

**House Committee on Energy and Commerce
December 13, 2023**

Leveraging Agency Expertise to Foster American AI Leadership and Innovation
**Questions for the Record Submitted to Helena Fu, Director of the Office of Critical and
Emerging Technology, Department of Energy**

QUESTIONS FROM CHAIRWOMAN CATHY McMORRIS RODGERS

- Q1. Does DOE or the national labs have a generally accepted definition for what constitutes “artificial intelligence” that falls under its regulatory authority or research programs? If so, please provide these definitions.
- A1. DOE refers to the definition of Artificial Intelligence in the Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence, which states: “The term ‘artificial intelligence’ or ‘AI’ has the meaning set forth in 15 U.S.C. 9401(3): a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations, or decisions influencing real or virtual environments. Artificial intelligence systems use machine- and human- based inputs to perceive real and virtual environments; abstract such perceptions into models through analysis in an automated manner; and use model inference to formulate options for information or action.”

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QUESTIONS FROM REPRESENTATIVE MORGAN GRIFFITH

- Q1. Is your office actively researching and/or soliciting use cases from power generators, on artificial intelligence applications that could extend the useful life of fossil fuel power plants?
- A1. DOE's Office of Fossil Energy and Carbon Management (FECM) has over 130 current projects where AI is a key technology enabler. A variety of these projects could effectively increase fossil fuel power plant efficiency. Approximately 2/3 of the AI applications fall into one of three categories: optimizing energy exploration processes, enhancing energy capture technologies, and improving overall energy efficiency; the remainder of the projects focus on improving productivity through data reduction.

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QUESTIONS FROM REPRESENTATIVE JAY OBERNOLTE

- Q1. Can you describe the next steps needed to continue standing up the new DOE Office of Critical and Emerging Technology, and what results can we expect from its initial coordinating activities?
- A1. U.S. leadership in critical and emerging technologies such as artificial intelligence (AI), biotechnology, quantum, and microelectronics is key to enabling economic prosperity and our national security. These technologies will be a major source of new discoveries and breakthroughs, strengthen our ability to counter national security threats, and increase access to clean, reliable, and affordable energy. That is why DOE stood up the new Office of Critical and Emerging Technology to coordinate the development of these technologies across DOE programs and the 17 national laboratories, as tasked by the AI Executive Order. In the FY25 budget request, DOE seeks to staff this Office to ensure that it is maximally effective in focusing collective efforts across the Department to:
- Amplify DOE expertise in critical and emerging technology and leverage these capabilities to solve critical science, energy, and security challenges facing the Nation;
 - Coordinate DOE equities in critical and emerging technologies across diverse program portfolios, including the DOE National Labs, to support and inform policy making; and
 - Develop partnerships with industry and academia to advance breakthroughs and accelerate integration of technologies into the U.S. commercial sector.

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QUESTIONS FROM REPRESENTATIVE ANNA G. ESHOO

Q1A. Research and development of powerful artificial intelligence (AI) requires three main ingredients—good data, computing power, and people. These resources are expensive and mostly held in the hands of a few large technology companies. This concentration means that most of the talent in America is prevented from participating in AI R&D. This reduces competition, limits the boundaries of innovation, and hampers our ability to develop safe and trustworthy AI. That’s why I introduced the CREATE AI Act, bipartisan, bicameral legislation to fully authorize the National AI Research Resource (NAIRR) and provide these resources to all sectors of society, including, small businesses, startups, the medical community, academia, nonprofits, and the public sector. To develop AI that is safe, trustworthy, and responsible, we must democratize access to it and allow every sector of America to participate in its research and development. President Biden recognized the importance of the NAIRR and directed the National Science Foundation (NSF) to stand up a pilot program.

For the record, please answer the following questions:

From the perspective of the Department of Energy (DOE), why is it important for Congress to fully authorize the NAIRR? How will providing access to these important resources to all sectors of society improve the research and development of safe and trustworthy AI? How will democratizing AI and diversifying AI R&D help the United States stay competitive and continue to lead in AI innovation?

A1A. The United States needs all sectors of society engaged in the advancement of AI leadership. This includes enabling innovation for companies of all sizes, researchers, academia, and nongovernmental organizations – all key players in our innovation ecosystem. It also includes supporting the development of a diverse scientific workforce that can meet the rising demand for AI talent. DOE’s data science and high-performance computing capabilities serve the scientific community for both open science and classified needs. Longstanding partnerships with industry have led to today’s robust, innovative AI supercomputing systems, and DOE will continue to lead the way through community engagement on AI.

This is why DOE extended the lifetime of its pre-exascale supercomputer Summit and dedicated computing allocations as a concrete contribution to the NAIRR pilot. As announced in January 2024, Summit, one of the world’s most powerful AI-capable

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supercomputers at Oak Ridge National Laboratory, will now continue operations until October 2024. With this action, DOE continues to take accelerated computing to the next level by providing scientists with incredible computing power to solve challenges in energy, artificial intelligence, human health, and other research areas that were previously impractical or impossible.

