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119TH CONGRESS }
2d Session

SENATE

{ REPORT
119-129

NATIONAL PROGRAMMABLE CLOUD
LABORATORIES NETWORK ACT OF 2025

R E P O R T

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND
TRANSPORTATION

ON

S. 3468



JULY 13, 2026.—Ordered to be printed

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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED NINETEENTH CONGRESS

SECOND SESSION

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Mr. CRUZ, from the Committee on Commerce, Science, and
Transportation, submitted the following

R E P O R T

[To accompany S. 3468]

[Including cost estimate of the Congressional Budget Office]

The Committee on Commerce, Science, and Transportation, to which was referred the bill (S. 3468) to establish a national programmable cloud laboratories network to enhance research efficiency, innovation, and collaboration, and for other purposes, having considered the same, reports favorably thereon with amendments and recommends that the bill, as amended, do pass.

PURPOSE OF THE BILL

The purpose of S. 3468 is to require the Director of the National Science Foundation (NSF), in consultation with the Director of the National Institute of Standards and Technology (NIST), to establish and oversee a National Programmable Cloud Laboratories Network of up to six nodes to enable secure, automated, and remotely programmable scientific research. The bill sets eligibility and merit-based selection criteria for participating entities, requires standards for interoperability, cybersecurity, and data sharing, requires an interagency assessment of non-designated laboratories, directs annual briefings to Congress on the Network's operations, and sunsets the program in 2031.

BACKGROUND AND NEEDS

Programmable cloud laboratories (cloud labs) combine advanced instruments, robotics, and artificial intelligence to perform experiments, quality control, and data analysis remotely. They let re-

searchers run high-throughput experiments, produce reproducible results, and access equipment that individual institutions may not have.¹ Scientists and engineers use these labs in biotechnology, materials science, chemistry, and advanced manufacturing to design and test new drugs, develop advanced materials, optimize chemical reactions, scale production processes, and conduct quality control.

Expanding access to world-class biotechnology has been a priority for the Federal Government. The AI Action Plan, issued by the White House in July 2025, calls for America to lead in programmable cloud-enabled laboratories. The relevant policy proposal recommends that the Government, “[t]hrough NSF, DOE, NIST at DOC, and other Federal partners, invest in automated cloud-enabled labs for a range of scientific fields, including engineering, materials science, chemistry, biology, and neuroscience, built by, as appropriate, the private sector, Federal agencies, and research institutions in coordination and collaboration with DOE National Laboratories.”² The Office of Management and Budget and Office of Science and Technology Policy memorandum on research priorities for fiscal year 2027 directs department and agency heads to “prioritize research infrastructure investments that provide broad access, including for researchers from small colleges and businesses.”³ It specifically mentions that agencies “should prioritize efforts that advance and share new paradigms for research, including the expansion of autonomous experimentation facilities that can accelerate research and development (R&D) efforts.”⁴

Following up on the AI action plan, the NSF announced a funding opportunity to test, scale, and demonstrate new methods to advance automated science and engineering.⁵ The initiative, known as the NSF PCL test bed, would aim to spend up to \$100 million to create a network of remotely accessible laboratories to run user-programmed AI-enabled workflows. Specifically, the PCL initiative aimed to provide access to advanced cloud labs in classroom settings. The Directorate for Technology, Innovation, and Partnerships (TIP), which led the initiative, anticipates making up to six awards of 5 million per year over 4 years to institutions of higher education, nonprofits, and for-profit organizations.

In its final report, the National Security Commission for Emerging Biotechnology also recommended that Congress support the development of cloud labs. Recommendation 4.1D states that “Congress should authorize the National Science Foundation to estab-

¹Lauren Everett, “This Lab Allows Scientists to Conduct Experiments Remotely at Any Time,” Lab Manager, February 23, 2022, <https://www.labmanager.com/this-lab-allows-scientists-to-conduct-experiments-remotely-at-any-time-27609>.

²The White House, *Winning the AI Race: America’s AI Action Plan*, Executive Office of the President, July 23, 2025, at p. 8, <https://www.whitehouse.gov/wp-content/uploads/2025/07/Americas-AI-Action-Plan.pdf>.

³Executive Office of the President, *Fiscal Year (FY) 2027 Administration Research and Development Budget Priorities and Cross-Cutting Actions*, OMB memorandum M-25-34 / NSTM-2, September 23, 2025, at p. 7, <https://www.whitehouse.gov/wp-content/uploads/2025/09/M-25-34-NSTM-2-Fiscal-Year-FY-2027-Administration-Research-and-Development-Budget-Priorities-and-Cross-Cutting-Actions.pdf>.

⁴Ibid.

