Written Testimony of Dr. Paul Kearns
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Chairman Gardner and Ranking Member Manchin, and members of the subcommittee, thank you for the opportunity to appear before you today.

I am Paul Kearns, interim director of Argonne National Laboratory, one of America's first and largest multipurpose science and engineering laboratories, located in Lemont, Illinois. Before becoming Argonne's interim director in January 2017, I served as Argonne's Chief Operations Officer and prior to Argonne, I held leadership positions at Battelle Global Laboratory Operations, Idaho National Engineering and Environmental Laboratory, and Pacific Northwest National Laboratory. I also served as a visiting professor in engineering and physical sciences at the University of Manchester in the United Kingdom.

As you can see, I have devoted much of my career to expanding the national laboratories' unique mission of securing our nation and encouraging break-through discoveries in science and technology. It was the special mission of the laboratories that attracted me to the national laboratory system and it is the opportunity to work with such dedicated and talented people, on things that matter, that has kept me involved with the national laboratories.

For more than 70 years, the U.S. Department of Energy and its national laboratories have improved the way our nation generates, distributes, and uses energy. Time and again, the laboratories have been called upon to overcome the world's greatest scientific challenges. Working together to solve national challenges, the national laboratories bring to bear decades of expertise from researchers in physics, materials and chemistry, math and computer science, life sciences, nuclear energy and more.

This network of 17 national laboratories is a vital component of the science and innovation ecosystem of the United States with major continuing impact. It encompasses multipurpose science and security laboratories, as well as single purpose laboratories related to specific science and technology aims. Focusing on the core missions, dynamic programs and rapid response needs of the country allows the system to address major science programs and respond to needs such as answering urgent questions about outbreaks of Ebola in Africa and mitigating weather-related risks with innovative, detailed computer models.

For example, the DOE operates five light sources - the Advanced Light Source at Lawrence Berkeley National Laboratory, the National Synchrotron Light Source at Brookhaven National Laboratory, the Stanford Synchrotron Radiation Lightsource and Linac Coherent Light Source at the Stanford Linear Accelerator Center, and the Advanced Photon Source at Argonne National Laboratory. Each offers a different way of characterizing materials at the atomic and molecular level so that we may understand, predict, and ultimately control materials properties. These facilities generate both hard X-rays that penetrate nearly any surface to reveal the inner workings of materials and technologies as well as soft X-rays that are less intrusive.

Similarly, DOE also operates five nanoscale science research centers, strategically located within national laboratories across the country. Each center has particular expertise and capabilities in selected theme areas, with the goal of understanding, predicting, and ultimately controlling matter and energy at the atomic scale. This research provides the foundation for future new technologies and supports the DOE mission in energy, environment, and national security.

From these facilities come life-changing discoveries. Drugs used to treat and halt the progression of conditions including advanced kidney cancer, malignant and inoperable skin cancer, a common type of leukemia, and HIV all got their start at Argonne's Advanced Photon Source. Research there also has led to greater understanding of diseases ranging from autism to osteoporosis.

This ability to view matter in great detail has led to other innovations as well—the intense X-rays of the Advanced Photon Source helped Argonne design the technology used in the battery cell that powers the Chevy Volt. It has also led to insights about how to improve the reliability of additive manufacturing, the efficiency of internal combustion engines, and the possibility of hypersonic flight. These insights flow from open and productive partnerships with a range of industries, including pharmaceuticals, oil and gas, and transportation.

As we update Argonne's Advanced Photon Source, researchers will be able to peer deeper and develop, for example, 3-D images of the entire human brain, building upon current neuroscience research that has developed models of a mouse's brain. In other words, the ultimate 3-D microscope is within Argonne's grasp.

Breakthroughs such as this highlight many other strengths of the laboratories as well. For example, Argonne's interdisciplinary culture combines the imaging of the Advanced Photon Source with deep and broad materials science expertise and modeling capabilities of the Argonne Leadership Computing Facility.

More than 30 of the 500 fastest supercomputers in the world can be found at DOE laboratories. Like our light sources, these high-performance computing facilities offer an unparalleled combination of resources, which is helping scientists accelerate their research in many fields, enabling high-impact scientific discoveries, and making a transformative impact on society. At Argonne we have helped industry perform simulations in pursuit of more efficient jet engines and wind turbines, and now we are working to combine new capabilities in machine learning with novel data acquisition and analysis techniques and simulations to help doctors arrive at prognosis and treatment plans designed specifically for individual cancer patients. Scientists are also using these resources to enhance the creation of nanocircuits to usher in the next generation of electronic circuitry.

