Strengthening National Security Through Advanced Technology Hubs

The Emergence of NSF Engines

January 2026

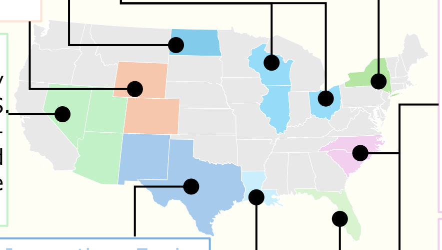
WASHINGTON | CORE

Around the world, countries are intensifying efforts to build regional innovation ecosystems centered on advanced technologies. Among these initiatives, the United States' NSF Engines program has attracted particular attention. In terms of its scale, design philosophy, and policy ambition, the program departs from conventional approaches. This paper focuses on the NSF Engines program as a distinctive effort to develop regional advanced-technology ecosystems aligned with U.S. national security strategy and provides an overview of its objectives and structure.

What are NSF Engines? Transforming Regions into National-Scale Innovative Centers

The National Science Foundation's Regional Innovation Engines (NSF Engines) program is an initiative led to establish regional innovation ecosystems across the United States. While many countries, including Japan, are actively promoting industry-academia-government collaboration and regional ecosystem development, this program stands out for its distinct scale and nation-wide coordination in strategically important fields including artificial intelligence (AI), advanced manufacturing, and biotechnology. At the core of the program is the concept of a regional consortium, the "Engine", that brings together wide-ranging stakeholders that include universities, private companies, nonprofit organizations, community groups, state governments, and local authorities. Through end-to-end support from early-stage research to commercialization, these NSF Engines decentralize advanced technological capability, ensuring that innovation capacity is distributed and supported nationwide rather than concentrated in select areas such as Silicon Valley and Boston. Further, the program leverages each region's existing technological strengths to simultaneously further regional development, accelerate technological innovation, and address geopolitical challenges, in a distinctly America First–oriented ecosystem strategy.

NSF Engine Programs Selected in the First Round



NSF AgTech Engine in North Dakota
This Engine aims to build a resilient and secure food system for the State by integrating advanced genomic analysis, climate modeling, nanoscale sensors, and computer networks to monitor and improve crop growth.

NSF ASCEND Engine in Colorado and Wyoming
This Engine develops solutions to enhance resilience to climate change by combining advanced sensing and analytics, AI-enabled decision support, and data-driven management. It supports local communities in monitoring, mitigating, and adapting to climate impacts.

NSF Futures Engine in the Southwest
This Engine addresses water scarcity, energy security, and air quality challenges in the U.S. Southwest. Its goal is to establish a long-term foundation for economic prosperity and regional innovation ecosystems while advancing sustainable solutions.

Paso del Norte Defense and Aerospace Innovation Engine
Located in the eight-county Paso del Norte region along the U.S.–Mexico border, this Engine sought to accelerate growth in the aerospace and defense manufacturing sector by building a platform that integrates emerging digital engineering approaches with skilled workforce development (Operations ended)

NSF FUEL Engine in Louisiana
This Engine seeks a statewide pathway to decarbonization and expanding Louisiana's clean energy economy through advancing research and commercialization in areas including carbon management, hydrogen utilization, and sustainable water and manufacturing technologies for clean energy.

NSF Water Innovation Engine in the Great Lakes
Focusing on environmental sustainability and industrial growth, this Engine promotes the discovery, development, and deployment of core technologies that attract water-intensive manufacturing to the region. It also emphasizes resource recovery (energy and critical minerals) from wastewater streams, the creation of workforce opportunities, and the maintenance of environmental integrity.

NSF Energy Storage Engine in Upstate New York
This Engine is creating an industry-led hub that supports the entire energy storage value chain, including developing new battery components, sustainable manufacturing, materials recovery, pilot-scale testing, application integration, and workforce development.

NSF Regenerative Medicine Engine in North Carolina
This Engine aims to drive breakthrough advances in healthcare and biomedical innovation by providing the resources necessary to rapidly translate regenerative medicine technologies into commercial products.

