge is ranked second; Aurora at Argonne is ranked third; and Tuolumne at Lawrence Livermore is ranked tenth.⁹

With this infrastructure, the National Laboratories use AI to advance scientific discoveries and national security. For instance, Argonne employs ArouaGPT to support scientific research while Los Alamos National Laboratory uses AI to bolster confidence in our strategic deterrent.¹⁰ In addition, DOE partners with other departments including the Department of Veterans' Affairs to advance Veterans' healthcare outcomes.¹¹ Moreover, Congress strongly supports DOE's AI research activities, which was formally authorized with the passage of the National Artificial Intelligence Initiative in 2020.

Quantum Information Sciences (QIS)

With the potential for QIS to revolutionize computing and processing power, DOE's National Labs are focused on QIS and its development. Authorized in the National Quantum Initiative Act (NQIA) of 2018, Congress directed DOE to establish a QIS research program and the Office of Science to create at least two National Quantum Information Science Centers (NQISRCs). In 2020, DOE selected Brookhaven, Argonne, Oak Ridge, Lawrence Berkeley, and Fermi to host the NQISRCs. Although distinct in their focus area, these centers combine basic research with engineering and technology development to advance quantum communication, computing, simulation, devices and sensors, materials and chemistry, and foundries. The National Labs, through its centers, partners with over 1,500 scientists and 115 academic, industry, and national science institutions to advance QIS.¹² In addition, Congress established the Quantum User Expansion for Science and Technology (QUEST) program in the CHIPS and Science Act. This program further encourages and facilitates access to quantum computing hardware for research purposes.

Semiconductors and Microelectronics

Authorized in the CHIPS and Science Act, Congress directed DOE to establish a microelectronics research, development, and demonstration program and up to four Microelectronics Science Research Centers (MSRCs) to conduct research in the design, development, and fabrication of microelectronics. In 2024, DOE announced three MSRCs: the Microelectronics Energy Efficiency Research Center for Advanced Technologies (MEERCAT), the Co-design and Heterogeneous Integration in Microelectronics for Extreme Environments (CHIME), the Extreme Lithography & Materials Innovation Center (ELMIC).¹³ These centers created sixteen projects, which involve ten

⁸ "Top500 List - November 2024." *TOP500*, 18 Nov. 2024, top500.org/lists/top500/list/2024/11/.

⁹ "November 2024." *TOP500*, 18 Nov. 2024, top500.org/lists/top500/2024/11/.

¹⁰ Los Alamos National Laboratory. "Artificial Intelligence." *Los Alamos National Laboratory*, 25 June 2024, www.lanl.gov/science-engineering/ai.

¹¹ "DOE and VA Team Up to Improve Healthcare for Veterans." *U.S. Department of Energy*, 18 May 2017, www.energy.gov/articles/doe-and-va-team-improve-healthcare-veterans.

¹² "National Quantum Information Science Research Centers." *U.S. Department of Energy*, 5 Mar. 2024, nqisrc.org/.

¹³ "Department of Energy Announces \$179 Million for Microelectronics Science Research Centers." *U.S. Department*

national laboratories. In addition, Argonne and Princeton Plasma Physics have unique expertise in this area. Given Princeton Plasma Physics specialization in plasma sciences, Princeton uses this energy form to fabricate microchips using diamonds.¹⁴ Meanwhile at Argonne's Microelectronics Institute, scientists use the lab's scientific user facilities such as the APS-U to develop advanced electronics.¹⁵

Fusion

Through the Office of Science's Fusion Energy Sciences Program, the National Laboratories conduct fundamental research into plasma sciences and develop the first fusion power plant. DOE has two main national laboratories, Lawrence Livermore National Laboratory and Princeton Plasma Physics Laboratory (PPPL), conducting research into fusion. The National Ignition Facility (NIF) at LLNL specializes in inertial fusion. In 2023, NIF achieved fusion ignition where it yielded an output of 3.15 megajoules with an input of 2.05 megajoules.¹⁶ Meanwhile, Princeton Plasma Physics Laboratory specializes in magnetic fusion. At PPPL, the NSTX-U, a large tokamak, is a testbed to study torus designs and plasma.¹⁷ In addition, the labs partner with DIII-D and the International Thermonuclear Experimental Reactor (ITER) to advance the development of the first commercial reactor. Likewise, in 2023, DOE announced the establishment of the Fusion Innovative Research Engine (FIRE) Collaborative to accelerate the development of commercial fusion. The FIRE Collaborations focus on four cross-cutting research topics including fusion materials, fusion enabling technologies, fusion blanket and fuel cycle systems, and advanced simulations for design and optimization. DOE announced that Idaho, Oak Ridge, SLAC, LLNL, Savannah River, and PPPL are part of this new program.¹⁸

Tech Transfer

The National Laboratories also serve as catalysts for the commercialization of energy, industrial, and manufacturing technologies. By working closely with the labs small businesses can work to innovate from a concept to a business plan that can be successful in the marketplace. This boosts the U.S. global technological leadership, energizes economic growth and reinforces energy security.

of Energy, 23 Dec. 2024, www.energy.gov/science/articles/department-energy-announces-179-million-microelectronics-science-research-centers.

¹⁴ Kremen, Rachel. "Ensuring a Bright Future for Diamond Electronics and Sensors." *Princeton Plasma Physics Laboratory*, 5 Nov. 2024, www.pppl.gov/news/2024/ensuring-bright-future-diamond-electronics-and-sensors.

¹⁵ "Imaging Memristive Behavior with Operando X-ray Microscopy." *Argonne National Laboratory*, 19 Jan. 2023, <https://www.anl.gov/imaging-memristive-behavior-with-operando-xray-microscopy>

¹⁶ "Achieving Fusion Ignition." *National Ignition Facility & Photon Science*, 7 Jan. 2025, lasers.llnl.gov/science/achieving-fusion-ignition.

¹⁷ "DOE Explains...Tokamaks." *U.S. Department of Energy*, 25 June 2020, www.energy.gov/science/doe-explainstokamaks.

¹⁸ "Fusion Fired up? Milestones Met and Six FIRE Collaboratives Named." *Nuclear Newswire*, 22 Jan. 2025, www.ans.org/news/2025-01-22/article-6698/fusion-fired-up-milestones-met-and-six-fire-collaboratives-named/.

Chairman WEBER. The Subcommittee on Energy will come to order. Without objection, the Chair is authorized to declare recesses of the Subcommittee at any time.

Welcome to today's hearing entitled "From Transformative Science to Technological Breakthroughs: DOE's National Laboratories." I recognize myself for 5 minutes for an opening statement.

So good morning, y'all. Today, the Energy Subcommittee will be examining the U.S. Department of Energy (DOE)'s National Laboratories and their role in advancing scientific discoveries, as well as developing innovative technologies. Our discussion will explore several topics, including research, security, DOE's world-leading user facilities, as well as emerging technologies.

Since its early formation in World War II, the National Laboratories have consistently been at the forefront of scientific achievement. As the largest Federal recipient of basic research funding in the physical sciences, the National Labs and their 28 user facilities have taken on the most fundamental challenges in the fields of computer science, high-energy physics, fusion energy, as well as materials science.

Despite these challenges, the labs have made significant scientific breakthroughs, which include sequencing the first human genome, mapping the universe, achieving fusion ignition, and discovering 22 of the elements on the periodic table. These achievements have been instrumental to U.S. technological leadership, creating new industries, as well as products.

In tandem, through public-private partnerships, the National Labs play a major role in transforming our energy sector. For instance, the National Energy Technology Lab, known as NETL, worked with industry to develop hydraulic fracturing technology. Before its widespread use in the late 2000's, the United States was actually in a dire energy state, relying on foreign powers to supply natural gas.

As a result, the United States built LNG (liquefied natural gas) terminals, including one in Freeport, Texas—my district—to import trillions of cubic feet of natural gas. Due to NETL's collaborative work with industry, however, the United States repurposed these same terminals to export LNG to our allies, while reducing the cost of energy at home. This showcases the importance of public-private partnerships and their ability to ensure our national security and our energy independence.

Likewise, the National Laboratories are involved in the development of next-generation energy technologies, for example, such as advanced nuclear energy. For over the last 20 years, researchers at Oak Ridge (ORNL) and Idaho National Labs (INL) have made significant improvements to TRISO fuel, which is a fabricated fuel using Gen IV reactors. Partly due to the lab's work, TRISO fuel has been adopted by some of the leading advanced reactor companies, including X-energy, a recipient of the Advanced Reactor Demonstration Program (ARDP). X-energy plans to use this fabricated fuel for its XE-100 reactor, which will provide power and heat to Dow's industrial production facility in Seadrift, Texas, just south of my district. Moreover, the lab's work in fabricated fuels, along with their ability to supply HALEU (high-assay low-enriched uranium), which will bring forth a new nuclear renaissance.

With our focus on National Laboratories, I would be remiss if I didn't bring up the *CHIPS and Science Act*. Back in the 117th Congress, I, as the Energy Subcommittee Ranking Member, along with the House Science Committee Members, worked across the aisle to produce the Department of Energy's *Science for the Future Act*, which included my bill, the *Computing Advancements for Materials Science, CAMS, Act*. This large, comprehensive House product ultimately became the basic text to the *CHIPS*, as well as the *Science Act*, which reauthorized the Office of Science's basic research programs, authorized upgrades and experimental facilities such as the Electron Ion Collider at Brookhaven National Laboratory, and directed DOE to implement new research security provisions.

Despite the wideset support for this bill, Congress has yet to appropriate to the levels authorized in the *CHIPS and Science Act*. This failure is partly due to the Biden Administration's prioritization of new and untested demonstration and deployment programs. While the *IIJA (Infrastructure Investment and Jobs Act)* and the *IRA (Inflation Reduction Act)* invested close to 100 billion for over 70 new programs, the Office of Science and its labs received only 2 billion, which is a paltry 2 percent of funding outside of the traditional appropriation process. This doesn't include the Biden Administration's risky loan office, which doled out tens of billions to its politically connected clean energy friends.

In 2017, I led a joint Subcommittee hearing titled, quote, "Risky Business: The DOE Loan Guarantee Program," end quote, where I highlighted in my opening statement that the Ivanpah solar project would come at the cost of the ratepayers if the—quote, "if the project fails and goes into default," end quote. With the recent announcement by PG&E ending its relationship with Ivanpah, it seems that my prediction was correct. It has—looks like it's coming true.

Moreover, I hope that the Trump Administration will work with Congress to fully fund the basic science programs at levels consistent with *CHIPS and Science* and reprioritize the Department to focus on basic research and its labs. This will ensure U.S. competitiveness and technological prowess in the 21st century.

I'd like to thank in advance our witnesses today for their testimony, and I look forward to our conversation here today.

[The prepared statement of Chairman Weber follows:]

Good Morning, today the Energy Subcommittee will be examining the U.S. Department of Energy's National Laboratories and their role in advancing scientific discoveries as well as developing innovative technologies. Our discussion will explore several topics including research security, DOE's world leading user facilities, and emerging technologies.

Since its early formation in World War II, the National Laboratories have consistently been at the forefront of scientific achievement. As the largest federal recipient of basic research funding in the physical sciences, the National Labs and their 28 user facilities have taken on the most fundamental challenges in the fields of computer science, high energy physics, fusion energy, and material science. Our labs met those challenges and made significant scientific breakthroughs, including sequencing the first human genome, mapping the universe, achieving fusion ignition, and discovering 22 of the elements on the periodic table. These achievements were instrumental to U.S. technological leadership creating new industries and products.

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was in a dire energy state relying on foreign powers to supply natural gas. As a result, the US built LNG terminals, including one in Freeport Texas, to import trillions of cubic feet of natural gas. Due to NETL's collaborative work with industry, the United States repurposed those same terminals to export LNG to our allies while reducing the cost of energy at home. This showcases the importance of public private partnerships and their ability to ensure our national security and energy security.

Likewise, the National Laboratories are involved in the development of next-generation energy technologies such as advanced nuclear energy. For over the last twenty years, researchers at Oak Ridge and Idaho National Labs have made significant improvements to TRISO fuel, which is a fabricated fuel used in GEN IV reactors. Partly due to the labs' work, TRISO fuel has been adopted by some of the leading advanced reactor companies including X-Energy, a recipient of the Advanced Reactor Demonstration Program. X-Energy plans to use this fabricated fuel for its XE-100 reactor, which will provide power and heat to Dow's industrial production facility in Seadrift Texas, just south of my district. Moreover, the labs work in fabricated fuels along with their ability to supply High-Assay Low-Enriched Uranium, or "HALEU" could bring forth a new nuclear renaissance.

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Despite the widespread support for this bill, Congress has yet to appropriate to the levels authorized in the *CHIPS and Science Act*. This failure is partly due to the Biden administration's prioritization of new and untested demonstration and deployment programs carried out in the *IIJA* and *IRA*.

This doesn't include the Biden Administration's risky loan office, which doled out tens of billions to its politically-connected clean energy friends. In 2017, I led a joint subcommittee hearing titled "Risky Business: The DOE Loan Guarantee Program" where I highlighted in my opening statement that the Ivanpah solar project would come at the cost of the ratepayers if the "project fails and goes into default." With the recent announcement by PG&E ending its relationship with Ivanpah, it seems that my prediction was correct.

Moreover, I hope that the Trump Administration will work with Congress to reprioritize the Department to focus on basic research and its labs; this will ensure U.S. competitiveness and technological prowess in the 21st century.

I would like to thank our witnesses for their testimony, and I look forward to our conversation here today.

Chairman WEBER. I now recognize the Ranking Member, the Representative North Carolina, for her opening statement.

Ms. ROSS. Well, good morning, and thank you so much to Chairman Weber for convening this hearing today to discuss the importance of the national laboratory network to preserving our Nation's leading edge in science and developing the energy solutions and workforce of tomorrow. I want to thank our distinguished witnesses for being here to share your testimony and insights on this topic.

As a nation, we have entered a pivotal stage where we have not one, but several emerging clean energy technologies that have the potential to reshape and improve our economy. We have advanced and modular nuclear demonstration reactors being designed and built right now that, when completed, will give investors the confidence they need to make them the backbone of our electrical grid and improve reliability.

We have fusion, right, Representative Lofgren? The holy grail of energy, making strides in defining—in being able to be realized in years rather than decades. We have energy storage technologies making leaps in performance and safety, which, when paired with

new smart grid technologies, will make intermittency concerns with renewable energy a thing of the past. These energy technologies are poised not only to decarbonize the electrical grid, but to make it more resilient, reliable, and secure in times of climate disasters.

In my home State of North Carolina, we are seeing hurricanes becoming increasingly stronger in the wake of climate change, and we need our grid infrastructure to improve accordingly. And clearly, we have also seen this in Texas, California, and throughout our country.

We also need to continue to support partnerships that share advanced computing resources between the national laboratories and NOAA (National Oceanic and Atmospheric Administration) that will enable more accurate forecasting of weather and climate events, allowing first responders to prepare ahead of time, and potentially save lives and property.

And, as I've come to understand, at the forefront of all of these technologies and partnerships is the Department of Energy's national laboratory network. I'm looking forward to hearing from our expert witnesses on the valuable work the national laboratories are doing, how they are improving the security of our communities, and what Congress can do to support their work.

That said, I'm also deeply concerned about the impact of the Administration's blanket freeze on Federal funding provided by the *Bipartisan Infrastructure Law* in flagrant violation of several recent court orders. It is undermining the ability of these labs, in partnership with the private sector, to strengthen our grid and prevent future severe impacts on our communities. So I'll be digging into that as well.

[The prepared statement of Ms. Ross follows:]

Good morning and thank you, Chairman Weber, for convening this hearing today to discuss the importance of the national laboratory network to preserving our nation's leading edge in science, and in developing the energy solutions and workforce of tomorrow. I also want to thank our distinguished witnesses for being here to share your testimony and insights on this topic.

As a nation, we have entered a pivotal stage where we have not one, but several emerging clean energy technologies that have the potential to reshape and improve our economy. We have advanced and modular nuclear demonstration reactors being designed and built right now that, when completed, will give investors the confidence needed to make them the backbone of our electrical grid. We have fusion, the holy grail of energy, making strides now defined in years, not decades. And we have energy storage technologies making leaps in performance and safety, which, when paired with new smart grid technologies, will make intermittency concerns with renewable energy a thing of the past.

These energy technologies are poised to not only decarbonize the electrical grid, but to make it more resilient, reliable, and secure in times of climate disasters. In my home state of North Carolina, we are seeing hurricanes becoming increasingly stronger in the wake of climate change, and we need our grid infrastructure to improve accordingly. We also need to continue to support partnerships that share advanced computing resources between the national laboratories and the National Oceanic and Atmospheric Administration that would enable more accurate forecasting of weather and climate events, allowing first responders to prepare ahead of time, and potentially save lives.

And as I have come to understand, at the forefront of all these technologies and partnerships, is the Department of Energy's national laboratory network. I am looking forward to hearing from our expert witnesses on the valuable work the national laboratories are doing, how they are improving the security of our communities, and what Congress can do to help.

That said, I am also deeply concerned about the impacts that this Administration's blanket freeze on federal funding provided by the *Bipartisan Infrastructure Law*—in flagrant violation of several recent court orders—is undermining the ability

of these labs in partnership with the private sector to strengthen our grid and prevent future severe impacts on our communities. So, I will be digging into that as well.

With that, I thank you Mr. Chairman, and I yield back.

Ms. ROSS. Now, Mr. Chairman, I want to ask unanimous consent to waive onto the Committee Representative Bill Foster for the purpose of asking questions of the witnesses during this hearing.

Chairman WEBER. Without objection, so ordered.

Ms. ROSS. Thank you, Mr. Chairman, and I yield back.

Chairman WEBER. Thank you, Ranking Member Ross.

Without objection, Chairman Babin's opening statement will be included in the record.

[The prepared statement of Chairman Babin follows:]

Good morning everyone. I want to thank my great friend from Texas, Chairman Weber, and the Energy Subcommittee for holding their first hearing this Congress on the importance of the U.S. Department of Energy's National Laboratories.

As another friend, former Texas Governor and U.S. Energy Secretary Rick Perry, once said, DOE's 17 National Labs are the "crown jewels" of American science—I couldn't agree more.

I'm grateful we have four esteemed Lab Directors here today, and I'm eager to dive into and hear more about the often-overlooked issue of maintaining the "crown jewel" status of our National Labs.

Many people often focus on topline research spending or shiny new facilities, and while still important, they forget that some of these labs date back to World War II. As a result, essential systems like electrical and water infrastructure are well beyond their expected lifespan.

It is crucial for the federal government to balance the development of new facilities with the maintenance of legacy infrastructure to ensure American preeminence in the coming decades. It is equally important to appropriately prioritize high-risk, high-reward basic research that does not crowd-out private sector investments, rather than favoring special interest groups.

Without appropriately balancing these efforts, there could be major impacts on the overall quality of science conducted at the laboratories and the ability to recruit the best and brightest talent.

Speaking of recruiting—it's becoming just as big of a challenge as funding and scientific complexity. This is largely due to the growing capabilities of our global competitors. Make no mistake: the United States is challenged by the Chinese Communist Party (CCP) across multiple emerging sectors, including space, nuclear fusion, quantum, and artificial intelligence.

They are significantly increasing their spending to attract a growing share of the world's top researchers within their borders. This is a clear attempt to outmaneuver the U.S. and lead in technological innovation.

Let me be clear: the CCP represents a significant threat to our American way of life, focused on intimidation and suppression instead of collaboration and freedom. Our nation has always taken pride in and prioritized an open and cooperative research environment. I hope to learn more today about how the National Laboratories are striking the right balance on research security.

It is imperative that they ensure that key U.S. technologies are protected while also engaging with the hard-working scientific community, who are vital for out-innovating our competitors.

We are also witnessing remarkable advancements in several emerging technologies that are shaping our future. The steps taken by the SST Committee this Congress will significantly impact the development of these technologies in large part by the National Labs, ensuring their successful rollout by the private sector.

I know Idaho National Lab, represented by one of our Directors here this morning, is working closely with a number of small modular reactor startup companies with the hopes of revolutionizing how we see the nuclear industry.

I also understand that Lawrence Livermore is collaborating with the growing commercial fusion sector, which hopes to deliver power to the grid in the next decade. These technological advancements are vital to powering the artificial intelligence expansion currently happening across the globe.

Once again, I cannot overstate the importance of the work our National Laboratories do to safeguard our national security and strengthen America's economic competitiveness and energy security.

I would like to thank our witnesses for their testimony, and I look forward to the important conversation about to take place.

Thank you, Mr. Chairman. I yield back.

Chairman WEBER. I now recognize the Ranking Member of the Full Committee for a statement.

Ms. LOFGREN. Well, thank you, and good morning, Chairman Weber and Ranking Member Ross, and thank you to the witnesses who got here through a snowstorm. We appreciate the effort that you've taken to be here today.

The Department of Energy, as we know, oversees 17 world-class national laboratories and an array of programs focused on ensuring U.S. leadership in clean energy industries of the future and keeping our Nation on the forefront of scientific discovery. The Department also has the solemn responsibility of stewarding and ensuring the reliability of our nuclear weapons stockpile.

Often for broad bipartisan hearings like this, where a major focus is on introducing our Committee's many new Members to the full range of exciting facilities and projects that the Department oversees, here is where I'd pivot to a favorite subject of mine that the Ranking Member just referenced, and that's fusion energy. We'll certainly get to that. And I'm very appreciative that we have the Director from Lawrence Livermore National Lab with the NIF (National Ignition Facility) facility here today.

I'm deeply disturbed, I will say, by the actions of the current Administration and its severe impacts on the entire research enterprise, including national labs. Funds appropriated by Congress to accelerate the development and deployment of a broad range of technologies have been arbitrarily and indefinitely frozen, and the new Director of the White House Office of Management and Budget (OMB) has threatened to make a large portion of these so-called pauses permanent by violating the *Impoundment Control Act of 1974*, and even more alarmingly, the power of the purse vested to Congress in Article 1 of the U.S. Constitution.

I'm also concerned about the assault on diversity in science. I remember last year's Chairman of the Committee in response to an amendment about broadening the scope, saying those good old boys in rural Oklahoma never get a chance to compete, we can't leave behind any bright mind in America. And it's worth remembering that not everybody has the same level of wealth and access to get in and compete. This is all about competition and merit and opportunity.