⁵National Science Foundation, “NSF to Invest in New National Network of AI-Programmable Cloud Laboratories,” *NSF News*, August 5, 2025, <https://www.nsf.gov/news/nsf-invest-new-national-network-ai-programmable-cloud>.

lish a network of cloud labs,” giving researchers state-of-the-art tools to make data generation easier.⁶

Global competitors increasingly invest in automated research infrastructure, making access to programmable cloud labs critical for U.S. leadership in science and technology. China, for example, launched the Advanced Biofoundry Shenzhen (ABS), a nearly 20,000-square-foot facility, in 2020.⁷ The institute focuses on synthetic biology research and is located within Guangming Science City, a 38-square-mile area in Shenzhen that serves as a hub for scientific and technological development in the People’s Republic of China. The facility began operating in spring 2025, with talent recruited from institutions like the California Institute of Technology, the Massachusetts Institute of Technology, and Harvard.⁸ Although little is known about the details of the experiments performed there, the RAND corporation believes that ABS, alongside an associated brain science institute, houses up to 1,800 pieces of equipment and hosts 100 researchers.⁹

Friendly nations are also devoting resources to cloud labs. Between 2010 and 2016, the United Kingdom launched three new cloud labs—Arctoris, LabGenius, and the Digital Innovation facility—focused on drug development and AI scientific discovery.¹⁰ In December 2025, Google DeepMind announced a partnership with the UK Government to establish its first automated science laboratory aimed at discovering new materials for use in energy and computing.¹¹

There is bipartisan interest in supporting the development of cloud labs. Cloud labs advance research capacity by allowing smaller firms to rent access to advanced technology that would otherwise be unaffordable, achieving an economy of scale. Because cloud labs could lower the barrier to high-tech equipment across the country, there has been an effort across the Government to establish such programs.

SUMMARY OF PROVISIONS

S. 3468 would do the following:

- Establish a national network of up to six NSF-designated programmable cloud laboratory nodes, including, as practicable, at least one node with biotechnology capabilities.
- Create a competitive merit-reviewed application process open to universities, nonprofits, industry, and consortia.

⁶National Security Commission on Emerging Biotechnology, *Charting the Future of Biotechnology: Final Report*, chapter 4 (“Out-Innovate Our Strategic Competitors”), April 2025, <https://www.biotech.senate.gov/final-report/chapters/chapter-4/section-1/#rec-4-1d>.

⁷Ying-Chiang Jeffrey Lee, et al., *Documenting Cloud Labs and Examining How Remotely Operated Automated Laboratories Could Enable Bad Actors*, RAND Corporation, April 2025, at p. 7, https://www.rand.org/content/dam/rand/pubs/perspectives/PEA3800/PEA3851-1/RAND_PEA3851-1.pdf.

⁸Window to China, “The World’s Largest Center for Synthetic Biology Is Being Built in Shenzhen. It Will Soon Start Work,” October 11, 2024, <https://window-to-china.de/2024/10/11/the-worlds-largest-center-for-synthetic-biology-is-being-built-in-shenzhen-it-will-soon-start-work/>.

⁹Ying-Chiang Jeffrey Lee, et al., *Documenting Cloud Labs and Examining How Remotely Operated Automated Laboratories Could Enable Bad Actors*, RAND Corporation, April 2025, at p. 10, https://www.rand.org/content/dam/rand/pubs/perspectives/PEA3800/PEA3851-1/RAND_PEA3851-1.pdf.

¹⁰*Ibid.*

¹¹Demis Hassabis, et al., “Strengthening Our Partnership with the UK Government to Support Prosperity and Security in the AI Era,” Google DeepMind Blog, December 10, 2025, <https://deepmind.google/blog/strengthening-our-partnership-with-the-uk-government-to-support-prosperity-and-security-in-the-ai-era/>.

- Direct NIST, in coordination with NSF, to develop and maintain interoperability, data-sharing, and remote experimentation standards.
- Direct NIST, NSF, and DOE to assess other programmable laboratories and identify opportunities for and barriers to coordination with the network.
- Authorize up to \$5 million per year for each designated node of the National Programmable Cloud Laboratories Network for a maximum of 5 years to support secure, automated, and programmable research.
- Require annual briefings to Congress on network performance, fiscal sustainability progress, and alignment with national scientific and economic priorities.
- Terminate the network and associated authorities and funding on September 30, 2031.

LEGISLATIVE HISTORY

S. 3468, the National Programmable Cloud Laboratories Network Act of 2025, was introduced on December 11, 2025, by Senator Fetterman (for himself and Senator Budd) and was referred to the Committee on Commerce, Science, and Transportation of the Senate. On February 12, 2026, the Committee met in open Executive Session and, by voice vote, ordered S. 3468 reported favorably with an amendment.