NSF Textile Innovation Engine in North Carolina
This Engine seeks to modernize the U.S. textile industry positioning the United States as a global leader while driving economic growth through the creation of high-quality jobs and strengthening critical national industrial foundations.

NSF Florida Semiconductor Engine
This Engine accelerates design and manufacturing capabilities for advanced semiconductor chip packaging, helping anchor critical industries within the United States while strengthening national defense and supply-chain security.

Source: Created by Washington Core based on NSF Engine's individual engine overview pages, etc.

Selected NSF Engines

The first round of NSF Engines funding attracted nearly 700 proposals with 10 programs spanning 18 states being selected in January 2024[1]. After early success of the first round, NSF is currently conducting the final review for a second round of funding, with final selections expected to be announced in early 2026[2].

Five Defining Features of NSF Engines

1 Unprecedented Scale: Long-Term Support and Up to $160 Million per Engine

NSF Engines are characterized in the scale and duration of the offered financial support.

Duration	Up to 10 years	Budget	Up to **160 million USD** per engine

Funding Stages	① Formative Stage	② Development Stage	③ Growth Stage

While many regional innovation policies adopt fragmented structures that allocate budgets separately based on different R&D phases or different thematic distinctions, NSF Engines are designed from the outset with a decade-long investment plan that targets the transformation of regional economies as a whole. The Great Lakes Water Innovation Engine (Illinois, Ohio, and Wisconsin) is representative of this approach with nearly $8.5 million invested across 12 R&D projects. Additionally, by committing substantial funding from the first year of operations, the program allows for early testing and validation, accelerating commercialization and deployment of key solutions and technologies[3]。

Source: Argonne National Laboratory[4]

2 Strategic Selection of Advanced Technology Focus Areas

The second characteristic of NSF Engines is the carefully considered strategic focus of each Engine. By accounting for both regional characteristics and national and geopolitical challenges, these initiatives enable the development of transformational, forward-looking solutions. NSF has identified the following as examples of key technology areas.

The focus area of the nine operating NSF Engines can be categorized broadly into three strategic groups

Key Technology Areas

- Advanced Manufacturing
- Advanced Wireless
- Artificial Intelligence (AI)
- Biotechnology
- Quantum Information Science (QIS)
- Semiconductors and Microelectronics
- Cybersecurity and Data

01 Advanced technologies the United States can leverage to secure and sustain global leadership

e.g.

- Semiconductors
- Regenerative medicine
- AI
- Textiles

02 Advanced technologies critical to supply-chain resilience

e.g.

- Advanced batteries
- Energy storage

03 Advanced technologies applied to pressing societal challenges

e.g.

- Climate resilience
- Clean energy transition
- Water resource recovery systems

This approach is clearly identifiable in each Engine. The Central Florida Semiconductor Innovation Engine is exemplary of this with its focus on the design and manufacturing of advanced semiconductor chips having the explicit dual goal of strengthening U.S. technological competitiveness while enhancing national security[5] .

NeoCity, Headquarters of the Central Florida Semiconductor Innovation Engine Program

Source: Florida Semiconductor Engine[6]

3 Unlocking Latent Innovation Capacity in U.S. Regions

The third characteristic of NSF Engines is their focus on unlocking innovation capacity in regions outside traditional technology hubs. While U.S. innovation has long been associated with centers such as Silicon Valley and Boston, many other regions have developed strong technical foundations that remain underutilized. NSF Engines specifically target regions where organizations, resources, and capabilities already exist, but where the innovation ecosystem has yet to operate as a fully integrated or efficient system.

Key Examples

- The North Carolina Textile Innovation and Sustainability Engine seeks to leverage its long-established textile industry to develop bio-based materials and advanced materials for extreme environments[7].
- North Dakota's strong agricultural base is utilized by the North Dakota Advanced Agriculture Technology Engine to advance genomic research and AI-enabled systems to produce crops resilient to climate change[8].
- The Colorado–Wyoming Climate Resilience Engine, operating in regions frequently affected by wildfires and water scarcity, focuses on developing sensing, monitoring, and predictive analytics technologies to address climate-related risks[9].