Lastly, I want to say that it is really unconscionable that the critical missions of the Department of Energy could now be catastrophically undermined by an ill-informed, unelected billionaire and his deeply inexperienced minions. We know that the new Secretary of Energy personally granted access to DOE's IT (information technology) system to personnel associated with the so-called Department of Government Efficiency, or DOGE, over the objections of DOE's own Offices of General Counsel and the Chief Information Officer. They objected in part because a 23-year-old member of DOGE had not undergone the standard background check normally required to gain access to this highly sensitive data. The risk is further heightened due to the enormous financial conflicts of in-

terest that Mr. Musk, as CEO (Chief Executive Officer) of Tesla, has with DOE.

This is why Ranking Members Deborah Ross, Emilia Sykes, and I recently sent a letter to the Secretary requesting a full account of DOGE's activities at the Department and the specific access that had been provided to proprietary as well as classified data. This breach is all the more galling given that Tesla itself received a \$465 million loan from the DOE Loan Program Office in 2010 that played a crucial role in the company's rise as a global leader in electric vehicles. There appears to be no end of the hypocrisy that these folks are willing to engage in.

All this said, I recognize that the witnesses before us today are certainly not responsible for the radical actions of this new Administration, even if they have been forced to address and mitigate their consequences as best they can. So I truly look forward to this discussion to better understand these impacts and to chart a better path forward for our country's best and brightest minds.

I look forward to hearing from the panel about recent advancements in the fusion industry. I do want to celebrate that this Committee has always operated in a bipartisan manner. That goes back decades. And I'm cheered by Chairman Weber's call that the science in *CHIPS and Science* be fully funded up to the authorized level. That is an important statement, Mr. Chairman.

And with that, I yield back.

[The prepared statement of Ms. Lofgren follows:]

Good morning and thank you, Chairman Weber and Ranking Member Ross, for holding this important hearing today. And thank you to this excellent panel of witnesses for being here this morning. The Department of Energy oversees 17 world-class national laboratories and an array of programs focused on ensuring U.S. leadership in the clean energy industries of the future, and on keeping our nation at the forefront of scientific discovery. The Department also has the solemn responsibility of stewarding and ensuring the reliability of our nuclear weapons stockpile.

Often for broad, bipartisan hearings like this where a major focus is on introducing our Committee's many new Members to the full range of exciting facilities and projects that the Department oversees, here is where I'd pivot to a favorite subject of mine, and that's fusion energy. And we'll certainly get to that. However, these are not normal times.

I am deeply disturbed by the actions of this Administration and its severe impacts on our nation's entire research enterprise, including the national labs. Funds appropriated by Congress to accelerate the development and deployment of a broad range of clean energy technologies have been arbitrarily and indefinitely frozen. And the new Director of the White House's Office of Management and Budget has threatened to make a large portion of these "pauses" permanent by violating the *Impoundment Control Act of 1974* and, even more alarmingly, the power of the purse vested to Congress in Article 1 of the U.S. Constitution.

The widespread assault on any federally supported individual or program involved in enhancing the diversity, equity, inclusion (DEI), and accessibility of our research enterprise is also frankly staggering. I want to be very clear about this. The talking point from the President, on down to justify these draconian actions is that we need revert to an entirely merit-based system. Well, I couldn't agree more that that should be our shared goal. But what the Administration is willfully failing to even try to understand is that while every American should have an equal opportunity to succeed, not every American is born into the same level of wealth and access. The Labs' broadening participation programs were never about undermining merit. They were about creating pathways for all Americans. If we continue to leave half or more of our nation's brainpower behind, we will never compete with China. Further, in most cases these efforts are required by statute.

Lastly, I must say that it is unconscionable that the critical missions of the Department of Energy could now be catastrophically undermined by an ill-informed, unelected billionaire and his deeply inexperienced minions. We know that the new Secretary of Energy personally granted access to DOE's IT system to personnel asso-

ciated with the so-called “Department of Government Efficiency,” or DOGE, over the objections of DOE’s own offices of General Counsel and the Chief Information Officer.

They objected in part because a 23-year-old member of DOGE had not undergone the standard background check normally required to gain access to this highly sensitive data. The risk is further heightened due to the enormous financial conflicts-of-interest that Elon Musk, as CEO of Tesla, has with DOE. This is why Ranking Members Deborah Ross, Emilia Sykes, and I recently sent a letter to the Secretary requesting a full account of DOGE’s activities at the Department and the specific access that they have been provided to proprietary and classified data.

This breach is all the more galling given that Tesla itself received a \$465 million loan from the DOE Loan Program Office in 2010 that played a crucial role in the company’s rise as a global leader in electric vehicles. There appears to be no end to the hypocrisy that these folks are willing to engage in.

All this said, I recognize that the witnesses before us today are certainly not responsible for the radical actions of this new Administration, even if they have been forced to address and mitigate their consequences as best they can. So, I truly look forward to this discussion to better understand these impacts, and to chart a better path forward for our country’s best and brightest minds. And yes, I look forward to hearing from the panel about recent advancements in fusion energy development.

With that I yield back.

Chairman WEBER. Thank you, Ranking Member Lofgren.

I’ll now introduce our witnesses. Our first witness today is Dr. John Wagner, the Director of Idaho National Laboratory. Our next witness is Dr. Thom Mason, the Director at Los Alamos National Laboratory. Our third witness is Dr. Paul Kearns, the Director at Argonne National Laboratory. And our final and—some would argue—best witness is Dr. Kimberly Budil, the Director at Lawrence Liverpool National Laboratory.

I now recognize Dr. Wagner for 5 minutes.

**TESTIMONY OF DR. JOHN WAGNER,
DIRECTOR, IDAHO NATIONAL LABORATORY**

Dr. WAGNER. Thank you. Chairman Weber, Subcommittee Ranking Member Ross, and Ranking Member Lofgren, it’s a pleasure to be here. Thank you for having me in this discussion today. My name is John Wagner. I’m the Director at the Idaho National Laboratory, the Nation’s center for nuclear energy research and development (R&D). I also serve as the Chair of the National Directors—National Laboratory Directors Council.

I considered it to be a true honor to be a part of a system tasked with finding solutions to our Nation’s greatest energy and security challenges. On a personal note, my first professional experiences as a college student was during internships in the summertime at Oak Ridge National Laboratory and Los Alamos National Laboratory. These experiences opened my eyes to amazing possibilities and had a profound impact on my career and on my life.

After beginning in the private sector, I worked at Oak Ridge National Laboratory for nearly 17 years before my passions for nuclear energy brought me to Idaho in 2016 as the Chief Scientist of the Materials and Fuels Complex, and later became Lab Director in 2020. As Energy Secretary Chris Wright recently wrote, “DOE’s R&D enterprise is the envy of the world.” Originating during the Manhattan Project, our national labs have achieved breakthroughs that have literally changed the path of human history and ensured American scientific and technical leadership.

Mastery of today’s new technologies is vital for our future global leadership. We must, as a nation, understand and be first in find-

ing answers to questions that will determine how future generations live. Questions such as, how do we leverage our abundant energy resources for our power prosperity? How do we innovate to ensure durable, stable energy dominance through fission, fusion, and other technologies? How do we harness AI (artificial intelligence), exascale computing, quantum computing to provide breakthroughs and solutions to benefit American people and American industry? How do we ensure domestic production of strategic and critical minerals and materials to secure our supply chain? How do we secure our grid and other critical infrastructure for the reliable delivery of necessary energy and water? And how do we ensure U.S. national security at home and abroad? The experts at our national laboratories are hard at work finding these solutions to these pressing challenges.

At the same time, they're constantly looking ahead over the horizon to be prepared for future challenges. Our labs design and operate unique facilities and unparalleled scientific instruments that enable a greater understanding of the origin of the universe, fundamental properties of materials, behaviors of biological systems, and development and delivery of pharmaceuticals, and so much more.

Within the DOE national laboratory system, there are three applied energy laboratories. Idaho National Laboratory is one of them, also the National Energy Technology Laboratory and the National Renewable Energy Laboratory. These applied energy laboratories, working together, play a crucial role in driving energy innovation for the Nation.

At INL, we have made historic contributions to our Nation's energy and national security. Notable achievements include first demonstration of nuclear power, which now provides nearly 10 percent of the electricity around the world and nearly 20 percent of the U.S. electricity, and also in the development of nuclear propulsion, which has played a key role in establishing U.S. Naval military dominance.

Today, INL is helping maintain and extend the lives of America's nuclear reactor fleet, while working with industry to demonstrate and deploy the next generation of nuclear power. Long-time nuclear leaders like Westinghouse, General Electric, Holtec, Southern Company, and a long list have joined with a growing number of nuclear startups like TerraPower, X-energy, Oklo, Kairos, Radiant, Lightbridge, and many others—sorry, I'm not going to be able to mention all of them—collaborating with the laboratories on innovative reactor designs, fuel development, and associated technologies to address and expanding completion—or expanding variety of energy use cases.

Our advanced reactor testbeds are nearing completion, and in the next few years, will enable multiple private sector reactor demonstrations, derisking these technologies to support commercial adoption and deployment. We see an example of this as U.S.-based refinery and chemical production companies are funding engineering evaluations for power, steam, heat, and hydrogen production from existing nuclear power plants, as well as advanced reactors. In support of these emerging technologies, U.S.-based Bloom Energy, FuelCell Energy, General Electric, and others are using the

capabilities at Idaho National Laboratory to demonstrate high-temperature electrolysis to produce hydrogen and oxygen.

But every DOE lab has exciting stories to tell, stories of harnessing research and development for the benefit of the American people and our industries. I believe that our 17 national laboratories are a primary difference-maker, our Nation's ace in the hole if you will, that will enable us to win the competition between nations, enhance our standing as a world leader in energy and technological innovation, and ensure our economic prosperity.

In closing, I appreciate very much the opportunity to be a part of this discussion, and I look forward to your questions.

[The prepared statement of Dr. Wagner follows:]

TESTIMONY OF DR. JOHN C. WAGNER
DIRECTOR, IDAHO NATIONAL LABORATORY
BEFORE THE ENERGY SUBCOMMITTEE
UNITED STATES HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

***Leveraging the Department of Energy National Laboratories to
Unleash American Energy Dominance***

FEBRUARY 12, 2025

Chairman Babin, Ranking Member Lofgren, Subcommittee Chair Weber, Subcommittee Ranking Member Ross, and distinguished members of the subcommittee, thank you for your interest in the U.S. Department of Energy's (DOE) 17 national laboratories and for the opportunity to be here today. My name is John Wagner, and I am the director of the Idaho National Laboratory (INL), the nation's nuclear energy research and development center. In this role, I lead a DOE national laboratory with approximately 6,300 scientists, engineers and support staff and multiple nuclear and non-nuclear experimental facilities, focused on changing the world's energy future and securing our nation's critical infrastructure.

I hold a Bachelor of Science degree in Nuclear Engineering from the Missouri University of Science and Technology and Master of Science and Doctorate degree in Nuclear Engineering from Penn State. My first professional experiences were summer internships at Oak Ridge and Los Alamos National Laboratories, which had a profound effect on the career. My first position following graduate school was with a private company designing and licensing spent nuclear fuel storage and transportation systems. I then returned to Oak Ridge, where I worked from 1999-2016, holding various positions of increasing responsibility, ultimately becoming director of the Reactor and Nuclear Systems Division. In February 2016, I joined INL as the chief scientist for the Materials and Fuels Complex, before becoming the associate laboratory director for the Nuclear Science and Technology Directorate. I am the author and co-author of more than 170 refereed journal and conference articles, technical reports, and conference summaries. I am a Fellow of the American Nuclear Society and the American Association for the Advancement of Science.

I am currently serving as chairman of the National Laboratory Directors' Council (NLDC). The NLDC consists of the directors of the 17 DOE laboratories. As Energy Secretary Chris Wright recently wrote in a memo, DOE's "R&D enterprise is the envy of the world." Our national laboratories have achieved multiple breakthroughs that have literally changed the

path of human history, improved the quality of life for people across the world, and unleashed American energy innovation. The DOE mission is critical to American security and prosperity. Our system of national laboratories are key drivers of that mission and set the United States apart from other nations.

The National Laboratory System

The origins of the national laboratory system can be traced to the Manhattan Project. By bringing together our best minds, taking an integrated approach to large-scale, interdisciplinary research, and developing world-class facilities, our nation won the race to develop atomic weapons and ensured freedom across the globe. From this successful enterprise, and supported by significant government investment, emerged a model for a national laboratory system that has played a crucial role in driving the U.S. economy and bolstering our national security.

The list of national laboratory accomplishments is extraordinary and long¹, but a few notable achievements include first demonstration of nuclear power, which now provides approximately 10% of electricity around the world and nearly 20% in the United States, and development of nuclear propulsion, which has played a key role in establishing U.S. naval military dominance. Both took place at Idaho National Laboratory.

Astonishing accomplishments in basic science, including decoding DNA, detecting neutrinos and discovering dark matter also trace their origins to our national labs. National labs have advanced supercomputing and are at the forefront of exascale and quantum computing. They help power NASA spacecraft with plutonium-238. They invent new materials that enhance industry and improve lives, and they have discovered 22 elements.

More recently, the fusion ignition at Lawrence Livermore National Laboratory was a landmark achievement, with significant implications. Our nation has built an unequalled innovation ecosystem with the 17 DOE national laboratories, and they are prepared to continue to unleash American energy, ingenuity, and innovation.

By working in partnership, our nation's private sector, academic sector, and the DOE laboratories have ensured American science and technology dominance, retaining and even expanding upon our historic position as the world leader in ideas, ideals, economic output, and security. The national laboratories are uniquely positioned and singularly capable of meeting today's challenges to our science and technology preeminence.

¹ <https://www.energy.gov/articles/75-breakthroughs-americas-national-laboratories-0>

Innovative breakthroughs in energy and national security are made possible by unique scale and scope of the national laboratory system: our world-leading research facilities and world-class workforce; our commitment to use mission-driven basic research; our pre-competitive applied energy research that compliments industry's efforts; and our partnerships with the private sector, utilities, and developers of innovative energy technologies. An important aspect of ensuring American exceptionalism today and into the future is making sure our research, facilities, and capabilities are secure and thriving.

The national laboratories draw on talent from around the world to work with U.S. citizens performing groundbreaking science while also gaining critical insights into the capabilities of both our allies and adversaries through international collaboration and engagement. DOE and its national laboratories use a managed research environment to balance the risks and benefits of this international scientific collaboration, and to protect taxpayer-funded research and intellectual property from foreign exploitation and exfiltration. We have a strong and time-tested process that effectively screens entry, manages access to key information, monitors activities, and manages risk.

World Class Facilities and Capabilities

Our labs conduct Big Science that is not possible anywhere else. They design and operate first-of-a-kind science instruments that enable a greater understanding of the origins of the universe, fundamental properties of material, behaviors of biological systems, and development and delivery of pharmaceuticals. The labs steward an unparalleled collection of world-class facilities, including supercomputers, nuclear reactors, light and neutron sources, colliders and many others as a direct result of strategic needs assessments and long-range planning carried out by the DOE.

The unrivaled infrastructure of the DOE national laboratories gives the U.S. a competitive advantage and enables extraordinary achievements that drive our economy, ensure national security, and improve the standard of living for all Americans. The national laboratories know how to successfully build and operate large, complex facilities that enable the achievement of exceptional science. Critical investments in DOE facilities and capabilities, including the world's fastest supercomputers, have made life better for all Americans.

The National Labs Will Enable U.S. Leadership for a Prosperous Future

Mastery of today's new technologies is vital to future global leadership. We must, as a nation, understand and be first in finding answers to questions that will determine how future generations live. Questions such as:

- How do we leverage abundant American energy resources to power prosperity?
- How do we innovate to ensure durable, stable energy dominance through fission, fusion, and other technologies?
- How do we harness AI, exascale computing, and quantum computing to provide breakthroughs and solutions that benefit American people and industry?
- How do we ensure domestic production of strategic and critical minerals and materials for supply chain security?
- How do we secure our grid and other critical infrastructure for the reliable delivery of necessities like energy and water?
- How do we ensure U.S. national security, at home and abroad?

And while the experts at our national laboratories are hard at work finding solutions to these pressing challenges, they are also constantly looking ahead, over the horizon, to be prepared for future challenges. Our nation has invested billions of dollars into this ecosystem, allowing the United States to grow a national laboratory complex that is both the envy of the world and our path to a more prosperous and secure future.

Those of us fortunate enough to work at a national lab understand what a privilege it is to be entrusted with finding solutions to the nation's most pressing science, energy, and security challenges. We are grateful for the investments made by our fellow citizens and the opportunity to change the world for the better through science, learning, and innovation. And we understand the importance of continued investments into national laboratory research, and the incredible results that can be achieved on behalf of the American people.

Ensuring American Energy Dominance

Within the DOE national laboratory system, there are three applied energy laboratories: Idaho National Laboratory (INL), National Energy Technology Laboratory (NETL), and National Renewable Energy Laboratory (NREL). The applied energy labs play a crucial role in driving innovation and ensuring the United States remains competitive in the global energy landscape. Our nation's applied energy laboratories are uniquely positioned to play critical roles in achieving the American energy dominance goals outlined by Energy

Secretary Chris Wright in a memo to DOE leaders, specifically advancing energy addition, unleashing American energy innovation, strengthening grid reliability and security, and unleashing commercial nuclear power in the United States.

The labs drive innovation and achieve positive results for the American taxpayer in an incredible variety of ways, often in partnership with private companies. By conducting research that makes the extraction, processing, and utilization of fossil fuels and other critical resources more efficient. By supporting development of advanced nuclear reactors and fuel cycles. By helping modernize the electric grid and advancing energy storage solutions. By improving the efficiency and sustainability of transportation systems.

At Idaho National Laboratory, we are rising to this challenge and providing leadership in energy development and critical infrastructure cyber-physical security. We have a long history of helping our nation develop the energy needed to power economic prosperity and bolster national security. Today, INL is helping maintain and extend the lives of America's high-performing nuclear reactor fleet while working with industry to demonstrate and deploy the next generation of nuclear power.

Longtime nuclear leaders, like Westinghouse, General Electric, Holtec, and Southern Company, and a growing number of nuclear startups, like TerraPower, X-energy, Oklo, Kairos, Radiant, Aalo Atomics, Antares, Lightbridge, and many others are collaborating with national laboratories on innovative reactor designs, fuel development, and associated technologies to address an expanding variety of energy use-cases. Our advanced reactor test beds are nearing completion and in the next few years will enable multiple private-sector reactor demonstrations – de-risking these technologies to support commercial adoption and deployment. Also in the next few years, INL will begin operating three new nuclear systems on our site, including: the Microreactor Applications Research Validation and Evaluation, or MARVEL, microreactor; Project Pele, a mobile microreactor being developed by BWXT for the Department of Defense; and the Molten Chloride Reactor Experiment, or MCRE, an experiment being developed in partnership with Southern Company and TerraPower.

INL plays a crucial role in ensuring the resilience and security of our nation's most critical infrastructure, conducts groundbreaking hydrogen and biomass research, and is developing an Energy Technology Proving Ground that will enable industry partners to demonstrate at-scale technologies and accelerate the transition of innovations from the laboratory to the marketplace while providing a cultural foundation of excellence and collaboration, guiding decision-making and strategic execution.

The next horizon – Artificial Intelligence and Machine Learning

One of the things that national laboratories do best is collaborate, leveraging capabilities and expertise across multiple labs, to address big problems with important outcomes for our nation. AI is an opportunity for the labs to do just that. Frontier AI has potential to transform DOE's national security, energy security, and scientific mission areas. The nation that masters frontier AI will have a competitive advantage technologically, economically, and militarily for decades to come.

The national laboratories have long been America's leader in solving complex challenges that fall beyond the capabilities of industry alone, bringing teams together to unlock groundbreaking technologies. In 2017, Google's invention of transformers propelled a new class of generative AI technologies that has led to tools such as OpenAI's ChatGPT across broad engineering, scientific, academic, and household use. Work through DOE's Exascale Computing Program led to the development of critical components of the GPU chips now essential for advanced simulations and AI.

America has leveraged its lead in semiconductor and software engineering to achieve breakthroughs across the field of AI, balancing large data and computer infrastructures, with new reasoning technologies such as test-time compute available in ChatGPT O1. However, our technological lead is rapidly shrinking.

Recently, China's DeepSeek R1 model shocked major media organizations around the world, as the model reached parity across many benchmarks when compared to the latest American production AI models, putting American leadership under threat. Chinese advancements in generative AI technology have been progressing over the last year.

The United States must further accelerate its advances in AI to maintain our competitive advantage. DOE's AI initiative provides an opportunity to unlock transformative, advanced energy technologies to propel America's energy dominance. Advanced frontier AI systems can dramatically reduce costs, accelerate deployment schedules, and semi-automate regulation to quickly dominate world-wide energy generation.

AI and machine learning have the potential to transform energy innovation by optimizing system performance, enhancing predictive maintenance, and accelerating the development of cutting-edge technologies. By integrating AI/ML with high-performance computing, DOE labs are unlocking efficiencies across the energy sector and expediting the creation of advanced materials.

An AI partnership

The nation's applied energy laboratories are leveraging their existing collaborative partnerships to develop frontier AI systems at forefront of American technological capabilities. These laboratories have a long history of partnering with the energy industry, computational industry, government regulators, and the university ecosystem to solve national energy challenges. By leveraging the innovation ecosystem of the applied energy labs to advance AI for energy dominance we can accelerate research in key areas to:

- Secure and automate grid operations, autonomously balancing energy supply and demand, ensuring disaster recovery and remediation of all hazard events in energy delivery systems.
- Transform the design and discovery of new energy materials.
- Discover new sources of critical minerals and natural resources needed for natural gas, coal, advanced semiconductors, nuclear energy, and other advanced technologies.
- Accelerate the deployment of nuclear energy systems to propel AI and data center communities.

There is also an incredible opportunity to accelerate the deployment of nuclear energy to power data centers and meet the dramatically increased energy demand of our technology sector². Focused AI efforts to accelerate the development and deployment of new reactors at the speed and scale to meet our nation's energy demands will include:

- Autonomous Design, Development, and Licensing
- Autonomous Operations
- Nuclear Energy Research and Development
- Proof of Concept First Deployment of an Advanced Reactor with a Data Center at a National Laboratory

This initiative holds the potential to significantly reduce nuclear power plant costs at all phases of design, construction, licensing, and operation, transforming American

² <http://eta-publications.lbl.gov/sites/default/files/2024-12/lbnl-2024-united-states-data-center-energy-usage-report.pdf>

leadership in nuclear energy and ensuring dominance of both nuclear energy and AI for another generation.