DOE is also expanding its efforts in trustworthy and responsible AI research, and researchers on Summit will also have access to Oak Ridge's CITADEL framework, a partnership between the lab and the U.S. Department of Veterans Affairs (VA) to safely and securely transfer and analyze health records at scale in a manner that also protects privacy. In addition, DOE will offer access to the Argonne Leadership Computing Facility's AI Testbeds, a growing collection of some of the world's most advanced AI accelerators for open scientific research. With advanced capabilities for AI training, inference, and data-intensive tasks for a diverse set of AI workloads, the testbeds will enable researchers to explore and accelerate next-generation applications to advance the use of AI for science and discovery.

DOE has a well-established network of relevant infrastructure and decades of experience to make these resources available to diverse group researchers from government, academia, and industry with varying degrees of expertise. This involves delivering and deploying state-of-the-art versatile systems; ensuring their functionality, performance and usability; providing technical support, training, documentation and tools to users; and running robust science engagement programs that partners users with experts in scientific domains and computation to obtain optimal scientific results from the computational resources and systems.

At the same time, DOE and its federal partners will need to continue building the workforce with the skills to ensure system trustworthiness and a culture of responsible practice. This will involve ensuring the establishment of a workforce that knows how to

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deploy and use AI systems safely. NAIRR, in addition to significant DOE investments in delivering and deploying state-of-the-art computing resources and in the preparation of a sustained talent pool, can help meet these needs.

Even as DOE supports the NAIRR pilot that will build AI capacity for the nation by democratizing access to compute, the Department is just as committed to building a frontier AI capability to solve our complex mission-driven challenges in science, energy, and security.

Q1B. The success of the NAIRR Pilot will depend significantly on the cooperation of executive agencies and the resources they can provide. How is the DOE cooperating with the NSF on the NAIRR pilot? What resources is the DOE committing to ensure it's successful?

A1B. DOE is playing a key role in the planning and execution of the NAIRR pilot that was announced on January 24. DOE is participating in the federal NAIRR Pilot Program Management Office and contributing resources to support the four NAIRR focus areas: NAIRR Open, NAIRR Secure, NAIRR Software, and NAIRR Classroom. We have extended operations of the Summit supercomputer at Oak Ridge National Laboratory (ORNL) through October 2024 to support NAIRR. Summit resources are available to the NAIRR pilot through a special allocation program. Apart from compute resources, DOE laboratory experts in high performance computing, networking, and data management are contributing to groups contemplating the NAIRR design, including an eventual NAIRR software stack.

DOE is co-leading the NAIRR Secure pilot with the National Institutes of Health (NIH), expanding its efforts in trustworthy and responsible AI research. NAIRR Secure focus area will showcase ORNL's CITADEL framework as an example of research infrastructure that enables researchers to safely and securely process protected data at scale. DOE is also expanding its research efforts under its Biopreparedness Research Virtual Environment (BRaVE) program with a new project under NAIRR that will leverage generative AI to create a high-quality set of synthetic pathology reports that can

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be used to develop new AI tools while eliminating the risk of exposing personally identifiable information. This effort builds on a longstanding partnership between DOE, NIH, the U.S. Department of Veterans Affairs, and the Centers for Disease Control and Prevention.

DOE will also offer access to the Argonne Leadership Computing Facility's AI Testbed, a growing collection of some of the world's most advanced AI accelerators for open scientific research. With advanced capabilities for AI training, inference, and data-intensive tasks for a diverse set of AI workloads, the AI Testbed will enable researchers to explore and accelerate next-generation applications to advance the use of AI for science and discovery.

- Q2A. President Biden's Executive Order on AI takes the first step in ensuring that US companies take the safety precautions necessary in order to keep malicious actors from co-opting their models for harm, such as for the creation of a bioweapon. However, there are many companies overseas which may not follow this or any other guidance.

For the record, please answer the following questions:

How can we encourage companies to adhere to best safety practices internationally, and ensure that US companies who are adhering to safety standards do not face a competitive disadvantage?

- A2A. AI is a dual-use technology, and the United States must maximize the opportunities presented by AI while also minimizing the risk of unintentional harms or intentional misuse. Many countries are investing heavily in AI in order to capture the technology's societal, economic, and national security advantages, and any efforts to regulate AI must be underpinned by deep knowledge of the technology itself. DOE has the expertise and capabilities to provide technical assistance that informs regulatory discussions; however, DOE's primary role will be to remain on the AI frontier, driving AI innovation for science, energy, and security.

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Any regulation, particularly regulation of a quickly evolving technology, must be informed by technical expertise and driven by a deep understanding of the benefits and risks, including related to social and economic impacts. With expertise across open and classified research domains and existing partnerships with industry, DOE is positioned to apply its technical expertise and work with other Federal agencies to help manage the risks presented by AI while also maintaining our ability to advance our global leadership in AI.