As identifiable, in North Carolina and North Dakota's NSF Engines, existing regional industries serve as the foundation for innovation rather than being replaced or newly developed. The Colorado-Wyoming NSF Engine takes a different approach in which the region's specific geography is utilized to develop technological innovation with broader application. These Engines demonstrate how NSF tailor innovation efforts, albeit in different ways, to region-specific challenges and strengths.

North Dakota Advanced Agricultural Technology Engineering Program
R&D

Source: Textile Innovation Engine[10]

4 Designed for Self-Sufficiency: Attracting Private Capital

Another distinctive feature of NSF Engines is their explicit focus on building pathways that enable regional ecosystems to mobilize private capital and become self-sustaining after federal funding ends. Although each Engine may receive federal support for up to ten years, NSF makes clear that these regional innovation centers are expected to continue operating and delivering critical technologies beyond the life of the program.

While NSF provides intensive launch funding during the first two years, for years three to five and six to ten, funding decisions resemble venture capital–style investment criteria, with distribution amount tied directly to performance and milestone achievement. If an Engine fails to meet key milestones, such as progress in technology transfer, private investment attraction, or workforce development, the NSF may reduce or terminate funding. The results-based design maintains strong execution discipline and incentivizes accountability and self-reliance. As a result, many Engines begin pursuit of private investment from as early as their first year of operation, with several Engines successfully doing so. One example is the Futures Engine in the Southwest (Arizona, Nevada and Utah), which initiated construction of the largest non-lithium battery energy testing facility in the United States leading to partnerships with leaders in water infrastructure, power infrastructure, and other various emerging technologies, securing $20 million in private funding[11] during the program's first phase[12]。

Non-Lithium Battery Energy Testing Facility Rendering

Source: ABC15 Arizona [13]

5 Emphasis on Demonstration and End-to-End Commercialization

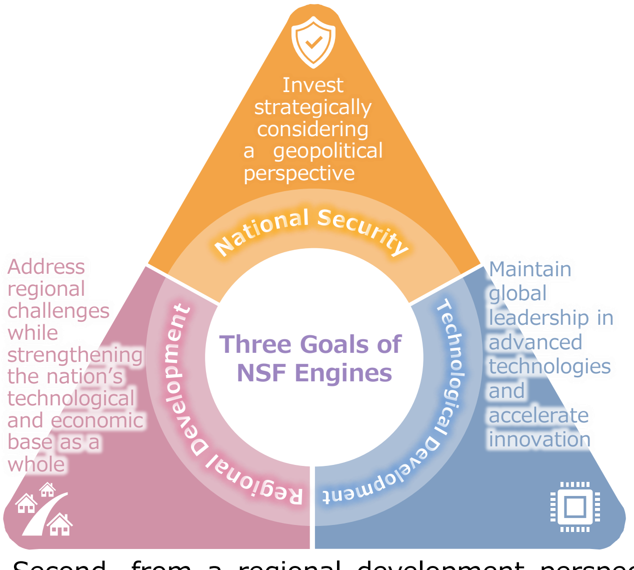
A fifth characteristic of NSF Engines is their deliberate support of the entire innovation lifecycle in an integrated, end-to-end manner, spanning ecosystem formation, basic and applied research, technology demonstration, early commercialization, business attraction, and private investment. Rather than funding individual stages sequentially, many Engines advance these activities in parallel, reducing the time between discovery and real-world deployment.