A crucial moment in history

We live in a period of great competition between nations. Innovation is essential to maintaining America's economic, technological, and military leadership. To meet this challenge, we will need to move faster, which requires us to evaluate our current operational model and look for increased efficiency and productivity. We must lean into our strengths as a nation to compete with our adversaries and advance U.S. leadership across the world. One of these strengths is a system of national laboratories considered by many to be one of our nation's crown jewels.

The national laboratories have shown they must play a crucial role in ensuring American exceptionalism. I believe that our 17 national labs are a primary difference maker, our nation's "ace in the hole," that will enable us to win this competition between nations, enhance our standing as the world leader in energy and technological innovation, and ensure economic prosperity and security for future generations of Americans.

I believe that, working together, we can accomplish our goals and, through an acceleration of innovation, strengthen the reliability and security of our nation's energy system, ensure American energy dominance at home and abroad, and enhance our national security.

I appreciate the opportunity to testify, and I want to thank the subcommittee for its interest in the labs and the important work they do for our nation. I look forward to your questions.



Biography

John C. Wagner, Ph.D.

Director, Idaho National Laboratory

Dr. John C. Wagner is the director of Idaho National Laboratory and president of Battelle Energy Alliance LLC. He is responsible for management and integration of a large, multipurpose laboratory that has a mission focused on nuclear energy, national and homeland security, and energy and environment science and technology. He manages this U.S. Department of Energy (DOE) national laboratory of approximately 6,000 scientists, engineers and support staff members in multiple nuclear and nonnuclear experimental facilities, with an annual budget of more than \$2 billion.

Wagner began serving as INL director in 2020. He has more than 25 years of experience performing research, and managing and leading research and development projects, programs and organizations. Wagner initially joined INL as chief scientist at the Materials and Fuels Complex in 2016 and served as associate laboratory director for Nuclear Science and Technology beginning in 2017.

Wagner earned a bachelor's in nuclear engineering from the Missouri University of Science and Technology in 1992, and master's and doctorate degrees from the Pennsylvania State University in 1994 and 1997, respectively. Following graduate school, Wagner joined Holtec International as a principal engineer, performing criticality safety analyses and licensing activities for spent fuel storage pools and storage and transportation casks. Wagner joined Oak Ridge National Laboratory as a research and development staff member in 1999, performing research in the areas of hybrid (Monte Carlo/deterministic) radiation transport methods, burnup credit criticality safety, and spent nuclear fuel characterization and safety.

While at Oak Ridge, Wagner held various technical leadership positions, including technical lead for postclosure criticality in support of DOE Office of

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Civilian Radioactive Waste Management's Lead Laboratory for Repository Systems, Radiation Transport Methods Deputy Focus Area lead for the Consortium for Advanced Simulation of Light Water Reactors, and national technical director of the DOE Office of Nuclear Energy's Nuclear Fuels Storage and Transportation Planning Project. Wagner held various management positions, including group leader for the Criticality and Shielding Methods and Applications, Radiation Transport, and Used Fuel Systems groups.

In 2014, Wagner became director of the Reactor and Nuclear Systems Division, with responsibility for management direction and leadership to focus and integrate the division's seven research and development groups (Advanced Reactor Systems and Safety, Nuclear Data and Criticality Safety, Nuclear Security Modeling, Radiation Transport, Reactor Physics, Thermal Hydraulics and Irradiation Engineering, and Used Fuel Systems) and the Radiation Safety Information Computational Center.

Wagner is a Fellow of the American Nuclear Society and the American Association for the Advancement of Science and recipient of the 2013 E.O. Lawrence Award. He has authored or co-authored more than 170 refereed journal and conference articles, technical reports, and conference summaries. He was the original developer of the A3MCNP and ADVANTG codes and led the development of the CADIS and Forward-Weighted CADIS hybrid transport methods.

Chairman WEBER. Thank you, sir.
 Dr. Mason, you're recognized for 5 minutes.

**TESTIMONY OF DR. THOM MASON,
 DIRECTOR, LOS ALAMOS NATIONAL LABORATORY**

Dr. MASON. Chairman Weber, Ranking Member Ross, and Members of the Committee, thank you for the opportunity to testify. I'm Thom Mason, the Director of Los Alamos National Laboratory. For more than 80 years, our lab, which is one of the 17 DOE national labs, played a critical role in advancing scientific discovery, technology development that strengthens U.S. security, economic competitiveness, and energy leadership.

Today, I will focus on three key areas: national security challenges in a rapidly evolving world, the role of artificial intelligence in defense and scientific advancement, and the need for infrastructure investment to sustain innovation.

Over the past 30-plus years, the geopolitical landscape has shifted from a bipolar cold war structure to a post-cold war environment where the United States was the sole superpower to the tripolar dynamic we see today with United States, China, and Russia compounded by independent and surrogate actors. This has created new challenges that demands technological innovation to maintain strategic stability.

A critical component of national security is energy security. The United States must invest in nuclear power as a stable energy source that reduces reliance on foreign supply chains, and Los Alamos is at the forefront of advancing reactor technologies in partnership with Idaho and fuel innovations that can support both national security and economic growth.

Today, however, in many areas, private sector investment in R&D is exceeding government investment, and that requires the labs to strengthen public-private partnerships to ensure that advancements align with national interests. Probably artificial intelligence is the best illustration of this dynamic. From a national security perspective, artificial intelligence is transforming global power dynamics faster than any other technology.

While the United States leads in areas of AI development, this lead is narrowing as China increases government investment in AI-driven defense and surveillance systems, which have the potential to undermine our legacy deterrent. AI is a force multiplier for national security, and Los Alamos is leveraging artificial intelligence to improve weapons simulations, to enhance deterrence, to strengthen cybersecurity against emerging threats, and optimize defense supply chains to ensure resilience.

However, our current AI efforts are not operating at the necessary scale. A national AI initiative is needed to apply the most advanced AI tools to national security challenges, to invest in classified AI infrastructure and high-performance computing and to maintain U.S. leadership in AI-driven deterrence strategies. The Nation that first scales AI for national security will shape global stability for decades.

Turning now to infrastructure, regrettably, aging research infrastructure does threaten innovation. At Los Alamos, many of our facilities essential for national security are outdated and in urgent

need of recapitalization. The Los Alamos Neutron Science Center, or LANSCE, is vital for nuclear certification, as well as medical isotope production, and it's more than 50 years old and requires modernization to maintain reliability. The LANSCE Modernization Project, which was recently approved for critical decision zero mission need is crucial for restoring full capability.

Similarly, our Explosive Research Complex, which supports national defense and warfighter safety, faces structural deficiencies that hinder critical research. These facilities must be updated to sustain scientific and defense innovation. The data from our experimental facilities is the raw material for training artificial intelligence, so investing in modern infrastructure is not just a scientific priority, it's a national security imperative.

Rapid technological advancements have also made technological surprise a growing concern. Unlike past areas where research could be tightly controlled, AI and emerging technologies are advancing, often in open-source environments, making them more difficult to monitor. To counter these risks, the United States must develop classified AI testbeds at the national labs to assess emerging technologies, leverage AI-driven intelligence to track adversarial advancements, and strengthen our collaboration with allies to maintain a strategic edge. The best way to prevent technological surprise is to lead in innovation and deployment. We must get there first.

Because private industry leads in AI and quantum computing and other disruptive technologies, the national labs must collaborate closely with industry to accelerate advancements and ensure they align with our public needs. At Los Alamos, we've already partnered with leaders like OpenAI and NVIDIA and can leverage the success of DOE's recently successfully concluded Exascale Computing Project to integrate AI into national security applications. Expanding these collaborations will accelerate scientific breakthroughs in national security applications, it will ensure that U.S. AI models drive innovation rather than foreign competitors, and it will keep us at the forefront of technological leadership across a broad range of scientific and engineering disciplines. Strong partnerships between national labs and private industry will drive American leadership in science, technology, and defense.

To ensure the United States remains the global leader in science security, we must take decisive action in three areas: launching a national AI initiative to maintain U.S. leadership in AI-driven security, investing in modern scientific infrastructure to sustain innovation, and expand public-private partnerships to accelerate technology development. This Committee plays a pivotal role in ensuring the United States does not fall behind. I urge you to support these investments in science, technology, and national security to secure our future.

Thank you, Mr. Chairman. I look forward to your questions.
[The prepared statement of Dr. Mason follows:]

Testimony of Dr. Thomas Mason
Director, Los Alamos National Laboratory
Before the Energy Subcommittee
House Science, Space, and Technology Committee
February 12, 2025

Chairman Weber, Congresswoman Ross, honorable members of the House Committee on Science, Space, and Technology, I am Thom Mason, Director of Los Alamos National Laboratory. Los Alamos is 1 of 17 Department of Energy laboratories, which have a rich history of providing groundbreaking scientific discoveries and technological innovations that have made America stronger through economic and national security impacts. As during the Manhattan Project when we developed the atomic bomb, Los Alamos' multidisciplinary scientific capabilities are brought to bear on complex national security challenges. We have helped achieve Vannevar Bush's post-World War II vision for the US to lead the world in scientific discovery and innovation through government investment and to leverage this leadership for a stronger, more secure, and more prosperous America. I am focusing today's remarks on national security, the changes in our labs, and the adjustments in our national approach that we believe are necessary for US strength and global security.

The world has changed significantly since the Vannevar Bush approach was launched, moving from a bipolar (Soviet—US) to a tripolar (Russia—US—China) environment with additional complexity due to surrogate and independent actors, leading to an erosion of the strategic stability we enjoyed for the latter part of the Cold War and the early post-Cold War era. This geopolitical environment requires innovation to ensure strategic deterrence and address the potential for disruptive technologies to undermine our legacy deterrent.

Access to abundant electricity is a national security advantage, which is why the nation would benefit from increased nuclear power generation. Los Alamos and other labs have made contributions to nuclear reactor designs and better fuels, and the labs are positioned to support national goals at the intersection of reactor research and development (R&D), power generation, and nuclear nonproliferation.

The US has the world's dominant economy, but this economy is no longer larger than that of the rest of the world combined. Private-sector investments in R&D now greatly exceed US government investments. As private companies continue to lead the world in research and technologies critical to national security, the national labs need to develop even stronger partnerships for the future.

Historically, the US has led scientific and technical innovation at scale. This is no longer the case in many areas. Large-scale science often requires significant investments in infrastructure (think of the large accelerators producing x-rays or neutrons needed to

understand the fundamental properties of materials). The international community has closed the gap through team science with the US and in competition with us. I believe that we need to substantially increase our investment in the infrastructure that enables the US to regain its leadership in big science, beginning with core national security facilities.

US companies lead the world in artificial intelligence (AI), but that lead is measured, at best, in months. China outpaces the US in government funding of AI and is likely on the front foot for adapting this critical capability for national security purposes. Los Alamos has already seen the value of AI tools for accelerating our current mission work, R&D, and operations. We also see the potentially transformative impact of the most recent advances in AI, such as reasoning capabilities and AI agents, which could enable Los Alamos to deliver solutions at an unprecedented pace. The main lesson learned from our AI efforts over the past several years is that we are not operating at the required scale to meet the security needs of the nation. I believe we urgently need a national initiative to apply the best AI tools, systems, and approaches offered by US industry to the science and innovation that drives national security, especially in existential areas like weapons of mass destruction. At the same time, a bold AI initiative for American security and prosperity will guard against attempts by adversaries to use these powerful technologies to gain an advantage.

Over a decade ago, my predecessor, Charlie McMillan, testified that the pace of change over the next decade was going to be significantly faster than that of the century before. He came out of retirement to work on AI because he recognized that it would not merely allow us to do things incrementally faster, but 10 to 100 times faster, which would in turn enable us to do things in a completely different way. Although gains in efficiency will be most welcome, the opportunity to change the pace of scientific discovery is transformational. AI is to today as the Industrial Revolution was to America in the late 1800s because scientific discoveries often serve to increase the potential for breakthroughs in other areas and because the gains compound over time.

The country that wins the race in applying AI at scale will not be caught. This new way of doing things and the significance of the potential impacts represent a new era of national security. America is positioned to lead this era through bold action by leveraging the advantages of our private sector and the ability to do research at scale.

Delivering on Deterrence

The US must deliver a contemporary nuclear deterrent without re-creating the Cold War infrastructure, thereby avoiding environmental complications and excessive costs. We must expand our use of AI and other approaches to accelerate all steps in the management of our nuclear weapon development and production and to find solutions for deterrence gaps outside of the nuclear domain. The use of AI will accelerate high-resolution simulations, helping bridge gaps across scales and physics that cannot currently be

captured within a single simulation code. It will assist in the discovery of new molecules and materials, which will enable supply chain resilience and security. AI will also lead to the optimization of the design, development, manufacturing, and qualification process, enabling a more responsive stockpile.

To realize these gains, the government must robustly invest in computational hardware, data preparation, and workforce. Full-time access to on-premises classified computing hardware at scale is a must. We have started to see what can be done with modest-scale AI using our recently installed Venado supercomputer on unclassified applications. The results are impressive, and to have an immediate mission impact, we have committed to moving this computer to our classified environment. While these results are significant, an important lesson learned is that the scales of the model (computer) and the available quality data matter.

The announcement by DeepSeek showed what can be done by thinking about training models in a different manner. Although DeepSeek has shown impressive baseline training using smaller computers, they also demonstrated that the quality of scientific data used in model training matters.

The Department of Energy has some of the best unclassified and classified scientific data in the world. It now must be converted into a form that can be harnessed for AI applications.

Many of the scientific tools used to design, certify, and assess our stockpile and conduct the underlying research across a range of disciplines are ageing and in need of revitalization for today's mission. The Los Alamos Neutron Science Center (LANSCE), which is one of the nation's preeminent particle accelerator facilities, is an example. The front end of the accelerator beam line at LANSCE was once state of the art, designed by Los Alamos for fundamental science and later adapted for use in weapons research. Today, that beam line powers one of the critical tools in weapons certification, produces isotopes for medical treatment, and guarantees the safety of all aircraft avionics. However, LANSCE is more than 50 years old and presently requires six months annually for maintenance and start up, delivering less than 50% of the scheduled production beam-hour the other half of the year. The LANSCE Modernization Project (LAMP), which recently achieved Critical Decision-0, would replace the front end of the beam line, ensuring greater reliability for a tool that is required for so many critical activities.

Other facilities, such as our explosives research complex, also need replacing. This facility dates to the early days of the Cold War and provides critical scientific research into the fundamentals of energetic materials, supporting our warfighters, law enforcement, and commercial industry. However, the building is plagued by challenges, such as leaking roofs and a lack of heat in the winter and cooling in the summer.

These are just two examples of facilities that need modernization. There are instances, though, where we can take advantage of prior investments that have resulted in state-of-the-art experimental capabilities. In a world of AI, verification and validation through experiments becomes even more valuable because experimental data is the raw material for training bespoke models. We are taking advantage of government investments in open science facilities by investing in new experimental capabilities at the Advanced Photon Source at Argonne National Laboratory, the Linac Coherent Light Source at Stanford, and the National Synchrotron Light Source II at Brookhaven National Laboratory. The ability to use these multi-billion-dollar facilities (rather than replicating them) helps us meet our mission needs in material evaluation and qualification and supports advancements in AI models.

Guarding Against Technological Surprise

In addition to the national labs' role in innovation, we must continue guarding against technological surprise. We know that AI will enable rapid technological development in ways that could bypass our strategic warning systems. Unlike the early days of the nuclear era where we could classify research and prevent the transfer of knowledge, we have reached a point where countries are advancing hardware and models despite actions we take. Given the pace of innovation, we should not be surprised at rapid advancements; however, in many cases, we only know about advancements because the developers wanted us to know.

For our country to know how adversaries may be using AI at scale, we must also be using the most recent frontier models. The US must be prepared to rapidly evaluate new technologies in classified settings and respond in short order. The best way to avoid surprise is to get there first.

In addition to leveraging an AI program established for our national security, the national laboratories can combine an AI effort with our unique infrastructures and experiences, acting as testbeds for national security and rapid countermeasure deployment.

Energy Dominance

The national labs have contributed to countless breakthroughs in energy production and stand poised to continue this tradition. One mission of Los Alamos is to help reduce the likelihood of nuclear weapons proliferation while supporting our national and economic security through the development of safeguards and proliferation-resistant nuclear energy technologies. We need to help expand technical options for US energy companies to compete domestically and globally and ensure that new technologies do not pose unwelcome proliferation concerns.

The same AI technologies used in the support of our nuclear deterrence mission can be used across the national laboratory complex to assist in addressing a host of energy

challenges. Our country needs to rapidly develop and approve new small modular reactor (SMR) designs, and we need better electrical-grid modeling to help properly site AI data centers. These challenges need to be solved to ensure American economic and national security dominance into the next century.

Protecting Space Access

As the need for all manner of satellites continues to increase, it is imperative that we maintain our edge in this arena. AI will be needed to accelerate our development of novel aerospace materials for flight vehicles, sensing and communications equipment, and to better project the errant flight paths of space debris. Los Alamos has been at the forefront of space technology since the first US satellite. We partner with the significant national security organizations in this area as well as with most of the private sector firms. Our goal is to assist in keeping the US in front of all competitors by supporting both the national security and commercial entities in this country. For example, we have already demonstrated the value of machine learning in forecasting space weather to mitigate the risks that solar activity poses to satellite communications.

Partnerships

Private industry in the US is outpacing the government in R&D investments. We must embrace the opportunities from AI created by industry to achieve national security objectives on much shorter timescales and potentially in more creative ways. This can only be done in partnership with US industry, as demonstrated at Los Alamos by our partnerships with OpenAI, Nvidia, and other US companies.

DOE and NNSA have unparalleled experience in these mission-driven public-private collaborations. Through the Exascale Computing Project (ECP), DOE worked with industry partners to co-design and develop critical components of the computing platforms that power today's leading AI models. Many of the key technologies being built into the massive AI training data centers were developed as part of the ECP.

This type of partnership is a win-win for our country. The government gets access to leading models while industry works with the laboratories to train their models on the best scientific data available in the world.

Offensive Footing

Much conversation over the past several years has focused on protecting access to technologies through export controls and to laboratories through greater entrance restrictions. As I learned over four years of work with National Academy of Science's Roundtable on Science, Technology, and Security (<https://nap.nationalacademies.org/catalog/27976/national-science-technology-and-security-roundtable-capstone-proceedings-of-a>), we must guard against efforts to

undermine our open research ecosystem. However, winning the competition for talent and ideas also demands efforts to increase the pace of our activities. We must double down on collaboration with allies who share our values and adhere to the norms of research to ensure we stay on the cutting edge in the fields of AI, nuclear power, materials, and space science.

Unfortunately, the “open science” international culture that we value and benefit from has been infected by countries that do not follow community standards and seek disproportionate advantages. We must continue to protect our work and technologies.

This does not mean that we should cut ourselves off from the rest of the world. Strict export controls and access requirements only slow our adversaries’ technological advancements. In the end, these restrictions drive our adversaries to accelerate their own indigenous capabilities and technological advancements. Export controls and restrictions on access can be valuable tools to limit harms, but their ability to influence competition is strongly dependent on the degree to which we are in a position of technological leadership.

The delays created by restrictions may buy us months, but if we are not taking advantage of these months to accelerate our own advancements, it does not matter. If we are to lead the world in energy production and technology development for our economic and national security, the government must invest boldly in science. China’s rapidly growing investments on science and technology does not distinguish between public and private or between military and civilian. This is leading to a shift in scientific leadership in the world. The Australian Strategic Policy Institute, which tracks research over 64 critical areas, recently showed that China now leads in 57 of the 64 areas—an increase from 3 areas in 2003–2007. The US, which led in 60 areas from 2003–2007, now only leads in 7. Should the US want to regain this leadership, the government must fund scientific research at the national labs in those areas where the end uses or timelines preclude private investments. The labs, in turn, should partner with industry and universities to leverage their advances and accelerate our pace of innovation.

We are facing a future with new and complex challenges. With decisive action and renewed commitment to leadership in science, we can help ensure a secure and prosperous America.

Thank you, Mr. Chairman, for the opportunity to present to the Committee today.



Thom Mason



Thomas (Thom) Mason is the President and CEO of Triad National Security, LLC (Triad) and serves as the Director of Los Alamos National Laboratory.

Most recently he was the Senior Vice President for Global Laboratory Operations at Battelle where he had responsibility for governance and strategy across the six National Laboratories that Battelle manages or co-manages.

Prior to joining Battelle, Thom worked at Oak Ridge National Laboratory (ORNL) for 19 years, including 10 years as the Laboratory Director. Under his leadership, ORNL saw significant growth in programs, new facilities, and hiring while achieving record low safety incident rates.

Before becoming Laboratory Director, he was Associate Laboratory Director (ALD) for Neutron Sciences, ALD for the Spallation Neutron Source (SNS), and Director of the Experimental Facilities Division.

During his time in Oak Ridge, Thom was active in the community serving as Chair of the Oak Ridge Public Schools Education Foundation as well as Innovation Valley, the Knoxville–Oak Ridge area regional economic development organization.

He moved to ORNL from the University of Toronto where he was a faculty member in the Department of Physics and previously worked as a Senior Scientist at Risø National Laboratory and a Postdoc at AT&T Bell Laboratories.

For the past 30 years, he has been involved in the design and construction of scientific instrumentation and facilities and the application of nuclear, computing, and materials sciences to solve important challenges in energy and national security.

Thom has a Ph.D. in Experimental Condensed Matter Physics from McMaster University and a BSc in Physics from Dalhousie University.

Chairman WEBER. Thank you, sir.

Dr. Kearns, you're now recognized for, I guess, 5 minutes.

**TESTIMONY OF DR. PAUL KEARNS,
DIRECTOR, ARGONNE NATIONAL LABORATORY**

Dr. KEARNS. Chairman Weber, Ranking Members Ross and Lofgren, Members of the Subcommittee, thank you, really, for the opportunity to appear before you today. It's my honor to discuss the Department of Energy's National Laboratories and the drive to innovation and science at scale which underpins the economy and our national security. I am Paul Kearns. I'm a Director of Argonne National Laboratory, which is stewarded by the Department of Energy's Office of Science, the largest funder of physical sciences across the Federal Government.