ESTIMATED COSTS

In accordance with paragraph 11(a) of rule XXVI of the Standing Rules of the Senate and section 403 of the Congressional Budget Act of 1974, the Committee provides the following cost estimate, prepared by the Congressional Budget Office:

S. 3468, National Programmable Cloud Laboratories Network Act of 2025			
As ordered reported by the Senate Committee on Commerce, Science, and Transportation on February 12, 2026			
By Fiscal Year, Millions of Dollars	2026	2026-2031	2026-2036
Direct Spending (Outlays)	0	0	0
Revenues	0	0	0
Increase or Decrease (-) in the Deficit	0	0	0
Spending Subject to Appropriation (Outlays)	0	*	not estimated
Increases <i>net direct spending</i> in any of the four consecutive 10-year periods beginning in 2037?	No	Statutory pay-as-you-go procedures apply?	No
Increases <i>on-budget deficits</i> in any of the four consecutive 10-year periods beginning in 2037?	No	Mandate Effects	
		Contains intergovernmental mandate?	No
		Contains private-sector mandate?	No
* = between -\$500,000 and \$500,000.			

S. 3468 would direct the National Science Foundation (NSF) to allocate \$30 million a year from 2026 through 2030 from amounts already available to the foundation to establish a network of up to six cloud-based lab systems, in consultation with the National In-

stitute of Standards and Technology (NIST) and the Department of Energy (DOE). The systems would need to be programmed to support automated, remotely accessible research. The bill also would require NIST to develop interoperability and data standards and the NSF to report to the Congress on existing laboratory capabilities and program activities.

Using information from the NSF, CBO estimates that the agency is currently funding up to six cloud programming nodes under its general authorities provided by current law at a cost of about \$5 million for each node. In addition, the NSF, in collaboration with participating entities, is currently developing the data standards required by the bill. On that basis, CBO estimates that implementing the bill's requirement to establish cloud-based systems and develop data standards would have no budgetary effect.

Based on the cost of similar reports, CBO estimates that the reporting requirements would have an insignificant cost over the 2026–2031 period. Any related spending would be subject to the availability of appropriated funds.

The CBO staff contact for this estimate is Katherine Chou. The estimate was reviewed by H. Samuel Papenfuss, Deputy Director of Budget Analysis.

PHILLIP L. SWAGEL,
Director, Congressional Budget Office.

REGULATORY IMPACT STATEMENT

In accordance with paragraph 11(b) of rule XXVI of the Standing Rules of the Senate, the Committee provides the following evaluation of the regulatory impact of the legislation, as reported:

Number of Persons Covered

S. 3468 would cover academic, nonprofit, and private-sector entities that seek designation as nodes in the National Programmable Cloud Laboratories Network (Network), including consortia of such entities. Researchers, faculty, technical staff, or students at these entities may be directly affected through access to Network platforms, participation in automated and remotely programmable research, and adherence to Network standards. Non-designated laboratories may be indirectly affected through opportunities to coordinate with nodes or adopt Network standards. Private-sector infrastructure providers, research collaborators, and end-users that benefit from innovation, workforce development, or infrastructure improvements enabled by the Network may also experience indirect impacts.

Economic Impact

S. 3468 may have an indirect impact on the U.S. economy if expanded access to automated, remotely programmable laboratory infrastructure accelerates the development of new tools and procedures in biotechnology, chemistry, materials science, and other sectors.

Privacy

S. 3468 would have no impact on the personal privacy of individuals and does not impose new requirements or grant authorities that would affect the privacy of businesses. The bill would ensure

that proprietary data, including research results, methods, and procedures in biotechnology, materials science, and other scientific disciplines, would not be shared with other nodes or across the Network without permission. The bill would establish standards and protocols to protect sensitive data and prevent unauthorized disclosure.

Paperwork

The Committee does not anticipate a major increase in paperwork burdens resulting from the passage of this legislation. S. 3468 would require the Director of the NSF, in consultation with the Director of the NIST, to designate nodes for the Network through a public solicitation and corresponding merit-based review process. Agencies may need to compile data, evaluate applications, coordinate with participating entities, and prepare annual briefings to Congress. The overall administrative burden would be limited and proportional to conducting merit-based review and overseeing Network operations and spending.

CONGRESSIONALLY DIRECTED SPENDING

In compliance with paragraph 4(b) of rule XLIV of the Standing Rules of the Senate, the Committee provides that no provisions contained in the bill, as reported, meet the definition of congressionally directed spending items under the rule.

SECTION-BY-SECTION ANALYSIS

Section 1. Short title.

This section would provide that the bill may be cited as the “National Programmable Cloud Laboratories Network Act of 2025”.

Section 2. Definitions.

This section would define key terms, including “artificial intelligence”, “biological data”, “Director”, “institution of higher education”, “Network”, “node”, “non-designated laboratory”, and “programmable cloud laboratory”. It would clarify that the Director refers to the Director of the National Science Foundation unless otherwise specified.