For example, the Upstate New York Energy Storage Engine established a dedicated technology-transfer funding program for startups, selecting two companies with plans to support five additional firms, for a total investment of 1 million USD. The program is designed to compress the commercialization timeline for core battery technologies from more than five years to less than two[14]. Importantly, NSF Engines define success not only through research outputs, but through demonstration milestones, validation in operational settings, and sustained engagement with industry partners. By emphasizing proof of concept, field testing, and early customer adoption, NSF Engines introduce execution speed and commercialization discipline into what has traditionally been a linear research funding model. This approach is further reflected in the Colorado–Wyoming Climate Resilience Engine, which launched a startup support program within months of its inception, providing tailored assistance to 14 startups and accelerating deployment of solutions for water quality, soil health, air quality, and wildfire mitigation[15].

Battery Safety Laboratory, Rochester Institute of Technology, Partner Institution of the NY Energy Storage Engine

Source:Technical.ly[16]

The Strategic Significance of NSF Engines



As described in the figure, NSF Engines are deliberately designed to achieve three objectives simultaneously: accelerating technological innovation, revitalizing regional economies, and strengthening national security.

First, in terms of technological innovation, NSF Engines are structured to systematically accelerate the innovation cycle. While the National Science Foundation has historically focused on supporting basic research at universities, NSF Engines extend this role by creating institutional pathways that connect research outcomes to demonstration, deployment, and industrial development. Through this approach, scientific advances are not only generated but are actively translated into technologies and industries with real-world impact.

Second, from a regional development perspective, NSF Engines aim to rebuild regional economies around advanced technologies. By using cutting-edge technologies as a catalyst, the program brings together diverse regional stakeholders – including universities, industry, government, and community organizations – to align around shared objectives. This coordination strengthens regional innovation infrastructure and establishes a durable foundation for sustained, place-based economic growth.

Third, from a national security standpoint, NSF Engines focus on strategically important technology domains such as semiconductors, advanced manufacturing, artificial intelligence, and energy storage. These efforts are explicitly linked to enhancing supply-chain resilience and supporting the domestic production of critical technologies. In doing so, NSF Engines contribute to reducing strategic vulnerabilities and reinforcing the United States' industrial and technological base.

By integrating these three strategies into a single, coherent framework, NSF Engines function as more than a conventional R&D funding program. Instead, they operate as a mechanism through which national strategy is implemented at the regional level. This design philosophy positions NSF Engines as a new foundation for sustaining U.S. competitiveness across the next 10 to 20 years.

The selection process for Engine programs under the second NSF Engines funding round is currently underway, and while the program's core design principles remain largely unchanged from the first round, the second round introduces a notable expansion of the applicant pool. 58 organizations not selected in the first round but received separate NSF funding between 2023 and 2024[17] were eligible to apply, with 11 consortia having advanced to the final stage[18]. As a result, many of these applicants have already received support from NSF and have more advanced pre-existing regional foundations, shared visions, and proven collaboration structures. As such, the second round is expected to yield more mature and better-prepared Engine programs.

NSF Engines Second Round Finalists (As of September 22, 2025)[19]