From advancing discoveries in materials science, biology, high-energy physics, and nuclear research, to driving innovations in fusion energy, isotope production, and computational science, the Office of Science fuels research that spans all 17 of the national laboratories, engaging—engages over 300 universities and higher learning institutions, and impacts every State in the union, plus Puerto Rico and Washington, D.C.

The Office of Science national laboratories featuring—feature leading-edge scientific facilities that are essential to the innovation ecosystem. They provide critical scientific capabilities that propel discovery and American innovation through partnerships with industry and academia. These facilities empower multidisciplinary teams to advance bold and innovative scientific and technological endeavors. They are also instrumental in attracting and retaining a talented workforce, vital for Argonne's success, and they offer staff opportunities to pursue meaningful careers working on matters of global scale and consequence.

Last year was a transformational year at Argonne, where we completed the upgrade of two of the Office of Science facilities, the Advanced Photon Source (APS), which provides very high-energy X-rays that researchers use to study complex materials and systems, NRR, one of the Nation's first exascale supercomputers capable of performing a billion billion calculations per second.

These facilities are complex engineering marvels. The \$850 million upgrade to the Advanced Photon Source replaced the facility's 30-year-old electron storage ring, 1 kilometer in circumference, with a state-of-the-art machine increasing X-ray brightness by up to 500 times. Aurora joins Frontier at Oak Ridge and El Capitan at Lawrence Livermore National Laboratory as the three fastest supercomputers in the world. These supercomputers dramatically accelerate research. Cosmological simulations that took years can now be done in months. And months of drug discovery are now reduced to days.

Last year's Nobel Prize Award in chemistry was a testament to the important contributions of the Office of Science facilities they're making to break through fundamental science. The light sources at Argonne, Brookhaven, Lawrence Berkeley, and SLAC National Laboratories identified 1/3 of the 180,000 protein structures in the Protein Data Bank that three Nobel Laureates trained AI models on to successfully predict the three-dimensional shape of proteins.

Knowing the three-dimensional shape of proteins is essential to designing new drugs because it is the protein's shape that defines which and how other molecules will bind to it. This achievement has been heralded as perhaps the very first time AI significantly advanced the frontiers of humanity's scientific knowledge and will make a significant contribution to the development of a vast new set of drug candidates for cancer and other diseases.

To continue Nobel-level scientific contributions, we must reinvest in laboratory infrastructure and facilities that drive discovery, innovation, and development of the industries of tomorrow. The facilities' capabilities and resident—expertise resident in the national laboratories are vital to expanding America's leadership in critical and emerging technologies such as artificial intelligence, quantum information science, and microelectronics, and to establishing the United States as the pace setter in the race of nations vying for supremacy in science and technology (S&T).

Adversaries like China are making significant investments in these industries. Our technological edge of today is not guaranteed. To maintain U.S. leadership and best position ourselves in this evolving geopolitical landscape, we must lean into our core strength in research and development, leverage our unique scientific assets, and bolster our partnerships.

One of the most significant roles of the national laboratories is their ability to develop strategic partnerships with industry and academia and to convene stakeholders to address complex challenges and opportunities. I could cite many examples, but a few that come to mind for me are Argonne-led collaboration with the Greater Houston Partnership, which is working with regional companies like Chevron and ExxonMobil, bringing in the laboratory's expertise in advanced manufacturing and lifecycle analysis to really help the opportunities and the challenges such as those associated with low carbon systems for base chemicals. We're also working with industry leaders that John mentioned earlier, Oklo and TerraPower, using Argonne's deep capabilities and advanced reactor technologies and the nuclear fuel cycle really to accelerate the commercialization of next-generation technologies.

Our country stands at a pivotal moment. Innovations of today will see transformational breakthroughs that will enable our future prosperity. Now is not the time to hold back. With renewed investments in the infrastructure and expertise of the laboratories, the United States can contribute to lead in emerging technologies such as AI, quantum computing, and advanced manufacturing. By accelerating and scaling our fundamental R&D infrastructure and strategic partnerships, the United States can secure its position as global science and technology leaders of the future.

Thank you for your continued support and the opportunity to testify today. I do look forward to the questions as well. Thank you.

[The prepared statement of Dr. Kearns follows:]

Testimony of Paul Kearns
Director of Argonne National Laboratory
Before the
Energy Subcommittee of the Committee on Science, Space, and Technology
U.S. House of Representatives
From Transformational Science to Technological Breakthroughs: DOE's National Laboratories
February 12, 2025

Introduction

Chair Babin, Ranking Member Lofgren, Subcommittee Chair Weber, Subcommittee Ranking Member Ross, and distinguished members of the Subcommittee, thank you for the opportunity to appear before you today. It is my honor to discuss how the Department of Energy's national laboratories drive scientific and technological innovations that are key to our nation's economic and national security.

I am Paul Kearns, Director of Argonne National Laboratory, one of the nation's first and largest multidisciplinary science and engineering laboratories within the DOE complex. Argonne is located in Lemont, Illinois, near Chicago, and we have been accelerating science and technology for American prosperity and security for almost 80 years.

I have spent the majority of my career in the DOE national laboratory system, driven by a deep commitment to the labs' unique mission of advancing transformative science and technology. I served as Argonne's Chief Operations Officer for seven years before becoming laboratory director. Prior to joining Argonne, I held leadership roles at Battelle Global Laboratory Operations, Idaho National Engineering and Environmental Laboratory, and Pacific Northwest National Laboratory. It was also a privilege to serve two terms as chair of the National Laboratory Directors Council, which provides a forum for advising DOE senior leadership on areas that affect the laboratories and their ability to contribute to the DOE mission.

These experiences shaped my passion for the national laboratories, the talented people who work there, and our collective impact on matters of global scale and consequence. The laboratories spur new discoveries in fundamental science, and harness those breakthroughs to enhance our quality of life, develop new technologies that underpin our economy, and make our nation more secure. National laboratory discoveries have transformed our understanding of the universe, from confirming the Big Bang and

discovering dark energy to identifying 16 new elements, including those crucial for medical imaging and safety devices. Their contributions also played a key role in the digital revolution by bringing the first web server to North America, laying the foundation for modern internet infrastructure.

Argonne is managed by UChicago Argonne, LLC for the DOE Office of Science. We are one of the 17 DOE national laboratories that together form a world-leading research enterprise that is foundational to the U.S. innovation ecosystem. At Argonne, the breadth of our research initiatives includes:

- Fundamental science, including materials science, chemistry, physics, and biology
- Support of large-scale experiments in high-energy and nuclear physics, both technically and scientifically
- High-performance computing, Artificial intelligence (AI), quantum information science, and microelectronics
- Advanced nuclear energy and other solutions for generating, storing, distributing and using energy
- Nuclear and electric grid security
- Large-scale, complex engineering systems which power a world-leading light-source 1 km in size and supercomputers that are among the fastest and most capable on the global stage
- Securing domestic supply chains for scarce materials
- Advanced manufacturing
- Critical infrastructure including energy, water, communications, and transportation

At Argonne, we trace our history back to the Manhattan Project and the experiments at the University of Chicago that created the world's first self-sustaining nuclear reaction. From our initial mission to develop nuclear energy, Argonne has grown into a world-leading multi-program research laboratory. Every day, we leverage the expertise of our researchers, our academic and industrial partnerships, and specialized scientific facilities to address national challenges and advance U.S. prosperity. Argonne has driven transformative advancements across multiple fields from advancing next generation battery technologies to providing critical insights for the development of treatments for HIV, RSV, and other viral diseases.

Our work in nuclear energy also remains robust. We are integrating AI and machine learning to optimize reactor operations and maintenance and pioneering nuclear fuel recycling technologies to reduce waste while maximizing domestic fuel resources to strengthen energy abundance. We're also leveraging advanced modeling and simulation to make reactor development and deployment more cost effective and leading nuclear waste

management to ensure safe, long-term storage solutions.

Sustaining U.S. Science and Technology Leadership

Our country stands at a pivotal moment, when the pace of science and technology is rapidly accelerating and driven by fierce global competition. Geopolitical adversaries like China are making strategic investments across key science research areas and facilities, seeking to achieve global technological leadership. In a July 2024 report “Ensuring U.S. Leadership in a Competitive Future”, the National Laboratory Directors Council noted: “In 2003, the United States produced 20 times more high-impact scientific papers than did China. By 2022, China achieved parity with the U.S. and has since surpassed it.”

To maintain U.S. innovation leadership that powers our world-leading economy and best positions us in this evolving geopolitical landscape, we must lean into our core strengths in research and development, leverage our unique scientific assets, and bolster partnerships with our private sector and academic partners. DOE’s national laboratories are, collectively, home to the largest scientific workforce and the most powerful collection of research facilities. Together, we are committed to making breakthrough discoveries and translating them into technological innovations that will ensure a strong, secure, prosperous future for our country.

Science at Scale

Breakthroughs in fundamental science are a prerequisite to the development of transformational technologies at scales large enough to meet the energy challenges facing our nation. As the United States’ largest funder of the physical sciences and through its stewardship of 10 national laboratories, the DOE Office of Science has a unique and central role to play in helping the new Administration meet its energy and national security targets.

The Office of Science maintains a vast research enterprise—spanning approximately 24 million square feet of laboratory space across 38,000 acres of land. These facilities are incubators of world-changing science.

The impact of this investment is profound. More than 11,200 permanent PhD researchers, along with 5,200 graduate students and 3,300 postdoctoral associates, are supported by the Office of Science, working on the most pressing scientific challenges of our time. Their work is amplified by nearly 40,000 users at 28 state-of-the-art scientific facilities, fostering collaboration and discovery across disciplines.

From advancing discoveries in materials science, high-energy physics and nuclear physics research to driving innovations in fusion energy, isotope production, and computational science, the Office of Science fuels research that spans all 17 DOE national laboratories, engages over 300 universities and higher-learning institutions, and impacts every state in the nation, Puerto Rico, and Washington, D.C.

The Office of Science is playing an increasingly impactful role in the field of biological research, which has an immense societal and economic impact. The U.S. biomedical industry alone contributes over \$69 billion a year to the U.S. GDP. For example, U.S. light sources and their partner institutions have contributed more than 27% of the 223,790 protein structures available in the Protein Data Bank, with more than 50% of the U.S. contribution coming from Argonne's Advanced Photon Source alone. AI-based prediction of protein folding structures from an input sequence of amino acids, a major milestone, was simply an intractable problem historically, until deep learning methods were developed and trained on these datasets. These breakthroughs are critical for furthering our understanding of fundamental biology, medicine, and energy, among others.

Last year, the Nobel Prize in Chemistry was won by a trio of researchers for their AI-assisted studies of protein folding that were conducted in part at Argonne's Advanced Photon Source and Leadership Computing Facility. One of the Laureates, David Baker of the University of Washington, is a longtime user of those facilities. Another, John Jumper of Google DeepMind, is a University of Chicago alum who also conducted research at the APS. This recognition underscores the role that Argonne and the national laboratories play in advancing high-impact scientific discovery and represents only a fraction of the overall impact of the Office of Science on the national economy and our daily life.

One of the largest scientific endeavors of our time is the Large Hadron Collider (LHC), the world's largest and most powerful particle accelerator, at the CERN laboratory in Geneva Switzerland. DOE Office of Science has played and continues to play a major role in the LHC; the greatest breakthrough in high energy physics in the last 20 years is the discovery of the Higgs Particle at the LHC in 2012, leading to a Nobel Prize in the following year. Scientists and engineers as well as the technical infrastructure at the DOE Laboratory complex were an essential part of this discovery and continues to be a vital part of the research at the LHC.

Advancing Innovation through Unique User Facilities

Office of Science national laboratories host world-leading user facilities that provide scientific capabilities to the entire research community on a competitive, peer-reviewed

basis. These facilities are unique not just in the tools they provide, but in the access to world-class expertise among the national laboratory staff at these facilities. These are vital resources for accelerating scientific discovery, supporting American innovation through partnerships with industry, and supporting STEM workforce development. Researchers can gain access to light sources, neutron sources, particle accelerators, nanoscale science research centers, microscopy centers, environmental research facilities, and advanced computing and data-analytics resources.

These facilities—essential enablers of big science—are too large and complex for any single company or university to manage independently, making the national labs their ideal steward. They also attract a diverse array of international researchers, further enriching our collaborative efforts and ensuring that scientific advancements benefit from a global pool of talent and expertise.

Last year was a year of transformation at Argonne where we completed the upgrade of the Advanced Photon Source (APS) and installation of the Aurora supercomputer. These facilities are complex engineering marvels. The \$815 million upgrade to the APS replaced the electron storage ring with a state-of-the-art machine and increased X-ray brightness by up to 500 times—that means the upgraded beam delivers up to 500 times more X-rays onto a structure of interest, enabling scientists to either focus the X-ray beam into much smaller areas and obtain higher-resolution images that reveal intricate details of the structure that were previously difficult to discern, or to observe changes and processes with dramatically improved sensitivity or time resolution.

The new storage ring at the Advanced Photon Source incorporates 1,321 powerful new magnets, each up to five times stronger than the ones that made up the original storage ring. These magnets were assembled into 200 modules, and the centers of each magnet are precisely aligned, within a 30-micron tolerance to steer and focus the electron beam into a much tighter shape. Together, these innovations combine to create a facility that will deliver world-leading ultrabright, high-coherence X-ray beams for the global scientific community.

Aurora joins Frontier at Oak Ridge National Laboratory and El Capitan at Lawrence Livermore National Laboratory (a National Nuclear Security Administration laboratory) as the three fastest supercomputers in the world. These supercomputers dramatically accelerate research: cosmological simulations that took years can now be done in months and months of drug discovery are reduced to days. The Aurora exascale computer, which delivers a new class of system with remarkable high computing speed and AI capabilities to drive unprecedented discoveries, weighs 600 tons. This equates to the weight of an

Airbus 380, one of the world's largest passenger aircraft in use today. Aurora's computing racks account for 10,000 square feet or four tennis courts, and are supported by 300 miles of optical cables, and 44,000 gallons of cooling water. Integrating these infrastructure components at scale and developing the codes to run on these systems is made possible by the expertise of our scientists and engineers.

Individually, APS and Aurora at Argonne represent a massive leap forward in technology. Together, they spur revolutionary science by enhancing capabilities in real-time imaging and enabling rapid interpretation of results and trends. Their co-location on the Argonne site means that they can exchange data practically instantaneously, working as an integrated tool for science and driving significant advances in energy security, grid resilience, and breakthroughs in cancer and drug discovery.

Other user facilities include the Linac Coherent Light Source at the SLAC National Accelerator Laboratory, the world's most powerful X-ray laser, enabling groundbreaking research in quantum materials. The Continuous Electron Beam Accelerator Facility at the Thomas Jefferson National Accelerator is a world leader in superconducting radiofrequency accelerator technology, advancing nuclear physics research.

The maintenance and upgrades of these facilities, alongside the development of new ones like the Electron-Ion Collider at Brookhaven National Laboratory and the Long-Baseline Neutrino Facility at Fermi National Accelerator Laboratory, are foundational to the nation's ability to compete in the global technological race.

The extensive portfolio of national laboratory scientific facilities, instrumentation, and support infrastructure has been developed over more than 80 years and needs continual improvement and investment. Addressing aging core infrastructure, such as utility and energy systems, and other deferred maintenance needs is also critically important to improve safety, mitigate operational risks, and increase the reliability of infrastructure that underpins our innovation ecosystem.

Pioneering Frontiers in AI, Quantum, and Microelectronics

The national laboratories are working to expand America's leadership in critical and emerging technologies and establish the U.S. as the pacesetter in the race of nations vying for supremacy in science, technology, and economic power—a competition where each breakthrough in AI, quantum, and microelectronics potentially shifts the balance of leadership. The labs are seeking not only individual discoveries but an integration that enables ever greater and transformative leaps forward.

By advancing cutting-edge AI models, constructing AI-optimized supercomputing infrastructure, convening national and international collaborators, and forging strategic industry partnerships, the laboratories are positioning the U.S. to lead in the next era of AI-driven scientific discovery.

For example, Argonne is leveraging AI to design novel materials by accelerating simulations that predict how materials will behave under extreme conditions, leading to breakthroughs in semiconductor design. AI-driven models are being used to improve medium-range weather forecasting, helping scientists predict hurricanes and other natural hazards with greater accuracy. Argonne-developed AI tools can make the energy grid more resilient by combining large language models with real-time diagnostic tools; this enables faster detection of and response to faults in nuclear power plants and renewable energy systems. In healthcare, AI expedites drug discovery, with Argonne researchers using AI-based algorithms to identify potential cancer treatments and develop predictive models for virus evolution to aid disease responses.

The Aurora supercomputer at Argonne is optimized for AI; it is being used to train AI models capable of processing massive data streams like those of the Advanced Photon Source. Argonne is also advancing next-generation AI platforms and infrastructure. Beyond its technical advances, Argonne partnered with other labs to convene over 1,300 scientists from all 17 DOE labs, more than 30 universities, and dozens of companies through a series of AI-focused town halls and workshops. These efforts crystalized the immense opportunity of AI to accelerate progress in national security, energy, and science, and informed the national laboratories' vision for a bold, comprehensive AI initiative at scale to usher in a new era of American discovery.

The DOE national laboratories are leading the charge in quantum information science, accelerating breakthroughs that will define the next generation of computing, sensing, and secure communication. Over the past four years, DOE's five National Quantum Information Science Research Centers have driven advancements in quantum device physics, developed state-of-the-art quantum processors and sensors, and expanded our understanding of quantum algorithms and materials. These efforts have laid the groundwork for a robust quantum ecosystem, uniting national labs, universities, and industry.

The national labs, through the DOE quantum research centers and engagement in regional organizations such as the Chicago Quantum Exchange, are working with a broad range of industry partners to accelerate quantum innovation. Collaborations with Fortune 500 companies, specialized quantum technology start-ups, and high-tech research institutions

ensure that DOE's quantum initiatives remain at the forefront of scientific and technological advancement.

Argonne, in particular, has achieved significant quantum milestones that are paving the way for future technological advancements. The laboratory spearheaded the development of a 52-mile quantum loop, serving as a critical testbed for quantum communication and laying the foundation for a future quantum internet. Building upon this, Argonne expanded the network to a 124-mile quantum network, in collaboration with the University of Chicago's Pritzker School of Molecular Engineering and industry partner Toshiba. This expanded network actively runs quantum security protocols, distributing quantum keys over optic cables at high speeds, and stands as one of the nation's first publicly available testbeds for quantum security technology.

As the lead institution for Q-NEXT, Argonne has contributed to more than 4,000 citations in quantum information science research and recently demonstrated the first superconducting qubit operating at millimeter-wave frequencies—an advancement with implications for quantum computing speed, scaling, and sensitivity. Investments in quantum foundries, including the Argonne Foundry, have dramatically accelerated device fabrication and characterization, reducing development cycles from months to days.

In microelectronics, a multifaceted approach again defines the laboratories' work. We are conducting cutting-edge scientific experiments, focused on discovering advanced materials and architectures for AI computing. This includes pioneering energy-efficient designs and reducing reliance on critical minerals. In this space as in others, the laboratories foster strategic partnerships, internal and external to the complex, to drive innovation and address global energy challenges. And we're leveraging investments in state-of-the-art facilities—at Argonne, for example, we are using the Advanced Photon Source and the Center for Nanoscale Materials for materials characterization and nanoscale fabrication. These facilities, combined with interdisciplinary expertise, enable Argonne to develop novel technologies and sustainable manufacturing practices, bolstering U.S. leadership in advanced computing and manufacturing while addressing critical global challenges.

Continued U.S. leadership in AI, quantum and microelectronics is not guaranteed. Countries like China are investing heavily in these technologies and seek to outpace us. Without sustained investment, progress could slow, and other nations will close the gap. Ongoing support for research and infrastructure remains essential to secure U.S. scientific and technological leadership, strengthen national security, and enable future economic prosperity.

Convening the Best and Brightest for U.S. Competitiveness

One of the most significant roles of the national laboratories is their ability to convene multidisciplinary teams to address complex challenges. A key strength of this convening power is the deep collaboration within DOE itself, where the Office of Science works across DOE offices to integrate fundamental research with applied innovation. This intra-agency coordination ensures that scientific discovery aligns with national energy, economic, and security priorities, creating a strong foundation for broader collaboration. Building on this internal strength, the Office of Science extends its impact through partnerships with other federal agencies and leverages complementary expertise and resources to tackle challenges that span national security, energy abundance, and economic competitiveness. These inter-agency collaborations, combined with strategic engagement with academia, industry, and state and local governments, accelerate innovation and drive breakthroughs in areas such as energy storage and high-performance computing, strengthening the nation's scientific and technological leadership.

Building on the strength of collaboration within the DOE complex, the labs also foster strategic cooperation with industry and academic institutions to accelerate scientific discovery and innovation. For example, an Argonne-led, dynamic collaboration with the Greater Houston Partnership, formalized in early 2024, brings labs and industry together to advance carbon management in the region. Engaging with companies including Chevron and ExxonMobil and marshaling the labs' advanced manufacturing, life cycle analysis, and other expertise, Argonne is helping to address challenges such as lower-carbon systems for base chemicals.

Argonne sees similarly great potential in its academic partnership with institutions like Purdue University; we are collaborating across multiple scientific and engineering domains, with a strong focus on pharmaceuticals, steel manufacturing, and data science. Late last year, Argonne and Purdue began exploring collaborations on next-generation microelectronics, focusing on advanced materials, materials characterization, and packaging to develop smaller, faster, and more energy-efficient devices.

Strategic partnerships with industry leaders like Oklo and TerraPower are helping Argonne advance the future of nuclear energy. Collaborating with Oklo, Argonne supports the development of fast reactors and advanced fuel recycling, leveraging world-class facilities to validate reactor safety, thermal-hydraulic models, and fuel cycle innovations. With TerraPower, Argonne contributes expertise in sodium fast reactors and molten salt energy storage, aiding in materials testing, fuel qualification, and component validation for the Natrium™ reactor. These collaborations are key to helping accelerate the

commercialization of next-generation nuclear technologies that will enable solutions to enhance grid reliability and deliver affordable and abundant nuclear energy.