Section 3. National Programmable Cloud Laboratories Network.

This section would establish a National Programmable Cloud Laboratories Network to support secure, automated, and cloud-enabled scientific experimentation.

This section would state the purposes of the Network, including maintaining U.S. leadership in advanced experimentation, biotechnology, laboratory automation, and artificial intelligence; reducing the cost of federally funded research through automation and reproducibility; accelerating the transfer of Government-funded research to private-sector commercial applications; improving collaboration among federally funded laboratories, institutions of higher education, and private industry; ensuring measurable cost savings, efficiencies, and long-term fiscal sustainability; incentivizing private-sector cost sharing; supporting workforce development aligned with industry needs; strengthening the domestic industrial base for scientific automation and robotics; and advanc-

ing programmable cloud laboratory research in disciplines such as materials science, biotechnology, chemistry, and related fields.

This section would require the Director of the NSF, in consultation with the Director of NIST, to designate and oversee a Network of not more than six nodes within 1 year of enactment to support secure, standards-based, and cost-effective remote experimentation and automated research. This section would specify that the assessment of non-designated laboratories required under section 5 would occur only after final node designation.

This section would require Network nodes to enable programmable workflows and automated science, provide access to advanced scientific and manufacturing instrumentation, including artificial intelligence-enabled tools, collaborate on common standards and best practices, and support interoperability across the Network.

This section would require the Director to issue a public solicitation for node designation and would authorize institutions of higher education, nonprofit research organizations, private-sector research entities, and consortia of such entities to apply.

This section would require applicants to submit a technical and programmatic plan for laboratory operations and automation, a plan and timeline for achieving long-term financial self-sustainability with reduced reliance on Federal funding, and evidence of non-Federal cost sharing or third-party contributions.

This section would require the Director to select nodes through a competitive, merit-reviewed, and transparent process that evaluates existing infrastructure, capacity for distributed cloud-enabled research, likelihood of long-term sustainability, ability to collaborate with other entities and Federal research agencies, research and cybersecurity protocols, and demonstrated user demand.

This section would require the Director to give preference to applicants demonstrating meaningful third-party cost sharing and pre-existing infrastructure and would, to the extent practicable, require that at least one node support cloud-enabled biotechnology research.

This section would authorize the Director to award each designated node up to \$5 million per year for a maximum of 5 years to support the Network.

Lastly, this section would require each designated node to collaborate with other Network members, participate with NIST in developing interoperability and data-sharing standards, support secure remote experimentation and data sharing, engage in public-private partnerships to facilitate technology transfer, develop revenue-generating sustainability models, establish performance metrics, and leverage commercially available hardware and software where practicable to reduce costs.

Section 4. Interagency collaboration.

This section would require the Director of NIST, in coordination with the Director of the NSF and participating entities, to develop and promulgate interoperability standards within 180 days after node designation. This section would require those standards to address laboratory instrumentation, data infrastructure, communication protocols, experiment execution systems, secure and standardized data-sharing (including biological data), minimum technical

and operational requirements for remote experimentation and reproducibility, and periodic updates to reflect technological advancements, in consultation with private-sector partners.

Section 5. Assessment of non-designated laboratories.

This section would require the Director of the NSF, in consultation with the Secretary of Energy and the Director of NIST, to conduct and submit to the appropriate congressional committees a comprehensive assessment of non-designated programmable laboratories within 180 days after final node designation.

This section would require the assessment to identify, to the extent practicable, Federal, academic, nonprofit, and private-sector laboratories with relevant automated or remote research capabilities; evaluate their instrumentation, automation, data, cybersecurity, and research security capacities; identify pathways for coordination with Network nodes; and assess legal, contractual, or intellectual property considerations that may affect participation.

Lastly, this section would require proprietary information to be protected from public disclosure and would require publication of a nonproprietary public summary, with the option to submit a proprietary annex to Congress.

Section 6. Reporting and oversight.

This section would require the Director of NSF to provide annual briefings to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Science, Space, and Technology of the House of Representatives beginning 1 year after enactment.

This section would require each briefing to assess alignment with national scientific and economic priorities, progress toward node-level financial self-sustainability, and performance metrics related to scientific output, cost-effectiveness, and engagement.

Section 7. Funding.

This section would authorize the Director of the NSF to allocate \$30 million per year for fiscal years 2026 through 2030.

Section 8. Sunset.

This section would sunset the National Programmable Cloud Laboratories Network, including all authorities, programs, and funding, on September 30, 2031.

CHANGES IN EXISTING LAW

In compliance with paragraph 12 of rule XXVI of the Standing Rules of the Senate, the Committee states that the bill as reported would make no change to existing law.