Name	State(s)	Primary Technology Areas
Advancing Quantum Technologies (QuantumCT)	Connecticut	Quantum Information Science and Technology; Advanced Materials; Robotics and Advanced Manufacturing
Advancing Photonics Technologies	Delaware, New Jersey, Pennsylvania	Advanced Computing and Semiconductors; Advanced Materials
Alaska Critical Mineral Accelerator	Alaska	Advanced Materials; Biotechnology; Advanced Energy and Industrial Efficiency Technologies; AI
Biobased Rural Innovation for Domestic Growth and Economic Security (BRIDGES)	Alabama, Tennessee	Biotechnology; Disaster Prevention and Mitigation; Advanced Materials; Robotics and Advanced Manufacturing
Carolinas Engine for Grid Modernization	North Carolina, South Carolina	Advanced Energy and Industrial Efficiency Technologies
Critical Materials Crossroads Energy Materials Ecosystem	Kansas, Missouri	Advanced Energy and Industrial Efficiency Technologies; Advanced Materials; Robotics and Advanced Manufacturing; Disaster Prevention and Mitigation
Frontiers of Advanced Semiconductor Technology	Oregon	Advanced Computing and Semiconductors; AI; Robotics and Advanced Manufacturing; Advanced Materials
Indiana Musculoskeletal Innovation Engine	Indiana	Biotechnology; Data and Cybersecurity; AI; Advanced Materials
Northeast Ohio Strengthening Manufacturing for American Resilience through Technology (NEO-SMART)	Ohio	Robotics and Advanced Manufacturing; Advanced Materials; Disaster Prevention and Mitigation
Northern New England Precision Forest Management and Advanced Forest Bioproducts Engine	Maine, New Hampshire, Vermont	Robotics and Advanced Manufacturing; Disaster Prevention and Mitigation; Biotechnology; AI
Quantum Connected	Illinois, Indiana, Wisconsin	Quantum Information Science and Technology; Advanced Communications; Data and Cybersecurity; Advanced Computing and Semiconductors
Resilient Energy Technology and Infrastructure Consortium -West Virginia and western Pennsylvania	Pennsylvania, West Virginia	Advanced Energy and Industrial Efficiency Technologies; Disaster Prevention and Mitigation; Robotics and Advanced Manufacturing
RuralSTAMINA — Rural Communities Enabled by Sustainable and Transformative Advanced Manufacturing Innovation and Partnerships	Iowa, Nebraska	Biotechnology; Advanced Materials; Robotics and Advanced Manufacturing; AI
STELLAR: Advancing Laser Technologies in the Rochester NY/Finger Lakes Region	New York	Advanced Computing and Semiconductors; Advanced Communications; Advanced Materials
New England Seafood Partnerships for Innovations, Research, and Engagement (NSPIRE)	Maine, Massachusetts, New Hampshire, Rhode Island	Disaster Prevention and Mitigation; AI

Endnote

1. https://nsf-gov-resources.nsf.gov/files/2.19.2025_NSF-Engines_FactSheet.pdf?VersionId=laBQi8W.Yjvt4HGTGMdRaIGQZWPq6JyI
2. https://www.nsf.gov/tip/updates/nsf-advances-29-semifinalists-second-nsf-regional-innovation
3. https://www.nsf.gov/funding/initiatives/regional-innovation-engines/portfolio/water-innovation-engine-great-lakes
4. https://www.anl.gov/article/vision-of-sustainability-success-argonne-targets-zero-emissions-and-encourages-others-to-join-the
5. https://www.nsf.gov/funding/initiatives/regional-innovation-engines/portfolio/florida-semiconductor-engine
6. https://semiconductorengine.org/about-the-engine/
7. https://textileinnovationengine.org/our-work/?scrollto=research-pillar
8. https://www.nsf.gov/awardsearch/show-award/?AWD_ID=2315315&HistoricalAwards=false
9. nsf.gov/funding/initiatives/regional-innovation-engines/portfolio/colorado-wyoming-ascend-engine
10. https://textileinnovationengine.org/our-work/?scrollto=research-pillar
11. The specific names of the invested companies are not disclosed.
12. https://www.nsf.gov/funding/initiatives/regional-innovation-engines/portfolio/futures-engine-southwest
13. https://www.abc15.com/news/local-news/largest-non-lithium-battery-project-to-break-ground-in-arizona-this-year
14. https://www.nsf.gov/funding/initiatives/regional-innovation-engines/portfolio/energy-storage-engine-upstate-new-york
15. https://www.nsf.gov/funding/initiatives/regional-innovation-engines/portfolio/colorado-wyoming-ascend-engine
16. https://technical.ly/civics/nsf-futures-engines-upstate-ny-battery-hub/
17. https://www.nsf.gov/funding/initiatives/regional-innovation-engines/portfolio
18. https://tableau.external.nsf.gov/views/NSFEngines2025Finalists/MapOverview?%3Aembed=y&%3AisGuestRedirectFromVizportal=y
19. https://tableau.external.nsf.gov/views/NSFEngines2025Finalists/MapOverview?%3Aembed=y&%3AisGuestRedirectFromVizportal=y