Securing Our National Science Enterprise

While we thrive on global collaboration, we are equally committed to safeguarding our research, ensuring that our partnerships strengthen—not compromise—our national security. Our managed research environments ensure safe operations and secure access, fostering an ecosystem that supports innovation while mitigating risks. By integrating secure data platforms and trustworthy AI systems, the labs enhance research security, ensuring the U.S. remains a global scientific leader.

National laboratories are vital to the nation's security infrastructure. As formal members of the U.S. Intelligence Community, our labs leverage scientific and technological expertise to support national security missions across defense, homeland security, cybersecurity, and energy security. The labs' deep understanding of frontier science enables them to anticipate and mitigate global security threats, from nuclear proliferation to cyberattacks. By advancing technologies such as AI, advanced semiconductors, and new materials, the labs play a crucial role in modernizing the U.S. nuclear deterrent and strengthening our national defense capabilities.

Enabling Economic Prosperity and Developing the Next Generation Workforce

The economic impact of the national laboratories is profound and quantifiable. Our labs are engines of economic growth, generating billions of dollars in economic activity and supporting thousands of jobs across the nation.

Cutting-edge science fuels industry growth and technological progress. For example, Sepion Technologies and Form Energy, spun off from the Argonne-led Joint Center for Energy Storage Research, advance lithium batteries and pioneer low-cost, long-duration energy storage solutions poised to transform the renewable energy sector. Princeton Stellarators, a spinoff from Princeton Plasma Physics Laboratory, focuses on advancing fusion energy technologies, while Optokey, a startup originating from Lawrence Berkeley National Laboratory, developed a miniaturized sensor based on Raman spectroscopy. The technology enables rapid and accurate molecular-level detection, with applications in food safety, environmental monitoring, and medical diagnostics.

Our ability to drive progress relies on a skilled workforce. The national laboratories are committed to building this workforce through comprehensive development programs that prepare scientists and engineers for the challenges of tomorrow.

Argonne's educational programs reach nearly 30,000 students and families each year, fostering interest and supporting development in science, technology, engineering and mathematics (STEM) fields. Lawrence Berkeley National Lab similarly shapes the STEM workforce; over the last several years the lab has engaged hundreds of interns and transitioned many of them into full-time roles. Our labs help ensure a steady pipeline of talent to support the U.S. innovation ecosystem, maintaining the nation's competitive edge in the global economy.

Pursuing Future Opportunities

The national laboratories, along with their university and industry partners, can bring the necessary expertise and capabilities to solve complex challenges and sustain America's global competitiveness. These challenges require focused, sustained investment in fundamental science and infrastructure to fuel progress long into the future.

Now is not the time to hold back—innovation is the key to seizing the opportunities that define this moment. The stakes are high. Artificial intelligence is reshaping how we live and work, next-generation medicine is unlocking new frontiers in human health, and rising energy demand calls for harnessing vast energy resources to power modern life. With world-class expertise, state-of-the-art facilities, and an unrelenting drive for discovery resident in its national laboratories, the U.S. is positioned to expand scientific leadership, strengthen the reliability of our energy system, and secure the nation's industrial and economic future.

I am proud of the work we do at Argonne and across the national laboratory system, and I am grateful for your continued support. Thank you for the opportunity to testify today. I look forward to answering any questions you may have.

Paul K. Kearns

Paul K. Kearns has served as director of the U.S. Department of Energy's Argonne National Laboratory since 2017. Kearns manages a growing multidisciplinary science and engineering research center with a \$1.2 billion diversified research portfolio and nearly 4,000 employees, over 7,000 facility users, and almost 2,000 visiting researchers. Under his leadership and the stewardship of the DOE Office of Science, the laboratory drives advancements in fundamental science, energy solutions, and high-performance computing that are key to U.S. economic and national security.



Kearns served as Argonne's chief operations officer from 2010 to 2017.

Kearns is a biologist and accomplished steward of diverse scientific resources to achieve ambitious goals in energy, environment, and national security. For over 30 years, Kearns has managed complex research and development enterprises by prioritizing science and technology leadership, operations excellence, and world-class talent.

Kearns' resume includes five years as an executive with Battelle Global Laboratory Operations and accomplished tenures with the U.S. Department of Energy's Idaho National Engineering and Environmental Laboratory and Pacific Northwest National Laboratory.

Kearns is a fellow of the American Association for the Advancement of Science. He also served as chair of the DOE National Laboratory Directors' Council for two terms and is currently a member of the U.S. Council on Competitiveness' National Commission on Innovation and Competitiveness Frontiers.

Kearns has a doctorate and a master's degree in bionucleonics and a bachelor's degree in natural resources and environmental sciences, all from Purdue University. He and his wife, Lynn Kearns, have three children and five grandchildren.

Chairman WEBER. Thank you, sir.

Doctor, is it Budil or——

Dr. BUDIL. Budil.

Chairman WEBER. Budil, Dr. Budil, you're recognized for 5 minutes.

**TESTIMONY OF DR. KIMBERLY BUDIL,
DIRECTOR, LAWRENCE LIVERMORE NATIONAL LABORATORY**

Dr. BUDIL. Thank you. Chairman Weber, Ranking Members Ross and Lofgren, Members of the Subcommittee, good morning and thank you for having me here today. I'm honored to speak to you on behalf of Lawrence Livermore National Laboratory, a DOE National Nuclear Security Administration (NNSA) lab, and proud member of the DOE's network of national labs.

More than three decades ago, I arrived at Livermore as a physics graduate student, seeking to do cutting-edge laser experiments for my research. What followed was a remarkable opportunity to become part of an amazing multidisciplinary team dedicated to pursuing world-class science and technology to advance U.S. national security and global stability. That commitment to service to the Nation is what animates our exceptional workforce of nearly 9,000 employees and inspires me every day.

Today, we find ourselves at a critical time in history with an evolving global security environment that presents unprecedented challenges. Sustaining U.S. leadership in this complex world requires a new approach. Speed and innovation must be our focus, a sentiment reinforced by our new Secretary of Energy. We must become more agile and adaptable, not only through S&T innovation, but also through taking bold, well-considered technical risks, seizing opportunities, and streamlining business practices.

This is also a strategic moment for NNSA and its national security laboratories. The need to modernize the nuclear deterrent is urgent. We face many challenges, particularly in aging and inadequate infrastructure, but it's also an opportunity to use our powerful S&T tools to go faster, develop new materials, pioneer new manufacturing approaches, reimagine the design-to-production lifecycle, and deliver new capabilities to meet emerging needs.

Modernization efforts are underway, and we're building strong partnerships across NNSA and with partners in the other labs and in industry to introduce innovative manufacturing technologies. We propose to create a complex at Lawrence Livermore called VIPRE where advanced materials and manufacturing methods will be developed, prototyped, scaled up, and quickly transferred to industry partners.

Two of NNSA's flagship and world-leading capabilities are located at Lawrence Livermore. The recently dedicated El Capitan supercomputer, which debuted at No. 1 on the top 500 list, and the National Ignition Facility both exemplify the importance of sustained, multiyear congressional support for investing in the core competencies and capabilities of the National Laboratories. El Capitan is a remarkable machine. It provides a 20-fold increase over our last computer and is made even more powerful when coupled with AI and machine learning. It's ideal for our modeling and sim-

ulation efforts, but it also has 44,000 GPUs (graphics processing units), making it an ideal machine for AI investigations.

With strong industry partnerships and continued support, we're poised to take full advantage of this rapidly evolving field to accelerate both product delivery and scientific discovery. Achievement of fusion ignition and energy gain at NIF in December 2022 was a historic event 60 years in the making. This success was only possible with that sustained support over decades. But fusion ignition is not an end point. It's the beginning of our pursuit of high yield for nuclear deterrence, energy security, and scientific discovery, and continued investment will be critical to our success going forward.

After 15 years of service and more than 4,500 experiments, the National Ignition Facility urgently needs refurbishment. NIF sustainment, which is now underway, is an essential investment, along with the Enhanced Yield Capability project, which was recently granted Critical Decision Zero (CD-0) or Mission Need by NNSA to increase NIF's laser energy, a critical step toward a future high-yield facility. As we learned in the pursuit of ignition, a little bit of energy goes a long way in these experiments.

As a national security laboratory, Livermore contributes to a wide range of important missions for other agencies: biodefense research to accelerate development of medical countermeasures; partnerships with other labs and with industry to computationally design new cancer therapeutics; novel laser research, laying the foundations for next-generation microchips or the next generation of EUV (extreme ultraviolet) lithography developed at the labs; and developing novel optics to create a new class of space-based platforms. These and other projects truly exemplify our motto, "Science and Technology on a Mission."

Thank you again for offering me the opportunity to share how Livermore's multidisciplinary workforce is contributing to U.S. security, scientific advancement, and global technological leadership, and thank you for your continued support for our important work. I look forward to today's discussion.

[The prepared statement of Dr. Budil follows:]

Dr. Kimberly Budil
Director, Lawrence Livermore National Laboratory

Testimony before the Energy Subcommittee
U.S. House Science, Space and Technology Committee

February 12, 2025

Chairmen Weber and Babin, Ranking Members Ross and Lofgren, Members of the Subcommittee. Good morning and thank you for having me here today.

I am honored to speak to you on behalf of Lawrence Livermore National Laboratory (LLNL), a National Nuclear Security Administration (NNSA) laboratory and proud member of the Department of Energy's network of national laboratories.

S&T Leadership in a Competitive World

The U.S. Department of Energy (DOE) national laboratories are unrivaled strategic assets in the competition for global economic, technological, and military leadership. The mission-focused multidisciplinary workforce and world-class scientific facilities and capabilities of the national labs have been referred to as the crown jewels of the U.S. research and innovation ecosystem. Over the past 80 years, the national labs have successfully delivered solutions to critical national challenges, new ideas, world-leading science, and innovative technologies to benefit our nation and the world.

Today, we find ourselves at a critical time in history, with an evolving global security environment that presents new and unprecedented security challenges and emerging and disruptive technologies like generative artificial intelligence, dramatically accelerating the pace of discovery in science and technology (S&T). Sustaining U.S. competitiveness in this complex world requires a new approach—speed and innovation must be our focus. This is also a strategic moment for NNSA and its national security laboratories. Nuclear deterrence is a mainstay of U.S. national security and the need to modernize the nuclear deterrent—warheads, delivery systems, and infrastructure—is urgent given the new and expanded capabilities deployed by Russia, China, and North Korea. U.S. leadership in strategic areas of S&T is critical to both national security and economic competitiveness.

LLNL is playing a central role in the effort to rejuvenate the NNSA's nuclear security enterprise (NSE). We are the responsible nuclear design agency for two modernization programs—the W80-4 Life Extension Program and the W87-1 Modification Program—which are helping to drive the modernization of the production enterprise. NNSA faces stiff challenges in this effort. The NNSA labs, plants, and sites must deliver these capabilities on stressing timelines within budget while working to accelerate our efforts to better match the pace of the threat. Our Laboratory is pursuing innovative new partnerships within the

NSE and applying recent S&T advances to dramatically accelerate the pace of product development and scientific discovery.

The threats we face demand a more agile, responsive, and resilient S&T ecosystem. For this to happen, the national laboratories must strengthen partnerships, particularly with industry, to ensure the U.S. can be at the leading edge of scientific discovery, technology development, and manufacturing. In the words of our new Secretary of Energy, Chris Wright, “We must protect and accelerate the work of the Department's National Laboratory Network to assure and secure America's competitive advantage and its security.”

DOE laboratories provide leadership in many areas of S&T. High-performance computing (HPC)—particularly as it applies to scientific and engineering simulations of complex systems—is a vital strength. The national laboratories hold the three top spots in the Top500 list of the world's most powerful supercomputers. This new generation of computers offers immense opportunities to both advance the state-of-the-art for modeling and simulation and harness the power of AI and machine learning to speed the cycle of learning dramatically. Opportunities abound for the laboratories to strongly support and provide innovative leadership in national efforts to accelerate scientific discovery, develop innovative new technologies, and transform manufacturing:

- *Capabilities.* The laboratories are multidisciplinary and well-suited for combining HPC simulations, AI and machine learning, experimental studies, and advanced manufacturing to drive potentially revolutionary changes in how we pursue science and develop new technologies.
- *Partnerships.* As federally funded research and development centers (FFRDCs), the laboratories are well-positioned to strengthen partnerships with industry to develop means to accelerate product delivery. These collaborations can help bridge the gap between what is “possible to do once” and what is “possible to affordably manufacture at scale.”
- *Innovation and investments.* Bridging the gap between invention and product has always been a challenge, often referred to as the “valley of death.” Catalyzing the national laboratories to accelerate scientific discovery and technological advances will require innovative approaches and strategic investments in infrastructure at DOE laboratories and sites.

Innovating and Accelerating Product Delivery within NNSA

Greater agility to bolster national security, support S&T leadership, and enhance economic competitiveness is urgently needed. Expediting design-to-product delivery requires a combination of innovation, streamlined processes, sustained investment, and effective partnerships. For the strategic modernization programs, our Laboratory has been vigorously pursuing novel materials and additive manufacturing (along with other advanced manufacturing methods) to modernize production of certain warhead components and materials and pioneer fundamentally new approaches to design and certification.

We have engaged NSE production agencies as partners to ensure that the technologies we design are adaptable to full-scale production. Investments in the Polymer Enclave at LLNL, where the application of novel direct-ink-write additive manufacturing tools was codeveloped with partners from the Kansas City National Security Campus, is an example of this new type of partnership to bring modern manufacturing techniques to NNSA production agencies. Such collaborations aim to speed the introduction of new technologies to make production faster and less costly, enable performance that otherwise would be unachievable, and reduce waste.

Another example is LLNL's Energetic Materials Development Enclave (EMDEC), where first-of-their-kind technologies have demonstrated safe 3D printing of precision insensitive high explosive components. This work is being pursued in close partnership with the Pantex Plant to guide the development of their proposed High Explosive Synthesis, Formulation, and Production (HESFP) Facility. Plans are underway to expand EMDEC with pilot-scale manufacturing capabilities to scale up for production use. We have also proposed the Vertically Integrated Prototype Realization Enclave (VIPRE) complex, where advanced materials and manufacturing methods will be developed that can be quickly transferred to NSE and U.S. industry partners, enabling us to move seamlessly from developing novel materials through prototyping to scale-up and deployment. These leadership efforts to accelerate manufacturing have broad applicability. There are other examples of partnering to modernize and expedite concept-to-manufactured product—as well as scientific discovery—that I will later highlight.

Two of NNSA's flagship capabilities, the El Capitan supercomputer, installed in 2024, and the National Ignition Facility (NIF), which first achieved ignition and fusion burn in 2022, are located at LLNL. Both exemplify the importance of sustained, multi-year congressional support for investing in the core competencies and capabilities at the national laboratories. These two NNSA flagship capabilities are poised to make significant contributions to continuing U.S. leadership in S&T areas that are critical to national security and also offer potentially revolutionary means to accelerate product delivery and scientific discovery.

El Capitan—the World's Most Powerful Supercomputer

When the Stockpile Stewardship Program was launched in 1995, researchers set the ambitious goal of increasing computing power by a factor of 3,000 within a decade. By working in close partnership with U.S. industry over three decades, El Capitan—NNSA's first exascale supercomputer—is nearly 30,000 times faster than the initial goal. The path to exascale required not only developing new types of computing hardware and architectures but also reducing the power requirements for such a machine to achievable levels and upgrading our computing facilities to meet the power and cooling needs of these new systems.

A key foundation for El Capitan was DOE's Exascale Computing Project (ECP). Launched in 2016, the ECP enabled NNSA and DOE Office of Science (SC) researchers to work collaboratively with U.S. industry to overcome imposing technical challenges and deploy the exascale Aurora at Argonne National Laboratory and Frontier systems at Oak Ridge National Laboratory. The NNSA laboratories took the next step with El Capitan, working closely with industry partners to co-develop first-of-a-kind hardware, the required software ecosystem, and compatible scientific applications. With a peak performance of 2.79 exaFLOPs (2.79 quintillion calculations per second), El Capitan provides scientists and engineers a factor-of-20 improvement in modeling weapon performance in high-fidelity resolution and quantifying uncertainties.

Capabilities to routinely run large-scale 3D models are essential for sustaining an aging stockpile and certifying modernized weapon systems. El Capitan will also accelerate progress in inertial confinement fusion, enable discoveries in material behavior under extreme conditions, and support other critical national security missions. Importantly, exascale computing—in combination with AI and machine learning, precision additive manufacturing, and novel experimental capabilities—offers the potential of changing the way we think about the design of a new technology or autonomously guiding the next steps in a high-repetition-rate experimental campaign. An LLNL research team recently applied these tools to successfully “inverse design” a linear shaped charge. The engineering design process started with the desired performance and AI-guided HPC simulations refined an initial device design to optimize performance. Similarly, Laboratory researchers have developed an AI tool to guide the design of metal alloys to achieve desired performance. Other applications discussed below include the design of ignition targets for NIF and the design of antibodies to combat viruses.

The National Ignition Facility

Achievement of fusion ignition and energy gain at NIF in December 2022 was a historic event, an effort which began 60 years ago with the “big idea” of inertial confinement fusion (ICF). In the late 1970s, the Atomic Energy Commission began investing in a sequence of large lasers at the Laboratory as tools to study high-energy-density physics issues pertinent to weapons design while recognizing its long-term potential for meeting the world's energy needs. Success in ignition was the result of the hard work of the ICF community over many decades and benefited from key advances made in the last several years. The *Physical Review Letter* reporting the achievement listed more than 1,370 contributing researchers from 44 international institutions. NIF is a flagship facility for a vibrant ICF community. Since the initial success, five more NIF experiments have achieved energy gain, one with a record setting 5.2 megajoules (MJ) of energy and a gain of more 2.3 times the laser energy. This success was only possible with sustained support and investment in the facilities, diagnostic development and target design, and workforce development over the decades, and continued investment will also be critical to our success going forward.

Fusion ignition was not an end point—it is the beginning of our pursuit of high yield to explore the most extreme states of matter ever produced in the laboratory. Fusion producing experiments, which provide detailed information about complex underlying physics, are vital to meeting current and future needs for stockpile sustainment and modernization. They have given us exceptional insight into the science of nuclear weapons and provide a test bed for assuring the survivability of military systems in nuclear environments. Our planned activities to achieve higher fusion yields for nuclear security missions align closely with the needs to move forward in inertial fusion energy (IFE) research and development. Efforts include:

NIF Refurbishment. NIF began operations 15 years ago and has staged more than 4,500 experiments over this time. A multi-year sustainment plan has begun to carry out urgently needed refurbishments, recapitalization, and improvements to assure continued mission delivery over the next decade and beyond. Obsolete components and failing systems are being replaced, and efforts to harden critical equipment to tolerate the more extreme radiation environment produced in high-energy-yield shots are underway. In addition to sustaining NIF's outstanding performance, these efforts train the current generation workforce—many of whom are new to our Laboratory—about this unique and highly complex system.

Target design improvements. Through many improvements to mitigate damage to optics from high laser fluences, NIF can now operate at 2.2 MJ laser energy for fusion experiments, 20 percent higher than its initial design specifications. This additional energy can improve the performance of fusion ignition experiments, but it is clear that improvements in target design and manufacture are required to achieve higher fusion energy yields. The ICECap (Inertial Confinement on El Capitan) project has prepared LLNL to transform its approach to ICF target design optimization. It combines El Capitan's 2D and 3D simulations with machine learning to revolutionize digital design—with a focus on discovering the next generation of robust, high-yield ICF designs. LLNL researchers are also pioneering the development of an advanced additive manufacturing technology precise enough to 3D print NIF target capsules, which would accelerate the pace of experimentation and support pursuit of IFE.

NIF Enhanced Yield Capability (EYC). DOE's approval in September 2024 of a CD-0 for the EYC project formally recognizes NNSA's mission need to increase the laser's energy to 2.6 MJ from its current high of 2.2 MJ, making fusion yields greater than 30 MJ possible. EYC will enable researchers to probe weapons physics phenomena in ways that have never been possible, and experiments will also inform decisions about next-generation high-yield ICF facilities.

Inertial Fusion Efforts. With its flagship ICF facility and supporting expertise, our Laboratory provides the U.S. a unique opportunity to lead the world in IFE research. Building on the ignition successes, LLNL launched an institutional initiative in IFE in 2023. By leveraging decades of investment by NNSA in ICF and exploiting emerging technologies, this initiative

seeks to provide leadership and pursue technical efforts in areas highly synergistic with our stockpile stewardship mission, and importantly, work with stakeholders to support the emerging public and private IFE landscape.

In December 2023, the DOE Office of Fusion Energy Sciences awarded a four-year, \$16 million project to a multi-institutional team led by LLNL to accelerate IFE research. The IFE Science and Technology Accelerated Research for Fusion Innovation and Reactor Engineering (STARFIRE) Hub consists of members from seven universities, four U.S. national laboratories, one international laboratory, three commercial entities, one philanthropic organization, and three private IFE companies. IFE-STARFIRE is accelerating the demonstration of high-gain target designs, target manufacturing and engagement, and diode-pumped solid state laser technologies. In addition, in January 2025, the University of California Regents unanimously approved the University establishing the “Pacific CREST” Fusion partnership, which brings together the University of California, private companies like General Atomics, and LLNL and other laboratories to accelerate progress toward commercial fusion energy.

Innovations in support of “S&T on a Mission”

Our mission is to enable U.S. security and global stability and resilience by empowering multidisciplinary teams to pursue bold and innovative science and technology. Livermore was established as a “new ideas” laboratory to develop innovative solutions to the nation’s pressing needs to advance nuclear weapons S&T. Our mission has evolved to include broader aspects of national security, always using our unique S&T capabilities to drive toward meaningful impact, providing solutions for important problems. To meet today’s needs, we must become more agile and adaptable—not only through S&T innovation but also through taking bold, well-considered technical risks, seizing opportunities, and streamlining business practices.

Attracting and retaining a high-quality workforce is essential for LLNL’s success. Staff are attracted to the Laboratory by the opportunity to work on important issues for the country and the prospect of challenging careers. Currently about 50 percent of our employees have five years or less service at the Laboratory, presenting both unique challenges and opportunities. We are adjusting to this changing workforce by focusing on employees’ needs, providing frequent and actionable feedback on performance, assisting with career planning, setting clear technical and developmental goals, and supporting skills development. These new employees bring tremendous talent and energy along with new ideas but must also rapidly move up the learning curve for our important national security missions.