The national laboratories make these large-scale, powerful facilities and their specialists available to a community of more than 30,000 researchers from all 50 states annually from industry, academia, and other national laboratories.

None of what the national laboratories accomplish would be possible without highly skilled and visionary researchers. World-class researchers who work at the national laboratories keep our nation secure and economically competitive.

We design, build, and operate distinctive scientific instrumentation and facilities, making supercomputing, imaging, and other resources available to the wider research community. This impact multiplies as we collaborate with more than 30,000 users of our facilities, combined with nearly 60,000 scientists, engineers, and employees across the Department of Energy's national laboratory complex. With our unique talent and tools, national laboratories play a critical role in large-scale, long-term research and development that complements the pursuits of universities and industry to discover new knowledge and better human lives.

Argonne's materials science and chemistry research has yielded a spectrum of innovations ranging from some of the toughest ceramic ever produced—perfect for energy and transportation applications—to smart, highly insulated windows that could save 5 percent of the nation's energy budget.

Elevating our accomplishments is the constellation of relationships the national laboratories have with other researchers. Partnerships mutually benefit the DOE laboratories and universities—from single collaborations between principal investigators to long-term, interdisciplinary scientific programs leveraging multiple resources in talent, facilities, and ideas. These partnerships capitalize on the different strengths of the respective organizations and bring unique solutions to regional and broad national challenges. As an example, the Institute for Molecular Engineering, created as partnership between Argonne and its parent organization, the University of Chicago, looks to impact major society issues with innovative technologies achieved through molecular-scale design and manipulation.

Universities make up a third of the partner organizations in the Argonne-led Joint Center for Energy Storage Research (JCESR), DOE's battery and energy storage hub, with many others serving as affiliates and collaborators. The hub's mission is to create next-generation battery technologies that will transform the transportation sector and the electric grid the way lithium-ion batteries transformed personal electronics. JCESR is an example of a successful public-private partnership, bringing together collaborators from universities, industry, and other national laboratories.

In addition to energy storage, national laboratories are working to create a more reliable and resilient power infrastructure for U.S. energy and economic security. We are using such solutions as grid-scale storage to take full advantage of intermittent resources and we are empowering consumers to manage more of their consumption via smart appliances, smart meters, and transparent pricing. In collaboration with local utilities and first responders, national laboratories have developed technologies such as self-healing frameworks to mitigate the consequences of cyber-attacks and advanced sensor technologies to aid in physical security of the electric grid and our infrastructure.

Our breakthrough science and engineering accomplishments are rolling back the frontiers of discovery in many areas.

The laboratories increase the mobility of our citizens with new transportation systems to diversify fuel sources and increase efficiency. We integrate combustion, fuels, and lightweight materials research and development to improve internal combustion engine efficiency, and develop and deploy new energy storage technologies for electric and hybrid-electric vehicles.

National laboratories make us all more secure by advancing nuclear materials management, detection, and forensics capabilities to protect the nation. They also enhance the safety, security, and reliability of the nation's nuclear deterrent. We provide the targeted, sophisticated data collection and lightning-paced parsing necessary to inform national security decision-making, and create an advantage with energy and power solutions specially designed to fulfill national security missions.

Our researchers contribute to the greater health of our nation by increasing the understanding of diseases in order to fight them more effectively. Argonne scientists were part of a team that determined the 3-D atomic structures of more than 1,000 proteins and deposited their findings into World-Wide Protein Data Bank. National laboratories are melding medical research and high-performance computing to create precise therapy options based on genetics.

Underpinning all these goals is the fact that the national laboratories are equipped like none other to expand our fundamental understanding of matter, materials, and their properties. With world-leading X-ray sources, particle accelerators, supercomputers, nanoscale science centers, and other facilities, we conduct basic research across the spectrum from the large-scale structure of our universe to the microscopic nature of matter at subatomic levels. We discover new materials and chemical assemblies and apply their novel structures, functions, and properties to new ways of generating, distributing, and using energy.

The success of the national laboratory system is being noticed by other countries that are looking at our model to replicate its unique interdisciplinary culture. We must continue to invest in this system to remain at the forefront of research and development as we overcome the greatest scientific challenges.

Thank you for your time and your interest in how the national laboratories bring greater security, health, and prosperity to Americans. The decades of time national laboratories have invested, combined with our world-class talent and one-of-a-kind tools, enables us to excel in large-scale, research and development challenges that complement those of universities and industry, to explore new frontiers of knowledge and elevate the well-being of society. I welcome any questions that you might have.