Global competition in AI requires a transformative effort, involving whole-of-government action, mission-driven public-private partnerships, and collaboration with academia and non-governmental organizations. We also need to work with allies and partners, and we are actively working to develop and leverage those strategic partnerships. Throughout, DOE is committed to ensuring robust research security measures to minimize the risk of improper transmission of technologies and research.

Q2B. Are there any lessons learned from the nuclear industry or airline industry that you can think of in terms of a no-fault reporting system for near-misses or other safety concerns?

A2B. The ability to effectively manage high consequence industries such as the nuclear or airline industries requires a deep knowledge of that industry. Similarly, DOE is leveraging the deep expertise of the national labs across many scientific domains and research partnerships with industry and academia to advance the development of trustworthy and responsible AI. The nuclear and airline industries have mechanisms for sharing operational experience to promote safety, which may be beneficial models to consider for AI development. However, given the complexity of AI and machine learning and the wide variety of applications, it is difficult to definitively comment at this time if the lessons learned from these fields could be broadened and applied to AI.

Q3A. DOE has been tasked with creating “tools to evaluate AI capabilities to generate outputs that may represent nuclear, nonproliferation, biological, chemical, critical-infrastructure,

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and energy-security threats or hazards,” and developing model guardrails that reduce such risks.

For the record, please answer the following questions:

Does DOE intend to create tools that as a baseline evaluate capabilities for the highest-consequence biorisks, such as the risk that an AI model accelerates or simplifies the re-introduction of particularly dangerous extinct viruses, or dangerous viruses that only exist now within research labs, that have the capacity to start epidemics or pandemics?

- A3A. The October 30, 2023 Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence charges the Department of Energy with developing “tools to evaluate AI capabilities to generate outputs that may represent nuclear, nonproliferation, biological, chemical, critical infrastructure, and energy-security threats or hazards” as well as “model guardrails that reduce such risks.” To mitigate AI-related risks, DOE will help conduct red-teaming tests; develop testbeds to support safe, secure and trustworthy AI; assess potential risks related to AI and critical infrastructure; evaluate the potential for AI to be misused for Chemical, Biological, Radiological, and Nuclear (CBRN) threats; minimize the risks at the convergence of AI and biology; and help identify the technical conditions for AI models and computing clusters subject to industry reporting.

For example, DOE is expanding its research efforts under its Biopreparedness Research Virtual Environment (BRaVE) program with a new project that will leverage generative AI to create a high-quality set of synthetic pathology reports. BRaVE was launched to leverage the highly successful framework of the National Virtual Biotechnology Laboratory (NVBL), which the Department stood up in 2020 to use the capabilities and expertise across DOE’s 17 National Laboratories to address key technical issues in the fight against COVID-19. BRaVE provides new capabilities for biopreparedness, and this new synthetic data will serve as a training benchmark for AI models devoted to detecting cancer and other diseases and will open up a new research resource for testing federated learning AI techniques. This effort builds on a longstanding partnership between DOE,

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the National Institutes of Health (NIH), the U.S. Department of Veterans Affairs (VA), and the Centers for Disease Control and Prevention (CDC).

Through BRaVE and other initiatives and programs, the DOE ecosystem has already demonstrated substantial capability in the biothreat space. For example, our national laboratories have partnered with academic institutions and hardware companies to develop a prizewinning AI tool based on “large language model” techniques – using the language of the virus genome instead of the language of humans – to understand the virus behind COVID-19. Moreover, our labs have also leveraged broad expertise in AI, biology, and chemistry, together with DOE’s computing resources and X-ray and neutron sources, to accelerate development of medical countermeasures, including anti-viral drugs and vaccines approved for use in the US, enhancing pandemic preparedness and bioassurance capabilities.

- Q3B. Will DOE create tools to evaluate the risk that an AI model could enable, accelerate, or simplify the creation of entirely new biological constructs that could start epidemics or pandemics?
- A3B. To ensure the deployment of safe, responsible, and trustworthy AI, the U.S. needs to develop methods for assessing and red-teaming AI models to identify and mitigate the risks presented by cutting edge AI systems. DOE’s technical expertise across multiple science and security domains, AI expertise, AI-capable hardware, and industry partnerships can be brought to bear to understand and mitigate the spectrum of AI security risks.

To implement the recent AI Executive Order, DOE is working with the Department of Commerce to develop guidance and benchmarks for evaluating and auditing AI capabilities, with a focus on capabilities through which AI could cause harm, such as in the areas of cybersecurity and biosecurity. We are also conducting initial AI red-teaming evaluations to inform future research and development programs for identifying,

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prioritizing, measuring, and mitigating potential harms, thus enabling the deployment of safe, secure, and trustworthy systems.

In addition to the responsibilities noted in the answer to the previous question, and others, related to biosecurity, the AI Executive Order charges DOE with supporting work to reduce “the risk of misuse of synthetic nucleic acids, which could be substantially increased by AI’s capabilities in this area, and improve biosecurity measures for the nucleic acid synthesis industry.” DOE is committed to fulfilling its responsibilities as charged in the AI Executive Order.