We are working to create a work environment that fosters innovative ideas and taking on the grand challenges that LLNL missions demand—and the workplace requires attention to aging and inadequate infrastructure to enable this effort. Our 20-year site development plan takes into account the need for greater opportunities for interactions, which spark innovation. In January 2025, DOE approved a CD-0 to begin planning for the National

Security Innovation Center (NSIC), a multi-building complex at the center of the Laboratory providing about 1,000 offices, additional classified space, and a replacement for a more than 60-year-old auditorium. The NSIC is vitally needed to improve office quality and capacity, foster collaboration, and increase staff retention. Today, our researchers are spread across our campus, working sometimes in trailers or facilities built in the 1950s or before.

Another area that requires considerable attention, particularly given heightened interest in protecting U.S. intellectual property, is the protection of taxpayer-funded research and development from foreign exploitation or exfiltration. LLNL maintains a Managed Research Environment that balances the risks and benefits of international scientific collaboration and engaging or employing foreign-born staff by carefully managing access to people, places, technologies, and information. The Managed Risk Environment consists of policies, procedures, tools (like DOE's S&T Risk Matrix) and infrastructure (like DOE's Counterintelligence (CI) program) that provide layers of security and protection enabling classified and unclassified research on sensitive technologies to occur at the same labs with unclassified basic research sometimes conducted in partnership with foreign entities and foreign nationals.

Given this Committee's keen interest in innovative research as relates to critical and emerging technologies, space science, and biotechnology, I wanted to share a few snapshots of how LLNL is contributing more broadly to U.S. national and economic security.

Artificial intelligence. As highlighted through many cited examples, AI and machine learning are crucial tools for addressing LLNL national security and science missions. We are widely applying AI and machine learning to increase the predictive power of simulation models, design new molecules for needs ranging from disease therapies to energetic materials, integrate complex multimodal data for national security decision support, and much more. For many applications, we use a cognitive simulation approach that combines state-of-the-art AI technologies with leading-edge supercomputing. Our Laboratory established an AI Innovation Incubator (AI3) to **advance AI for applied science at scale**. AI3 serves as a collaborative hub, working with experts across many domains and partnering with commercial entities, consortia, and academic institutions to expand the Laboratory's capabilities. Within the Laboratory, AI3 *provides leadership* in AI for applied science, *develops informed strategies* for mission-driven AI investments, and *coordinates investments* focused on exploring and developing AI.

Quantum computing. The Livermore Center for Quantum Science offers a state-of-the-art facility that connects researchers, capabilities, and development efforts, both internally and externally, to further quantum innovation and streamline collaboration. Recently, researchers installed a microchip containing 21 coupled superconducting qubits inside the center's Quantum Device and Integration Testbed. The microchip's implementation was a significant step toward developing larger qubit arrays and longer, more complex algorithms

needed to execute quantum operations. LLNL has also made breakthroughs in reducing quantum devices' susceptibility to noise and hardware to achieve better performance. Researchers have also successfully developed miniaturized circulators—devices used to protect qubits from noise sources—that are 1,000 times smaller than previously achieved.

Biodefense and warfighter protection. For the Department of Defense (DOD), a LLNL-led, multi-institutional and interagency team is developing Generative Unconstrained Intelligence Drug Engineering (GUIDE) as a first-of-its-kind platform to accelerate medical countermeasure development to address known, unanticipated and engineered biological and chemical threats. Initially focusing on therapeutic antibody development to combat bacterial, toxin, and viral threats, GUIDE has reduced initial candidate discovery from years to weeks while significantly lowering developmental risk. GUIDE combines data, structural biology, bioinformatic modeling, and molecular simulations—driven by machine learning and HPC—to provide the DOD with a capability to rapidly design countermeasures preemptively and responsively. This effort also includes an automated rapid response laboratory, designed to rapidly synthesize and test candidate therapeutic molecules, again speeding the design-to-deployment cycle.

Human health. LLNL has also collaborated with Fredrick National Laboratory for Cancer Research and an industrial partner, BridgeBio Oncology Therapeutics, to apply our HPC and an LLNL-developed platform that integrates AI and traditional physics-based drug discovery to produce a breakthrough cancer drug—called BBO-8520. This drug aims to inhibit mutations of KRAS proteins—targets long considered “undruggable” by cancer researchers. In record time for this stage of development, the U.S. Food and Drug Administration cleared BBO-8520 for human trials in December 2023, with first dose in humans in June 2024.

Extreme ultraviolet lithography (EUVL) for next-generation microchips. A new research partnership led by LLNL aims to lay the groundwork for the next evolution of EUVL, centered around an LLNL-developed driver system dubbed the Big Aperture Thulium (BAT) laser. The LLNL-led project is a four-year, \$12 million investigation that will test BAT laser's ability to increase EUV source efficiency by about 10 times when compared with carbon dioxide (CO₂) lasers, the current industry standard. This could lead to a next generation “beyond EUV” lithography system producing chips that are smaller, more powerful and faster to manufacture while using less electricity. LLNL's expertise in EUVL builds upon prior work with Sandia National Laboratories, Lawrence Berkeley National Laboratory, and private sector partners that was commercialized in the 2010s utilizing EUVL to create significantly smaller transistors on a chip—enabling the packing of more transistors into a smaller space and paving the way for advanced microchip designs with greater performance and energy efficiency.

Space satellite optics for national security and space science. LLNL's expertise in optical science and engineering of complex systems engineering has enabled development of cutting-edge telescope optics for small satellites. These innovations make space-based

telescopes more compact, robust, and cost-effective, enabling new scientific discoveries and operational capabilities, and advancing both national security and space science. Laboratory researchers developed monolithic optics, where the primary and secondary reflectors are made from a single piece of fused silica. These optics are compact (1- to 10-inch diameters or larger) and robust to launch vibrations, which make them ideal for small satellites, and they are licensed for production. LLNL also developed the CODA family of optics in partnership with Corning. They are low-cost, aluminum telescopes that are easy to manufacture, enabling constellations of half-meter-class space telescopes. CODA optics are central to NASA's Pandora Small Satellite Mission, at a cost of \$20 million. The mission, which is expected to launch within the next year, will study exoplanet atmospheres and stellar activity.

Concluding Remarks

Thank you, again, for offering me the opportunity to share how LLNL's multidisciplinary workforce collaborates with other DOE national laboratories, the NSE, industry, and others within America's S&T ecosystem to enable U.S. security and global stability by pursuing bold and innovative science and technology. Thank you for your continued support for our important work. I look forward to today's discussion.

**Kim Budil – Biography**

Dr. Kim Budil has served as the director of Lawrence Livermore National Laboratory since 2021, where she leads a team of 8,700 employees dedicated to advancing national security and strengthening our nuclear deterrent through groundbreaking science and technology. Under her leadership, Lawrence Livermore achieved a historic milestone with the world's first successful fusion ignition in 2022 and the installation of El Capitan, the world's fastest supercomputer, in 2024. Dr. Budil holds a Ph.D. in engineering and applied science and is a fellow of the American Physical Society. Dr. Budil has authored numerous publications and is the recipient of many national and international awards in recognition of her leadership and impact.

Chairman WEBER. I thank the witnesses for their testimony. I now recognize myself for 5 minutes of questioning.

This will be a question for each of you. Last month, President Trump signed an Executive Order (EO) “Unleashing American Energy,” which pauses funding allocated through the *IRA* and *IIJA*. On January 27, OMB released a memo to temporarily pause new awards, disbursements of Federal funds under all open awards, and open notices of funding opportunities. Although two district court judges issued temporary restraining orders, would any of your labs have been impacted by the EO or memo if implemented as it specifically relates to DOE-related work? And before you answer, to be clear, I’m not asking about lab-related work from other agencies or departments.

Dr. Wagner, we’ll start with you.

Dr. WAGNER. Following some time to implement, we have not been impacted.

Chairman WEBER. Short and sweet. Dr. Mason?

Dr. MASON. Yes, if you’re excluding other agencies, then the impacts are rather limited. We’ve identified \$200,000 of current funding, and there is some additional funding that was in the pipeline award that’s not yet been received that could potentially be impacted in the future.

Chairman WEBER. OK. Dr. Kearns?

Dr. KEARNS. Impacts at Argonne are more severe. About \$37 million in research activities have been suspended or put on hold. That represents the work of some 140 staff. Not all our staffs are fully funded by the activity, so it equates to about 40 FTEs (full-time equivalents).

Chairman WEBER. Thank you. Dr. Budil?

Dr. BUDIL. So we had one project funded under the *Infrastructure Investment and Jobs Act* supporting grid resiliency activities, so this is a \$7 million project where the funds were unallocated on January 28.

Chairman WEBER. Thank you. And, Dr. Wagner, I’m going to come back to you. Under the *Nuclear Fuel Security Act*, Congress mandated that DOE provide developers of advanced nuclear reactors no less than 3 metric tons of HALEU by September 30, 2024. Today, it’s February the 12th, 2025, and my understanding is that DOE has not released a single kilogram of HALEU. Is that correct?

Dr. WAGNER. I would really defer to the Department of Energy to answer that question, but I think it’s probably correct.

Chairman WEBER. Dr. Mason, do you think that’s correct too?

Dr. MASON. We have a partnership with Kairos that’s looking at that HALEU fuel, and I have not yet heard from Kairos whether or not they have had an impact on their planned supply.

Chairman WEBER. Dr. Kearns?

Dr. KEARNS. I don’t have any additional information.

Chairman WEBER. Dr. Budil, no? OK.

Dr. BUDIL. Nothing additional.

Chairman WEBER. X-energy, an ARDP recipient, is building its XE-100 reactor at Dow’s facility in Seadrift, Texas, which is roughly, probably, I don’t know, 100, 150 miles south of my district. So my question for each of you is how important is HALEU to the suc-

cess of the ARDP and Gen IV reactors broadly? I'm going to go in reverse. Dr. Budil, I'll start with you.

Dr. BUDIL. I'm probably not the right expert to answer the question since we have very limited involvement with nuclear fission.

Chairman WEBER. We'll go back this way. Dr. Kearns?

Dr. KEARNS. Yes, HALEU is certainly important, really, to the development of advanced reactors, so many of the vendors that we're working with do have plants to power the reactors using HALEU, so critically important.

Chairman WEBER. Dr. Mason?

Dr. MASON. As I mentioned, we have an activity with Kairos, which is one of the SMR (small modular reactor) startup companies, and the particulars of that involve the fabrication of the TRISO HALEU fuel that would be used for their very first test reactor that's being built in Oak Ridge. They have built a fabrication facility in Albuquerque adjacent to Kirtland Air Force Base, where they've been prototyping the fabrication of these TRISO pellets. But in order to work with HALEU, which is necessary for their reactor design, which involves TRISO pellets and molten salt coolant, they needed a facility that could handle that sort of material. And actually, at Los Alamos, we have the capability to work with special nuclear material. It's not our intention to get into the fuel fabrication business long term, but it helps solve the chicken-and-egg problem, which is critical to this technology.

Chairman WEBER. But you are—it sounds like you are confident they're going to be able to get this done?

Dr. MASON. Yes, it's a very promising thing. And once the technology has been demonstrated in the test reactor, then I think a commercial supply would be stood up to supply the ongoing needs, so we're just helping the transition to reality.

Chairman WEBER. Dr. Wagner, do you concur with that?

Dr. WAGNER. Yes, I concur with that. I'd just say that the high-assay LEU, or HALEU, is essential to almost all of the advanced reactor concepts. The supply of that material is incredibly important, and the timely supply of that material is important. We are working with the Department of Energy. They are working to make material available at Idaho National Laboratory. We do have some stocks of high-assay LEU that we are working with the Department to make available to private sector companies, Kairos, Oklo, and many others.

Chairman WEBER. OK. Thank you for that.

I now recognize Ranking Member Ross for her opening—for her questions.

Ms. ROSS. Thank you, Mr. Chairman. As you all heard in my opening statement, grid resilience and reliability is a key priority, I think, not just of mine in North Carolina, but this entire country. And so I'd like to ask a few more questions, Dr. Budil, about the \$7 million that you have yet to receive. My understanding is that that was in partnership with the private sector to support a project focused on reliability and resilience. I'd love to hear more about the project and its status and whether you've been given any explanation for why it's—the funding has ceased.

Dr. BUDIL. Thank you for the question. So the project involves utilization of a special laboratory we have at Lawrence Livermore

called Skyfall. Skyfall is a cyber physical testbed so we can use our high-performance computing to run models of the grid operating and then put real hardware from grid systems in line with those models. And that's a way for us to run scenarios where there might be a cyber attack or other operational upsets and understand how the equipment will respond to that. So this is a really important partnership for us, working with utilities and private sector companies, so that they can understand, in a real-world environment, how their different types of technology they're introducing into the grid will operate in that system.

So I think this is critically important work. It's a great partnership between us and the private sector, and it really does give them access to a different capability because of this high-performance computing backbone where we can put a very realistic scenario together.

It's also a place where we train a great deal of workforce on questions like cyber resiliency. So we run a cyber program where we bring in teams of students and teach them about cybersecurity of complex systems like the grid, and they actually do an exercise where they work as ethical hackers to take the system down. We have a little town that we've built that they do team challenges against so this is a way for them to gain real-world experience. Most of these students don't come from computer science background, so this is really their first experience of cybersecurity. So that nexus of real hardware, large-scale models of grid, and an understanding of the threat space, and then the workforce training pipeline, I think, are all critical to ensuring the next generation of technologies are deployed securely.

Ms. ROSS. Well, I think you're going to love a bill that we got through with bipartisan support on the House side the last time that deals with more funding for cybersecurity in DOE, and we're going to reintroduce it.

I also understand that Livermore had a partnership with the State Department to focus on cooperative threat reduction, and this ongoing effort has just been terminated by the new Administration. Could you give us any more details on that?

Dr. BUDIL. So this is about a \$1 million effort as part of a program through Brookhaven National Lab's Nonproliferation and National Security Department to do cooperative threat reduction work where we have a long legacy doing things like capacity building, international support for things like nuclear forensics, and understanding, you know, how to manage interdicted nuclear materials should they arise. It's about \$1 million project, and as far as I know, to date, it's paused. We don't know if it will be restarted at a later time.

Ms. ROSS. Well, hopefully we can work on both of those things in a bipartisan way.

Several of you have talked about the importance of AI for our energy leadership, and I don't know who would be the best person to answer this question. We only have a minute left. But can you describe how meeting the demand for critical AI infrastructure can help support both the scientific enterprise and the public interest? Maybe Dr. Mason first since you emphasized AI in your response.

Dr. MASON. Yes, AI and electricity go together for sure. And in fact, the AI demands are kind of baseload demand. It's always on. You always need to be running, and so that has implications in terms of the type of electrical supply. But our ability to support that at the scale that's needed is going to be challenged just because the rate at which we ramp up electrical production is very different than the rate at which AI is ramping up as a discipline, and so I think, as a nation, we are going to be challenged to respond quickly enough to maintain the very tenuous lead that we have in this field.

Ms. ROSS. OK. With the last 9 seconds, anybody have anything to add to that?

Dr. BUDIL. I'll just say that AI is really transforming everything we think about science, how we use data, how we do experiments, even how we think about developing new technologies because AI with advanced manufacturing allows you to make things you couldn't even conceive of before.

Ms. ROSS. Thank you, and I yield back.

Chairman WEBER. I thank the gentlelady.

The Chair now recognizes the gentleman from Tennessee, Mr. Fleischmann, for 5 minutes.

Mr. FLEISCHMANN. Thank you, Mr. Chairman. I appreciate your having this hearing.

To each and every one of the witnesses, thank you. I've visited many of your labs. I've worked with you all, I guess, over the past 14 years, now 15 years. In short, our National Labs are a national treasure. It's probably the most enlightening experience I've had as a Member of Congress and now as a senior appropriator chairing the Energy and Water Subcommittee, which funds the Department of Energy, but could not be more pleased and thankful for your opening statements and the questions.

I wanted to ask each and every one of you your thoughts about this. My district is home to the Oak Ridge National Lab—actually, Oak Ridge Reservation. We have the NNSA facility there, Y-12 building, UPF (uranium processing facility). Nuclear cleanup is near and dear to my heart. At many of your reservations, I know Idaho has done a great job over the years, Los Alamos. I chair seven or eight nuclear-related caucuses, so this is what I do in Congress, and each and every one of you all have been my partners.

This Committee has long recognized the value of public-private partnerships—in fact, I think some of you alluded to this in your comments—that boost our Nation's competitiveness on a global scale. So I'm going to ask each and every one of you all, can you explain the benefits and share any examples of industry collaboration leading to the commercialization of transformative technological achievements? For example, in my district, X-energy, which the Chair has already referenced, developed their TRISO fuel at ORNL and is now building a commercial facility to produce it at scale.

Dr. Wagner, two companies working at INL are currently conducting a feasibility study to co-locate their fuel fabrication facilities and are exploring collaboration on reprocessing and recycling technologies, which is also near and dear to my heart.

Can you all comment on the benefit of industry collaboration and the pathways to commercialization? And I guess I'll just start with Dr. Wagner and go through. Thank you.

Dr. WAGNER. Thank you, Congressman. And I'd like to start by thanking you for your support of the national laboratories in general and for nuclear energy in particular. You've been a great advocate for the—both of those areas and much, much more.

So you already are quite familiar with a lot of the public-private partnerships and the important aspects of going, but I'd like to maybe just quickly talk about a couple. You mentioned TRISO fuel. It was the laboratories that came together with the Department of Energy more than a decade ago to figure out how to fabricate and then evaluate the performance of the fabricated TRISO fuel and graphite associated with those reactor types, working together with private industry and ultimately issuing a topical safety analysis report through the Electric Power Research Institute to the Nuclear Regulatory Commission that formed a baseline then for all of these reactor developers to work from, so really kick starting that fuel form in terms of the availability for private developers to use that.

Today, one of the things that we're really doing closely with multiple private companies is providing testbeds for full system reactor demonstrations that will derisk, as I said, their technologies and enable their path to commercial deployment. These things are not possible in facilities other than facilities like the Department of Energy national laboratories.

Mr. FLEISCHMANN. Thank you, sir. Dr. Mason?

Dr. MASON. So I guess maybe I'll highlight the importance of public-private partnerships in artificial intelligence. The United States is fortunate that we have private sector actors who are making massive investments in developing these capabilities. In fact, that's one of our big strategic advantages. When you look at what's going on in China, there are investments on a similar scale. And of course, in the Chinese system, there is no clear distinction between government investments and private investments and national security investments.

That's why it's essential that we are able to leverage the tremendous innovation that's happening in our private sector for our national security needs. We have been working with many of the AI companies, OpenAI, Anthropic. We've been using Lava, the Meta open-source AI, but I wanted to highlight two partnerships in particular. One is with NVIDIA, the chipmaker. Last year, we took delivery of a wonderful new machine called Venado that we agreed to purchase 4 years ago. It's a good thing we made the deal with NVIDIA 4 years ago because I don't think we could get it now. And recently, we reached an agreement with OpenAI to field their raw model weights on that machine in a classified environment in service of all three of the NNSA labs, Livermore, Sandia, and Los Alamos.

And this is an example where we can take advantage of the huge investment that OpenAI developed—expended in developing their advanced models, but do it in a classified environment for our national security applications. You know, there may not be as big a financial model to incentivize the private sector to do that sort of

work, and that's why we need to work to align our interests and hopefully drive forward the science and technology as well.

Mr. FLEISCHMANN. Thank you. Mr. Chairman, I think I've exceeded my time in all due respect to our witnesses, who I know very well and respect, but I certainly want to yield back. I know our colleagues all want to speak.

Chairman WEBER. Well, I wasn't going to point that out, but the gentleman yields back.

The Chair now recognize the Ranking Member, Ms. Lofgren, for 5 minutes.

Ms. LOFGREN. I would just like to note that the Chair of the Appropriations Subcommittee gets extra time.

Chairman WEBER. The gentlelady yields her time—no, no, no.

Ms. LOFGREN. First I—you know, I want to thank this really wonderful panel of witnesses, and—not only for being here, but for the work you do each and every day that advances science and helps protect our Nation.

Dr. BUDIL, I—you know, I want to congratulate you again on the—NIF's stunning achievements. It's fabulous. DOE Office of Science selected Livermore to lead a multi-institutional endeavor called the STARFIRE Hub focusing on exploring and developing immense potential of inertial fusion energy technologies. Can you give us more details of the STARFIRE Hub to date and also what private fusion companies you've been working with and what unique capabilities they're bringing to the effort?

Dr. BUDIL. Yes, thank you for the question, Representative Lofgren. The STARFIRE Hub is a really exciting opportunity for us to lean into our opportunity to build an inertial fusion energy ecosystem, so this allows us to work with the many players emerging in the private fusion industry to begin to build programs to develop workforce that will support that industry and to begin work on some of the important technical challenges that stand between these companies and commercial deployment of fusion energy.

So in the inertial fusion energy realm, we're a smaller fraction of the fusion industry in the United States but still growing day by day. We have CRADAs, cooperative research and development agreements, with most of the companies in this arena, so that includes companies like Xcimer, Focused Energy, Pacific Fusion, and several new ones coming on the scene as time goes by. And in each of those cases, these companies are critically dependent on our capabilities and our workforce.

In particular, for inertial confinement fusion, the only facility where the physics of the igniting target can be studied is the National Ignition Facility at Livermore. So in each case, these companies are critically dependent on our research teams. We're also home to the most advanced modeling and simulation tools to enable them to design their new schemes for approaching a commercial scheme for fusion energy. So it's a small effort, you know, \$15 million to \$17 million, but very important as a community-building effort in the beginning.

I'll just note, for the broader fusion ecosystem, this need for investment in public research infrastructure is also critically important. And all of the fusion companies, magnetic and inertial alike,

are counting on the infrastructure at the national laboratories to really fill critical technical gaps for their schemes going forward.

Ms. LOFGREN. I'd just note, I mean, there's probably more private sector money going into fusion now than public, but there's some things only we can fund, the basic research that's going to be beneficial to every single company that's exploring opportunities.

I would note that China is currently building a NIF replica that's bigger than what we have, and meanwhile, we have needs just to keep up with what we've got.

I note that the—in the December releases for fusion from the Office of Science, there was an award using AI to address questions as to materials science for first-wall fusion issues. What else needs to be done in terms of testbeds, which—I mean, the fusion scientists did an outline of what we should do. We haven't funded it, but China has fully funded it. What do we need to do to beat them to the punch on this and to be successful in our quest for fusion?

Dr. BUDIL. So I think ramping up the effort at the facilities that we currently have in the national laboratories to do things like understand the performance of first-wall materials and other critical componentry in high-radiation environments. These companies need us to help them with the tritium fuel cycle, so each of these reactor concepts that uses tritium requires a closed fuel cycle concept. Only the National Labs really have the infrastructure to advance that.

There are other types of materials and systems integration questions which are difficult to answer without the infrastructure at scale that we have. So the fusion labs—Princeton, Lawrence Livermore, Oak Ridge National Laboratory, Idaho—have a critical role to play, really, in providing that infrastructure.

There are a set of new facilities that have been proposed by Fusion Energy Sciences in the Office of Science that would play a critical role in advancing the cause, but I fear that the timescale to develop new facilities means that we need to invest more in existing facilities to really try to fill these gaps.

Ms. LOFGREN. I'm not chairing an Appropriations Subcommittee, so I will yield back my time since I'm over.

Chairman WEBER. The gentlelady yields back.

The Chair now recognizes Lieutenant Colonel Representative Biggs from South Carolina for her 5 minutes of questioning. Welcome.

Mrs. BIGGS. Thank you, Chairman Weber, for holding this important hearing today with the National Laboratories. And I would like to thank the Directors of Idaho, of Los Alamos, of Livermore, and of Argonne National Labs for joining us.

And I want to bring attention to our friends, my friends at the Savannah River National Laboratory. So the security of our power grid is paramount. The modern world is more interconnected now than ever before, and with this comes the risk of cyber attacks from non-State actors and foreign adversaries alike. Savannah River National Laboratory, through its Global Security Directorate, supports the United States' national security community by focusing its efforts on power grid security, electronic warfare, and wireless test and evaluation processes.

So my question is for each of you. Because of President Trump's America First agenda, the United States is ready, once again, to strive for energy independence and dominance. We must ensure that our energy infrastructure is secure and that it is resilient in face of today's threat environment, especially from the growing perils of cyber attacks. What are your labs doing to address the challenges to energy resilience, and what partnerships do you see as critical to the success to reach this goal?

Dr. WAGNER. May I start?

Mrs. BIGGS. Please.

Dr. WAGNER. Thank you for the question. So at Idaho National Laboratory, in addition to our energy mission, we do a lot of work in critical infrastructure security, primarily cybersecurity for physical control systems, as well as physical security of those systems, partnering with Savannah River and other laboratories. We do a lot of work for the Department of Energy's CESER office—that's Cybersecurity, Energy Security, and Emergency Response—as well as the Department of Homeland Security's CISA. That's critical—or Cybersecurity Infrastructure Security Agency.

So what we do then is we've developed—we've done a lot of things. As you probably are aware, there's a lot of control systems in our infrastructure that were put in place before we understood the cybersecurity risks, so we do vulnerability assessments to understand where those are, how to address them, working with the control system and the critical infrastructure owners to address those risks.

We also have developed methodologies to address consequence-based cybersecurity measures, such that, as we deploy new critical infrastructure, that we deploy it in a more cyber-secure way from the very beginning, multiple tools as well as training for the different owners of these critical infrastructures relative to their vulnerabilities. And lastly—I wanted to give time for my colleagues—we are working hard on more firm energy sources to shore up the reliability of our grid as well. Thank you.

Mrs. BIGGS. Great. Thank you.

Dr. MASON. I can maybe illustrate with an example something that relates to your question. At Los Alamos, we've been collaborating with our colleagues at Oak Ridge National Lab, looking at the application of quantum encryption to the controls that support electric grid operation. We've been doing this in partnership with EPB, the Chattanooga utility that, several years ago, implemented a fiber network across all of their grid. And so they're an excellent partner for looking at what the future of the grid looks like where you have internet-enabled fiber optical connections between the various circuits that switch things on and off, which could be a source of disruption if a malign actor gained access. And so by applying quantum encryption, we have communications protocols that are much more resistant to external attack, and so this EPB partnership allows us to basically operate testbed for future, more secure grid security.

Mrs. BIGGS. Thank you.

Dr. KEARNS. There are four, four examples I would cite from Argonne. Argonne also does quite a bit of work in the cybersecurity and critical infrastructure protection for not only the Department

of Energy, but for other Federal agencies. A great example is really critical infrastructure interdependency, looking at, if you will, the impact of disruptions to our national gas supply to the electricity availability and transmission broadly across the country.

Another one is securing massive edge assets, and this, again, is looking at assets at the edge of the grid, if you will. It might be gas turbines, it might be combined heat and power, it might be distributed storage, it might be buildings themselves, and the list goes on. It's really the backbone, if you will, of the power grid.

The third one is supplying—securing the supply chain. Certainly, security at multiple levels is critically important, talk about materials and components in terms of really enabling the power system.

And the last one is extreme event assessment and mitigation, really understanding the impacts, if you will, of extreme weather and how to respond quickly—prepare for and respond quickly to those events.

Mrs. BIGGS. Great. I'm sorry, but my time has expired, and out of respect for my colleagues, I yield back.

Chairman WEBER. Well, the gentlelady would like to yield back, but Dr. Budil, would you like to weigh in before we do that? I thought you looked anxious.

Dr. BUDIL. Well, that's—how you decide where we sit depends on how much you get to talk. But the—

Chairman WEBER. It's the same way around our dinner table just so you know.

Dr. BUDIL. Exactly. We have many of the same efforts I mentioned already, our Skyfall lab, where we're really trying to understand these cyber-physical systems. Because of our work in national security, we have very strong capabilities in risk assessment and risk analysis. We understand the threat space very well and can bring that, again, in our partnerships with the private sector to critical civilian infrastructure like the grid, but we also have many partnerships looking at the intersection between civilian infrastructure and things like military installations, really trying to understand how to make those facilities resilient and ensure that critical capabilities like that always have secure access to energy in their environment. So thank you, sir.

Chairman WEBER. Now the gentlelady South Carolina yields back. Just remember, you owe me.

Chairman WEBER. The Chair now recognizes the gentlelady from Oregon for 5 minutes.

Ms. SALINAS. Thank you, Chair Weber and Ranking Member Ross, and thank you to our witnesses for being here today.

This is quite timely to have this conversation in the midst of unprecedented attacks on our research enterprise. Reports suggest President Trump is looking to cut the NSF (National Science Foundation) budget by 2/3. Blanket attacks on diversity have thrown existing research grants into question and caused panic and confusion amongst researchers. Elon Musk's henchmen are running amok at NOAA, threatening critical systems like the National Weather Service that researchers and the public rely on. *Inflation Reduction Act* funding has been frozen, and Musk's employees now apparently have access to DOE IT systems. And finally, in my backyard, the Oregon NIH (National Institutes of Health) has an-

nounced indirect funding cuts that will cost Oregon institutions tens of millions of dollars and hamstring critical biomedical research at the Oregon Health and Science University.

So I just want to be crystal clear. If the Administration continues down this path, lifesaving discoveries will fail to materialize, young Americans will have fewer economic opportunities, and our Nation will be weaker and less competitive on a world stage. All of this is a frightening state of affairs, as we watch China propel its AI development. So has any one of you been contacted by the Department of Government Efficiency, or DOGE, and if so, in what capacity or for what purpose?

Dr. KEARNS. I'll jump in first. No, there's been no contact at Argonne.

Ms. SALINAS. Thank you.

Dr. BUDIL. Yes, we've not had any contact at our laboratory either.

Ms. SALINAS. Thank you.

Dr. WAGNER. The same, no contact.

Dr. MASON. No contact at Los Alamos.

Ms. SALINAS. Thank you. Should anyone from DOGE seek access to your internal systems or proprietary data, how would you respond?

Dr. MASON. I mean, we take direction from the Department of Energy, so, you know, if contract direction was given and all the necessary requirements were met in terms of security and so forth, then we would certainly comply with that direction.

Ms. SALINAS. If I could follow up on that question, what if you were asked to forgo the security requirements?

Dr. MASON. The way the labs work is as contractors, we have a set of requirements that flow from the Department of Energy in the form of DOE orders. Those orders are in our contract. We are required to comply with them. If the orders were removed from our contract or waived, then that might provide a mechanism. But as of the moment, all the security orders are still in place, and we are required by contract to comply with them.

Ms. SALINAS. Thank you. So I imagine we might need litigation if contracts were not changed to take effect to override those security mechanisms. Is that correct?

Dr. MASON. I don't know about litigation, but certainly, it requires contracting officer direction to change any of those things.

Ms. SALINAS. OK. Thank you. The national labs engage in far-reaching partnerships with researchers at academic institutions across the country, and in Oregon, these include Oregon Tech students working on clean energy solutions with the National Renewable Energy Lab, Oregon State driving quantum advances with Argonne, and the University of Oregon working with the Pacific Northwest National Lab to pursue discoveries in materials sciences, just to touch on a few.

Have any of you proactively directed any university partners to amend or altogether stop research activities in response to the Administration's orders on DEI or any other executive order?

Dr. KEARNS. No, not at Argonne.

Ms. SALINAS. Thank you.

Dr. WAGNER. I don't believe we have it either.

Ms. SALINAS. Thank you.

Dr. BUDIL. No.

Dr. MASON. No.

Ms. SALINAS. Thank you. Have any of you heard from university partners with concerns about their ability to continue research partnerships?

Dr. BUDIL. No.

Ms. SALINAS. Thank you.

Dr. KEARNS. No.

Dr. MASON. No.

Dr. WAGNER. And no.

Ms. SALINAS. Great, thank you. I will yield back my time.

Chairman WEBER. The gentlelady yields back.

The Chair now recognizes Representative Harrigan from North Carolina for 5 minutes.

Mr. HARRIGAN. Chairman Weber and Ranking Member Ross, thank you very much for holding this hearing today, and to our witnesses, thanks so much for your testimony, really appreciate it. I would agree with the gentleman from Tennessee who said earlier that our National Labs are indeed national treasures. And as the American taxpayer invests their national treasures into our national treasures, your labs, we expect to have great and incredible outcomes from those investments. And I think in many cases, we do, but this Committee has heard in Full Committee setting testimony that we are behind in research and development and a portion of that difference that we've seen can be attributed to intellectual property theft.

And I'm just curious, as I read through your testimonies and have listened to you today, you all control collectively tens of thousands of employees. You have thousands of visiting researchers. How many of those employees and/or visiting researchers are citizens of the PRC (People's Republic of China)?

Dr. WAGNER. So at Idaho National Laboratory, we have approximately 50 foreign nationals from China.

Dr. MASON. As of right now at Los Alamos, there are about 100 citizens out of about 18,000 total people working at the lab—about 100 citizens of the so-called countries of risk: China, Russia, North Korea, and Iran. Obviously, with the new language in the *National Defense Authorization Act*, we are working through a process to come into compliance with that by the April end date, and so that number is going down.

Dr. BUDIL. So at Lawrence Livermore, citizens of China who are not yet legal permanent residents of United States, we have just short of 60 people, and we're working to come into compliance with the requirements of the *National Defense Authorization Act*. And I just noted in my testimony, this is on top of the significant systems we have in place to manage our research environment and ensure that we protect sensitive technology information, important research facilities, and access to our people on a daily basis.

Dr. KEARNS. At Argonne, Argonne is an Office of Science laboratory. The number of foreign nationals is much higher at the laboratory. Of the nearly 4,000 total employees, the total foreign nationals across Argonne's activities is approximately 700. Several of those do come from the People's Republic of China.

Mr. HARRIGAN. When you say several, are you talking about three of the thousand or more than that?

Dr. KEARNS. I'm talking a few hundred.

Mr. HARRIGAN. A few hundred—

Dr. KEARNS. Yes.

Mr. HARRIGAN [continuing]. OK. Have either of you—any of you, have you had any confirmed cases of espionage at your labs dealing with these individuals?

Dr. MASON. In terms of the people currently at the lab, no. Obviously, over the course of history at Los Alamos going back to Klaus Fuchs in the 1940's, yes, there have been instances of espionage, which, I would note, generally relates to access to classified information, which is something that is denied to any foreign national at Los Alamos.

Dr. KEARNS. None at Argonne. We do operate under what we call the managed research environment, which really provides really a close look at all we do in terms of engagement with foreign nationals, including vetting those that want to come to the laboratory to access our facilities or collaborate. We also make sure that we are extra careful in terms of scrubbing and reviewing any potential partnership opportunities, any partnership activities that we might do with a foreign company, so no.

Dr. BUDIL. Yes, I'll confirm nothing in even remotely recent history at our laboratory. Again, we've been in existence since 1952 working in sensitive areas. In addition to the things we've said to date about the managed research environment, we also have operated across that time with very strict controls around classified research, which is segregated both physically and by other controls, and no foreign nationals have access to that research or those networks.

Dr. WAGNER. I'd say at Idaho National Laboratory, just like the other national laboratories, there's a great level of interest from foreign countries in the work that we do. We have a number of safeguards that Director Kearns mentioned in terms of managing those risks, and we do not have any confirmed cases of espionage. But I would say that's largely probably because we work very hard to keep an eye and put safeguards in place before such things would occur.

Mr. HARRIGAN. Thank you all very much for your testimony. And, Mr. Chairman, I yield back.

Chairman WEBER. The gentleman yields back.

The Chair now recognizes the gentleman from Texas, Mr. Turner, for 5 minutes.

Mr. TURNER. Thank you, Chairman Weber and Ranking Member Ross. Let me thank you all for what you do. I want to also just highlight the importance of the research work you all are doing with the grid. I know in Houston in February 2021 it was weather-related, but it literally shut down the city and, in fact, affected even our water systems. So when you talk about weather cybersecurity, we know how detrimental it can be if we don't build in resilience and reliability.

And then Mr.—Dr. Kearns, I want to thank you all for your collaboration with the Greater Houston Partnership with ExxonMobil

and Chevron. Can you just elaborate a little bit more on what y'all are doing to establish a lower carbon system?

Dr. KEARNS. Yes, thank you for the question. The partnership really is relatively new, established about a year ago, really with great engagement from over 20 industry members in the Houston area. We're in the process of working with a few of the other laboratories, including the National Renewable Energy Laboratory and NETL, the National Energy Technology Laboratory, to really settle on a plan of attack, along with the industry members there in the greater Houston area.

So, right now, we're working to scope this study and really kind of understanding how we can be best available and able to really help the greater community there in the Houston area as they look at low carbon options for base chemical production.

Mr. TURNER. Well, let me applaud that collaboration.

And you all have also mentioned the public-private relationships, and, Dr. Kearns, you mentioned the engagement with more than 300 universities. Let me just ask, are any of those historically Black colleges and universities, HBCUs?

Dr. KEARNS. Yes, yes. Howard University, since we're here in the district, comes quickly to mind, but many others, including our North Carolina A&T, for example, working together in terms of some of our work associated with environmental monitoring activities, and it's been an area that we've really been deliberate about in terms of engaging—providing opportunities for really all, so thank you.

Mr. TURNER. OK. And then let me just ask in general. I know that there are some offices that have had to be closed because of the conversation, the Executive orders on diversity, equity, and inclusion. I think recently you had to close an office. Is that correct?

Dr. KEARNS. Yes, at Argonne, we closed the Diversity, Equity, and Inclusion Office. We no longer have a Chief Diversity Officer. We've discontinued our Diversity, Equity, and Inclusion Councils at the laboratory, so many changes have occurred, you know, to be in compliance with the new directives. Much of that activity was driven by a requirement in our contract to develop a DEI plan. That requirement's been eliminated as well by the Department.

Mr. TURNER. And also, can you tell us—elaborate the impact of having to close that Diversity, Equity, and Inclusion Office?

Dr. KEARNS. I think in terms of impact, certainly, there were individuals employed there that are no longer employed there. We've had to really kind of understand their strengths and look for other opportunities for them at the laboratory. Fortunately, we have what we call the Argonne Leadership Institute, which is really focused on the development of all our employees at the laboratory in terms of their training, thinking about career ladders, what opportunities they see, opportunities for them to engage broadly to really strengthen their base. And so that's really been what we've talked about in terms of not only past activities, but future activities. At Argonne, we have a set of what we call the core values. It's impact, safety, respect, integrity, and teamwork. That's really what we're using to engage with the Argonne workforce broadly as we move forward.

Mr. TURNER. And, Dr. Wagner, have you all been impacted by the Executive orders dealing with diversity, equity, and inclusion?

Dr. WAGNER. So we have not had any employees, you know, removed or eliminated, and so while we have changed some things in terms of what we say and how we talk about things, we have not had any further impacts than that.

Mr. TURNER. OK. And Dr. Mason?

Dr. MASON. Similarly, we've made some changes in our organizational structure consistent with the contract guidance that we received. However, we have—the lab has been growing, and we have other needs in human resources, so we've been able to accommodate the affected employees and have also made the necessary adjustments to both comply with the order, but maintain our commitment to maintaining—to having a workplace that is free from discrimination and is respectful of everyone and the contributions that they bring.

Mr. TURNER. And, Dr. Budil, unfortunately, my time is out, and your seating is—we'll have to work on that.

Mr. Chairman, I yield back.

Chairman WEBER. Well, before you do, let's yield the gentlelady some time.

Dr. BUDIL. Our situation is similar to what's described by the other labs. We did have an office that we closed. Those people—small team of people—spent most of their time really working on workforce engagement and building that sense of community and team that's so critical to doing big team science the way we do, and so we have restructured our program and directed them to other activities. So that's the main impact for us.

And I'll just say that the critical importance of bringing together a broad range of ideas, of backgrounds, of experiences is really how we drive excellence in our laboratories, so we're very strongly focused on continuing that focus on excellence.

Mr. TURNER. Thank you, Mr. Chairman.

Chairman WEBER. The gentlelady and the gentleman yields back.

I now recognize the gentleman, Mr. Baird, for 5 minutes.

Mr. BAIRD. Thank you, Mr. Chairman, Ranking Member, and appreciate all of our witnesses being here today. I'm always fascinated with the various kinds of basic research that you do. A lot of times, that's a precursor to industry doing theirs.

But, Dr. Kearns, you're probably the closest to our district in west central Indiana. In fact, last time I saw you, we were at a joint meeting at Purdue University. And I want to make sure you understood that Purdue University, right, was the—anyway—so anyway, you know, since that lab is so close, and I believe the projects really reflect the leading edge on quantum science in the Midwest has developed. And in fact, our Nation's sole quantum corridor runs from Chicago to Ohio, as you're well aware, with most of that corridor in northern Indiana.

So during this Committee's prior markup of the *National Quantum Initiative Reauthorization Act*, I offered an amendment to direct the National Quantum Initiative Advisory Committee to study the creation of a national quantum corridor connecting our National Labs, our universities, and our military bases across the

country with the speed and power of a quantum computer. So do you think we're headed in the right direction with that quantum corridor? And, if so, how can we best secure that corridor against any breaches in research in your opinion?

Dr. KEARNS. Yes, thank you very much for the question. I do appreciate the Subcommittee and the Committee's support of the National Quantum Initiative, really, in its renewal if you will in that regard, I think many good things have happened under the National Quantum Initiative. One that's particularly important to Argonne has been the stand up of the National Quantum Research Centers. We operate what's called Q-Next, really focused on quantum interconnects.

You know, the fascinating thing to me about this is really the strong interest from industry in many aspects, really, of quantum information science that we have from industry. We have 11 industrial partners as part of that center. The laboratory has had to devote 1 day a week for conversation with other industrial—potential other industrial partners that want to come to Argonne and talk about quantum science and their own ideas and how they might partner with us and other national laboratories. I think that's great.

In terms of pulling things together, you know, I think the Department of Energy, again, through the Office of Science and the National Quantum Research Centers—there are five of them—it's really created a very dynamic ecosystem. I think, initially, the first 5 years has really been focused on developing capabilities and building partnerships as we look really to moving forward, as suggested by the National Quantum Initiative, it's really about further activation of the ecosystem that's been established. Many of the, I would say, geographic regions of the country have developed quantum networks, quantum testbeds, if you will, for quantum communications. And there's always interest in thinking about linking systems. Can we join our efforts together in terms of that national quantum network that you spoke of?

The big challenge, technology is not just there yet, and so it's really important that we continue to invest both in the fundamentals and the engineering aspects associated with quantum information science.

Mr. BAIRD. You know, right along with that, it's amazing to me how much energy these data centers take. I've had energy suppliers indicate to me it's going to quadruple their demand for electricity.

But anyway, I'm going to go to everyone for this question. You know, I mentioned Purdue University, and we've been working on the small modular reactors in a nuclear study, and we're working with Duke Energy to study the feasibility of using the SMR to power an entire college campus. And recently, the reactor at Purdue was fully digitized and started back up.

So can you elaborate on the challenges that that kind of transition and taking it from analog to digital and the consequences of that related to the SMRs? And we got 46 seconds, so I'm going to start—

Dr. WAGNER. So I'll be very quick, but there are increased risk in cybersecurity and transfer—transitioning from analog to digital.

And researchers around the laboratory complex at multiple laboratories have been working with utilities and the Nuclear Regulatory Commission to address those considerations. And actually there's progress been made on a utility in the United States to do that as a frontrunner pilot to addressing that—those concerns. And I do see that going in that direction in the future.

Mr. BAIRD. We got 12 seconds for three of you. You got 4 seconds apiece.

Dr. MASON. I would just note that, actually, this is an area where DOE did pave the way because the High Flux Isotope Reactor at Oak Ridge reached the digital controls well in advance of industry. And that, I think, perspective informs some of the work that my colleague discussed.

Mr. BAIRD. Mr. Chairman, could I ask for a couple more seconds to get—

Chairman WEBER. Yes, sir.

Mr. BAIRD. I'd like to get—thank you.

Dr. KEARNS. Yes, certainly, as has already been commented on, it's underway. I think it's important that we really stay really engaged and really look at the opportunities with open eyes and be as smart as we possibly can to make sure that we're at the cutting edge in terms of the transition.

Dr. BUDIL. Agreed. And I think Thom's point about highlighting the role that we can play in partnership in the public sector. We have facilities and experience in many of these areas that could really help accelerate this transition for industry.

Mr. BAIRD. Thank all of you, and I yield back.

Chairman WEBER. The gentleman yields back.

The gentleman recognizes the Representative from California, Representative Friedman.

Ms. FRIEDMAN. Thank you, Chair Babin and Ranking Member Lofgren. For the record, I firmly believe in continued Federal funding into basic research, and I am deeply alarmed by Musk and President Trump's basic freezing of all Federal funding that has very much damaged American scientific leadership. And we've heard today about what cuts are doing to your institutions. There is massive return on investment from these research dollars, as we know, and I think it's idiotic to indiscriminately cut funding when we get such a massive return for those dollars. Even beyond nuclear energy, which we've heard a bit about today, this is key for our national security.

And the value of those investments can be seen very clearly in California, where we're proud of our scientific leadership. We have a long history of being both a national and global leader in science and have set the standard for groundbreaking research, from aerospace to advanced computing to climate change research and clean energy. And that work continues today with new technologies like artificial intelligence. We're home to leading universities and research institutions that attract the best and brightest from around the world, and we are proud that our children have access to those great institutions as they look for opportunities as they grow.

We have collaborations between our national labs and leading universities that have fostered a real culture of innovation in California. In fact, right outside my district, Cal Tech's Joint Center for

Artificial Photosynthesis has brought together 100 world-class scientists and engineers from Cal Tech to partner with Lawrence Livermore National Laboratory. Those lab-driven advancements translate to high-quality jobs, the kind of jobs that people want for upward mobility, and they grow our local economies in California and beyond.

But we have huge challenges in California. We recognize that manmade climate change has led to huge challenges just in our State. We are grappling with droughts and huge swings in weather, and we know that the megafires that we have seen in the last 10 years are a direct result of that climate change. And, at the same time, our new—our President is saying that we should “drill, baby drill.”

Now, we know what burning fossil fuels means in California, where we have the worst air quality in the Nation, especially in the Central Valley, and we are suffering in Los Angeles from devastating fires that were certainly fueled by drought, made much worse by climate change.

Director Budil, I am wondering how your research is figuring into the clean energy solutions that are not only creating great jobs in California but will help us lead the world out of the climate change impacts that are being felt, not just in California, not just in the United States, but all over the globe. And we know that other governments will—are looking desperately for solutions, and I think it's pretty clear that whoever—whatever country comes up with the solutions that will help us escape climate change are going—is going to have the world's leading economy because that technology is so highly sought after.

So what are you doing and what do you see on the horizon for those clean energy solutions?

Dr. BUDIL. Thank you for the question. I divide my answer into two parts. In the near term, our researchers have been working hard to manage carbon in our environment, so how to make fossil fuel burning technologies cleaner, how to capture and store carbon, how to utilize oil and gas infrastructure after it's been expended for some of these efforts. And we have been a big part—the labs have been a big part of building the national—natural gas economy in the United States. So I think that adaptation of those technologies in a way that makes them sustainable in the near term is critically important.

For the future, we are right at the heart of building this future fusion economy, and the United States has an extraordinary opportunity to lead on this front. We have many of the leading facilities in the world and the only facility in the world that's ever achieved energy gain in a fusion experiment. So that moves fusion technology from the realm of fantasy technology into perhaps a relatively nearer-term solution for large-scale baseload energy development with a new technology.

So we're working very hard to buildup the ecosystem that goes along with that and addressing the R&D challenges that still remain to making fusion energy commercially viable, working with companies to understand the gaps they have, and then directing our research to rapidly fill those gaps—again, materials, tritium fuel cycle being two notable ones—and advancing the state-of-the-

art in key technologies for things like inertial fusion energy where advanced laser technology, high-repetition rate experiments, and higher gain target designs, which we can work on at our National Ignition Facility, will be central to success.

Ms. FRIEDMAN. Thank you, and I yield back.

Chairman WEBER. The gentlelady yields back.

The Chair now recognizes the gentleman from New York, Representative Riley.

Mr. RILEY. Thank you. Thank you, Mr. Chairman, and thank you to all the witnesses here. I really appreciate hearing about all the incredible work you're doing on everything from fusion to machine learning, all these things that we really need to do to stay competitive in our global economy. It's really, really important stuff.

I wanted to use my time today to talk about something different that's really immediate and hitting close to home in upstate New York and something that I want to ask for your help with, and that is the opioid epidemic. It's just ripping through towns across upstate New York. In west Endicott, where I'm from, we've lost some of my high school classmates or their parents because of overdoses and addiction. In Sullivan County, we're losing two people per month because of overdoses, and we're having 10 overdoses per month, so two deaths and 10 overdoses per month in just Sullivan County. Greene County in my district, we've got the second highest overdose rate in the State. I was at a diner in Catskill in the fall, and it was one of the issues that came up over and over again. We're losing kids and parents and friends and neighbors.

And I think there's a lot of reasons for this. A big part of it is, frankly, we've just got a wide-open border when it comes to fentanyl trafficking. So you've got China sending these ingredients to Mexico, and then the cartels are making fentanyl, and then they're smuggling it into America, where it's killing our people, and it's got to stop. It's got to stop. And I think we really need the help of the best and the brightest scientists in this country to do it.

We need better technology at the border to stop the fentanyl trafficking and to detect the fentanyl. It seems like the sort of thing that if we were able to harness the best and the brightest scientists in this country, we could find a way to detect fentanyl as it's coming to the border. I know that there's already some work being done with our national labs in partnership with the Department of Homeland Security on this.

I put to you all, as some of the leading scientific voices in this country, how can we start detecting this fentanyl? What do you need from Congress in terms of if we have to give you the mission, if we have to have—what do we need to do to galvanize some folks to put some of our best and brightest minds on this issue?

Dr. MASON. I actually have something that might be of interest to you, but I'm not able to discuss it in an open forum.

Mr. RILEY. I understand. I would—that sounds even more interesting now that you put it that way. And because it's a response to my question but also it sounds—now, it sounds even cooler. So let's find a time. I'm going to drop off my card with you, and let's talk about that.

Dr. BUDIL. So we have something that we can tell you about, which is a development of a new countermeasure to counter the ef-

fect of fentanyl on those who might come in contact with it, perhaps not an overdose, but, for example, first responders who go out into the field. So using the combination of our experimental and computational capabilities, we were able to develop a therapeutic that counters the toxic effects of fentanyl that could be used for that purpose.

Mr. RILEY. Incredible. Yes, that's exactly the type of work I think we need.

Anybody else have suggestions on this? One of the things I'd like to work with you all on and work with the Administration on is whether there's a way—I mean, you guys are just doing incredible stuff, like amazing breakthroughs, and I just think that we have the best scientists and researchers in this country, and we have this immediate problem that is literally killing my constituents. And what I want to do is take all of your talents and your skills and put folks to work on this mission of detecting this stuff before it gets into the country. We've got to get the border secure. We've got to do it, and to do that, we need better technology. And to get better technology, we've got to have our scientists working on it. So I want to support you in supporting that kind of work.

And, Dr. Mason, we'll talk after about the super-secret, cool stuff that you guys are doing.

Thank you, and I'll yield back my time.

Chairman WEBER. The gentleman yields back.

The Chair and recognizes Dr. Foster for 5 minutes.

Mr. FOSTER. Well, thank you. And I guess since we were just talking about fentanyl, I can't resist pointing out that Argonne National Lab, one—research performed at Argonne won the Nobel Prize for the study of the G protein-coupled receptor. And this is the actual mechanism when the opioid molecule hits the receptor in your brain that causes the addict to become addicted. This can be directly imaged and has been at the Argonne APS. They can see exactly what happens when the—well, the fentanyl and—it's everything that happens after that to the fentanyl molecule hits the brain and how that works.

And when you get that kind of understanding, we are now rolling out medically assisted treatments that directly crowbar that receptor so that when the—you know, when the opioid molecule arrives, you actually don't—you don't feel it. And so it is this kind of research over decades that really—you know there are many lines of defense we need against fentanyl and the damage it's doing. The last best line of defense is the human brain. And if we can find simple ways to crowbar the response of the human brain to fentanyl, you won't need border security or anything else because no one will be—we won't have addicts desperate to buy the fentanyl. And so I'm just really proud that that's happened in my district. It was Argonne National Lab and the APS.

That's—you know, as I mentioned, I—you know, I have Argonne in my district, and that was a really, really impressive line of research. And I hope—you know, I hope that all of the labs will really survive this review that's coming up with flying colors because for years prior to COVID, I was the Chair of the National Labs Caucus where I got to drag Members of Congress to the national labs. And when they arrived, they'd—I have no idea this neat stuff

is happening. And then they were big advocates for preserving the—and expanding the budget of the national labs.

And so at some point, now that COVID is over, I think we'll resurrect that because it's really—you know, it's really breathtaking, what's happening. And a lot of it—the labs serve as a very powerful flywheel because things tend to go in and out of fashion. You know, and fusion—you know, fusion's gone in and out of fashion and—in different forms several times during my career in science. And it's—and so it's really nice that the national labs have a capacity that is there in good times and bad. And to make that happen, you have to have Congress and the Department of Energy that understands the permanent value of keeping the team together, even when, you know, it's not popular.

And that's why I think it's really going to be an all-hands-on-deck moment to preserve the budgets of these so you don't see layoffs just because you can during bad times on the budgets here. So I think that's—let's see. I have now used up like way too much of my time and things—let's see. Is there—a little bit—you know, there's a really valuable thing the national labs do, which is to curate datasets. You know, I think that was mentioned, the protein folding problem datasets. That was generated, you know, in large part, well, at Argonne and other labs, and that gets curated at national facilities. Sometimes that's necessary because of national security reasons. Other times, when they're—you know, when there are medical privacy reasons that there's been a role for laboratories to keep those secret and yet appropriately accessible to researchers. And, you know, it's a tough thing, and the labs have the background to do that.

Director Kearns, can you say a little bit about what Argonne's been doing in terms of just curating datasets and providing compute for, you know, researchers?

Dr. KEARNS. Yes, thank you very much. It's a critical matter for sure. It is something that not only Argonne but several of the other laboratories have strengthened as well.

Thank you for mentioning the Advanced Photon Source, a tremendous opportunity here to work with the broader scientific community, over 7,000 users on an annual basis. I mentioned earlier that we've just completed the upgrade, which will make it—I think create even more demand for the science that one will be able to do there.

It does generate a tremendous amount of data, and we're working hard to really understand how best to really help the researchers take that data and really use it to provide needed information to further their experiments and so critical in that way.

We also have the honor, really, of having a leadership computing facility at Argonne, Aurora I mentioned earlier, exascale system. Certainly, one of the key aspects in terms of really having that kind of compute capability is really being able to store and work with large amounts of data. All of the exascale systems across the Department, all three of them have really been built with, certainly, modeling, simulation, data science, and AI in mind. I think Kim mentioned earlier that El Capitan has over 40,000, I think, GPUs. Argonne's Intel-built system at Aurora has about 60,000 GPUs, so really fantastic in terms of—

Mr. FOSTER. So I'm afraid my time is now up, and so—but I just want to thank the Chair and the staff for letting me—

Chairman WEBER. Well—

Mr. FOSTER [continuing]. Come back here. I miss this—

Chairman WEBER [continuing]. Mr. Foster, if you need to move on with two more questions for the other witnesses, we don't want to feel—them to feel left out.

Mr. FOSTER. Well, I know I could ask about scientific breakeven versus economic breakeven, but I guess I won't go there right now.

Chairman WEBER. I'm getting the—so the gentleman yields back.

The Chair now recognizes Chairman of the Full Committee, Dr. Babin.

Chairman BABIN. Thank you, Chairman Weber, appreciate it. And I want to say thank you to our witnesses here for being here today with your valuable introspection and expertise and knowledge.

I'm going to ask this of all of you witnesses if you don't mind, and I would ask you, please be brief because I have other questions I want to ask.

When we talk about the importance of maintaining critical infrastructure facilities and workforce to support our basic research, it's important to understand the context of where funding went recently. Over the last 5 years, the Department of Energy recently close to \$100 billion—received close to \$100 billion in supplemental appropriations from the *IIJA*, the *IRA*, which established over 70-plus new programs. Of the \$97 billion appropriated to DOE, what percentage and amount went to the National Laboratories out of that \$97 billion? And how much did each of your labs receive from these supplemental appropriations? Please answer very, very briefly. How much did you get out of the \$97 billion?

Dr. WAGNER. So I cannot speak to the percentage that went to the Department of Energy laboratories. I can get back to you with that information.

Chairman BABIN. Please do.

Dr. WAGNER. For Idaho National Laboratory, we received \$150 million, and we use those dollars toward modernization of facilities at our Materials and Fuels Complex—

Chairman BABIN. OK.

Dr. WAGNER [continuing]. And Advanced Test Reactor.

Chairman BABIN. Thank you. Yes, sir?

Dr. MASON. Los Alamos received \$200,000.

Chairman BABIN. So \$150 million, \$200,000. Next, please?

Dr. KEARNS. Sixty million dollars really devoted primarily to helping us with the exascale computer at the laboratory, Aurora, and also some work in terms of heat recovery systems at the Advanced Photon Source.

Chairman BABIN. Got you. Thank you.

And Dr. Budil?

Dr. BUDIL. So we had a \$7 million project that was recently de-obligated from the lab.

Chairman BABIN. OK. Thank you very much.

And then, Dr. Wagner, Abilene Christian University in Texas received its NRC permit for the construction of the first liquid salt fueled reactor and—at Abilene Christian University in my State of

Texas. However, the project is currently facing issues with procuring HALEU fuel for its reactor. How can Congress help accelerate this procurement process, and what is the current status of the Experimental Breeder Reactor II, EBR-II, spent fuel being converted into HALEU? If you could answer that, I would appreciate it.

Dr. WAGNER. Yes, I'll try to be quick. Congress has already done quite a bit to try to establish the capabilities domestically to produce high-assay LEU or HALEU fuel—

Chairman BABIN. Right.

Dr. WAGNER [continuing]. Including \$700 million in the *Bipartisan Infrastructure Law* and, more recently, \$2.7 billion to establish domestic capability. I don't know what Congress can do relative to the procurement aspect. That's something the Department of Energy is pursuing.

On EBR-II, we are reprocessing spent nuclear fuel from the Experimental Breeder Reactor II. That was a high-enriched uranium fuel. We recover that material, we down-blend it to high-assay LEU, and we are making that—we will work with the Department to make that available to private companies and perhaps Abilene Christian.

As of now, we are on our path to reprocessing all that material that will result in about 9.2 metric tons of high-assay LEU by the end of this decade. We're about halfway through that material.

Chairman BABIN. That's great. It's kind of disconcerting to the university to have gotten their permit but not able to be able to obtain fuel.

OK. As I wrap up, I'd like to address one thing that was brought up today that caught my attention. My colleagues have mentioned that the Trump Administration's spending pause is unprecedented. I'd politely remind my colleagues that the previous Administration delayed allocation of funding from the *IIJA*, the *IRA* and *CHIPS and Science* laws to add non-statutory conditions like union requirements, unnecessary environmental reviews, and DEI conditions, not to mention the fact that the Biden Administration actually canceled and redirected funding for our border wall, which Congress had voted on, signed into law, even to the point of selling off the materials of the border wall that was unused for 10 cents on the dollar.

Unlike the previous Administration, if funding is required to be disbursed by a specific time, this Administration said that it would do so. If the law allows discretion, the President has the authority to review this funding. Given the billions of dollars that went out the door at the end of the last Administration—specifically, the Loan Program Office at Department of Energy that gave out over 50 billion in loan guarantees in just the last 5 days of the Biden Administration's term, some of those very risky—asking questions about funding that was described by previous Administration officials as throwing gold bars off the Titanic might be a good idea.

And so with that, Mr. Chairman, I will yield back.

Chairman WEBER. The Chairman yields back.

The Chair would like to enter into the record a letter from the Partnership for AI Infrastructure. Without objection, so ordered.

I thank the witnesses for their valuable testimony and the Members for their questions. The record will remain open for 10 days for additional comments and written questions for the Members. This hearing is adjourned.

[Whereupon, at 11:53 a.m., the Subcommittee was adjourned.]

Appendix I

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

*Responses by Dr. Paul Kearns***U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY****From Transformative Science to Technological Breakthroughs: DOE's National
Laboratories**

Dr. Paul Kearns, Director, Argonne National Laboratory

Questions submitted by Chairman Brian Babin, Committee on Science, Space, and Technology

1. Mr. Kearns, is Argonne working on a 45VGREET model update that would allow hydrogen producers to input project-specific emissions data for their natural gas supply chain as foreground data for the purposes of calculating the carbon intensity of produced hydrogen?

Argonne National Laboratory has been developing and updating its R&D GREET for the purpose of helping R&D of technologies. The R&D GREET is hosted at Argonne website and is on the annual release with peer reviewed publications to document new features. Argonne has been providing technical assistance to the 45VH2-GREET that the Department of Energy (DOE) has been developing for IRA 45V applications. The R&D GREET is the computational engine and the background of the 45VH2-GREET, which is hosted on the DOE website for the tax version which is hosted by the federal government.

The R&D GREET already has the option for users to adjust these values. Argonne is currently working with the DOE on updating 45VH2-GREET to allow for such user inputs as well. We anticipate that this will be completed within the next few weeks.

Argonne is also working on including regional leakage data in R&D GREET and then implement it in the 45VH2-GREET. We anticipate that this will be completed in a month or so.

2. When can we anticipate DOE publishing this new 45VGREET model that would allow for differentiated natural gas calculations?

Please see the response provided in the previous question.

**U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY**

**From Transformative Science to Technological Breakthroughs: DOE's National
Laboratories**

Dr. Paul Kearns, Director, Argonne National Laboratory

3. Is there anything that would prohibit Argonne from developing, and DOE from publishing, a new 45VGREET model allowing for project-specific emissions input from differentiated natural gas in 2025?

The above efforts will rely on data on methane emissions from different sources including the main source of company-reported data to the EPA Greenhouse Gas Reporting Program (GHGRP) program. Argonne will process these bottom-up data for GREET LCA applications. More importantly, these bottom-up data will be adjusted with top-down results from extensive results in the past 15 years by various organizations. Obtaining accurate, reliable data for R&D GREET (and then for 45VH2-GREET) is a time-consuming process.

Appendix II

ADDITIONAL MATERIAL FOR THE RECORD

LETTER SUBMITTED BY REPRESENTATIVE RANDY WEBER



PARTNERSHIP FOR AI INFRASTRUCTURE

The Honorable Randy Weber
Chairman, Subcommittee on Energy
Committee on Science, Space, and Technology
U.S. House of Representatives
107 Cannon House Office Building
Washington, D.C. 20515

The Honorable Deborah Ross
Ranking Member, Subcommittee on Energy
Committee on Science, Space, and Technology
U.S. House of Representatives
1221 Longworth House Office Building
Washington, D.C. 20515

Letter for the Record: Subcommittee Hearing on "From Transformative Science to Technological Breakthroughs: DOE's National Laboratories"

Dear Chairman Weber, Ranking Member Ross, and Members of the Subcommittee:

The Partnership for AI Infrastructure respectfully submits this letter for the record to outline the critical need for federal investments in artificial intelligence (AI) research and development (R&D), including at our nation's national labs, to advance our national science, security, and technology objectives. As a coalition of stakeholders committed to leveraging AI to accelerate technological breakthroughs, the Partnership commends the Subcommittee for its efforts to advance scientific R&D and for convening this hearing. As part of the Subcommittee work, the Subcommittee should focus on ensuring our nation's national labs have the tools they need to ensure the U.S. continues to lead the world with respect to artificial intelligence research and development.

The race to dominate AI now represents the defining technological challenge of our time and demands unparalleled resolve and innovation to secure America's global leadership. As the Subcommittee continues its work, the U.S. Department of Energy (DOE) and its National Laboratories is well positioned to launch a national initiative to build up our AI capabilities. Such an initiative, for example, could unify the nation's brightest minds, most advanced facilities, and industrial strength around a singular mission: securing American leadership in artificial intelligence.

While the U.S. leads the world in commercial AI development, federal scientific and national security missions require targeted investment in AI. This makes a federal AI initiative unique, yet complimentary to private sector commitments such as Stargate. While Stargate promises to advance commercial AI capabilities, it is likely to widen the gap between private and

federal AI capabilities, further highlighting the need for federal investment in AI R&D at DOE and other agencies.

Such a federal approach to AI R&D could be safeguarded from external influence and focused solely on national interests. What's more, because federal AI development will take place in national labs, new federal AI models can be trained on scientific data held by the labs and federal partners that in many instances the private sector does not, and cannot, access. The priorities for this initiative should be threefold: (1) advance scientific computing to fuel American innovation, (2) secure critical infrastructure through robust AI capabilities, and (3) develop AI systems to protect U.S interests and national security.

The need for advancing this AI initiative becomes more urgent as other nations, including our adversaries, rapidly invest in AI technologies and threaten to undermine our global lead. China has publicly pledged to invest \$26.69 billion in AI by 2026, likely focusing on military applications and surveillance systems. The recent release of China's DeepSeek AI Model, demonstrate the technological breakthroughs made possible through dedicated investments. In addition, India's government announced a \$1.25 billion investment in AI infrastructure, Japan launched their own initiative to invest \$65 billion in chips and AI before 2030, and the European Union recently committed \$775 million to advance their supercomputing capabilities to support the continent's AI innovation. In fact, even the UAE has invested more than the US government. It is very likely that the actual investments are much higher given the importance of AI for all sovereign nations in today's technological landscape.

Critically such an initiative could be modeled off of the Exascale Computing Initiative, which was a proven success and produced the three fastest supercomputers in the world in the DOE National Labs. The DOE AI Act, led by then Representative Brandon Williams (R-NY) and Rep. Suzanne Bonamici (D-OR), which was reported favorably by this committee on a voice vote, would provide a critical statutory authorization for just such an AI R&D initiative.

America faces a stark choice: lead the world in AI by launching a large-scale, national initiative, or risk ceding technological leadership to global competitors and adversaries. The Partnership for AI Infrastructure and our members stand at the ready to be a resource as this Congress looks to chart our AI future. We applaud the Committee's commitment to advancing science and technology to secure our nation's global leadership. Thank you for the opportunity to share our perspective and for convening this timely hearing.

Sincerely,

Partnership for AI Infrastructure