Side-By-Side Analysis of NSF Reauthorization Legislation (117th Congress)

Updated 4.27.2021

	Endless Frontier Act (S. 1260) -- bipartisan April 20, 2021 *(Red indicates significant change from an early draft bill.)*	NSF for the Future Act (H.R. 2225) – bipartisan March 26, 2021
General	Does not reauthorize NSF in the traditional sense; instead, it **authorizes a pool of funding for FY 2022-2026** for a new directorate (earlier draft authorized funding for all of NSF). The bill would create other programs and activities across the federal government, such as Regional Technology Hubs administered by the Department of Commerce (Sec. 7) and others aimed at boosting U.S. competitiveness. Addresses research (NSF and other agencies) through the lens of **U.S. national security and global competitiveness**. Among the changes from an earlier draft include addition of the Dept. of Energy to various sections.	Reauthorizes **NSF** through **FY 2026**. Addresses issues of **research integrity, security** and **STEM education** within the context of NSF.

Authorization of Appropriations	Sec. 4 (p.53) – **Endless Frontier Fund**
	• Authorizes a total of **$112.41 billion for FY 2022-2026 for implementation of the entire Act** (not just NSF). Early draft included $190 billion.
	• Funds are to be administered by the Director of OSTP, who would submit an annual allocation list to Congress as part of the President's Budget Request. The request would list the amounts proposed for various agencies and departments as well as a detailed description of each program proposed.
	• The CJS appropriations bill may also allocate funding, as long as it is not below the authorized amounts below.
	• Within the fund, the bill authorizes no less than the following amounts for the period **of FY 2022-2026**:
	  ○ **$100 billion over 5 years specifically for a new NSF Directorate for Technology and Innovation** (earlier draft included $100B for NSF and no less than $2B for the new directorate). The annual funding allocation to the T&I Directorate would be:
	  ▪ $5 billion in FY 2022
	  ▪ $10 billion in FY 2023
	  ▪ $20 billion in FY 2024
	  ▪ $30 billion in FY 2025
		Sec. 4 (p.5) – See attached table for details.
		• Authorizes appropriations for **FY 2022-2026**.
		• Would grow NSF to **$18.3 billion by FY 2026** (FY 2021 = $8.5 billion).
		• However, $5 billion would be earmarked for the new SES Directorate (see below), leaving **$13.2 billion for NSF and $10.5 billion for R&RA by FY 2026** (FY 2021 R&RA = $6.9 billion)
		• The SES Directorate's share of the R&RA budget would grow from 10.6% in FY 2022 to 32.6% in FY 2026.

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	▪ $35 billion in FY 2026 ○ $9.425 billion for a new regional technology hub program administered by Commerce. ○ $575 million for a new comprehensive regional technology strategy grant program (created in Sec. 8 of the bill) ○ $2.41 billion for the Manufacturing USA Program (Sec. 9 of the bill)	
New Directorate	Sec. 3 (p.10) – **Directorate for Technology and Innovation** • Establish within 90 days of enactment (previously 60 days).	Sec. 9 (p.59) – **Directorate for Science and Engineering Solutions (SES)** • Establishment is subject to availability of funds. • Directorate would be included in the **Research & Related Agencies** budget line (not as a separate line like EHR). • Create an advisory committee like other directorates. • Directorate will be evaluated after 6 years and recommendations made about whether it should continue.
Staffing	• Led by an **Assistant Director** like other directorates. • **Program managers** would operate similarly to DARPA program managers.	• Led by an **Assistant Director** like other directorates.
Purpose/Goals	• Strengthen U.S. leadership in critical technologies through basic research and commercialization. • Address and mitigate technology challenges integral to the geostrategic position of the U.S. • Enhance U.S. competitiveness by improving education in key technology areas. • Foster economic and societal impact of federally funded research though tech transfer to achieve goals in economic competitiveness, manufacturing, national security, shared prosperity, energy and environment, health, education, workforce, and transportation. • Encourage broad participation by underrepresented populations. • Earlier draft included "Addressing and mitigating societal challenges…" Struck in S. 1260.	To accelerate the translation of fundamental research and to advance technologies, support use-inspired research, facilitate commercialization and use of federally funded research, and expand the pipeline of students and researchers in **areas of societal and national importance**.
Activities	• Make awards to advance innovation in the key technology focus areas (below) through basic and translational research.	• Fund transformational advances in use-inspired and translational research. • Translate research into S&E innovations.

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	• Provide funds to and partner with other directorates related to the key technology areas. • Provide funds to other federal agencies for intramural or extramural research in the key technology areas. • Fund undergraduate scholarships, graduate fellowships/traineeships, and postdoctoral awards in the key technology focus areas. • Fund University Technology Centers. • Make awards to build capacity at universities to increase the likelihood that new technologies will succeed in the commercial market. • And others.	• And others, including "**identify social, behavioral, and economic drivers and consequences of technological innovations.**"
Award Selection Process	• Program managers or other directorate employees may select recipients of support. • **Selection criteria** for "financial assistance awards" **shall** include intellectual merit and broader impacts. The directorate "**may** use a peer review process…to inform the selection of award recipients." [intent of this language is unclear]	• Does not specify.
Existing Programs		Would move **convergence accelerators**, growing **convergence big idea**, and other programs as determined by the Director to SES.
Focus Areas	Legislation mandates an initial list of "key technology focus areas" for the directorate: • A/I, machine learning, other software advances • High performance computing, semiconductors • Quantum computing and information systems • Robotics, automation, and advanced manufacturing • Natural and anthropogenic disaster prevention or mitigation • Advanced communication technology • Biotech, medical technology, genomics, and synthetic biology • Cybersecurity, data storage, and data management • Advanced energy, batteries, and industrial efficiency	Director shall identify and regularly update up to **5 focus areas** to guide the directorate. The bill suggests (but does not mandate) consideration of the **following societal challenges**: • Climate change/environmental sustainability • Global competitiveness in critical technologies • Cybersecurity • National security • STEM education and workforce • Social and economic inequality

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	• Advanced materials science, engineering, and exploration • Struck from earlier draft: Innovation methods, processes and promising practices that can affect the speed and effectiveness of innovation processes at scale (not included in S. 1260). The list of key technology focus areas is to be reviewed by the NSF director in consultation with other agency heads and altered as appropriate every 3 years. The list cannot exceed **10 focus areas**. In extraordinary circumstances (undefined), the OSTP director may grant NSF the ability to add or delete technology focus areas outside the regular process.	
Transfer of Funds	Funds can be transferred to other directorates and other federal agencies.	Funds can be transferred outside the SES directorate to other directorates; however, funds cannot be transferred from other directorates to SES.
Roadmap		Within 1 year, the Director deliver to Congress a roadmap describing the strategic vision that will guide SES funding decisions over the next 3 years.
Appropriations	Authorizes $100 billion over 5 years just for the directorate would be: • $5 billion in FY 2022 • $10 billion in FY 2023 • $20 billion in FY 2024 • $30 billion in FY 2025 • $35 billion in FY 2026 Authorizes $10 million for the NSF Office of Inspector General specifically for oversight of the new directorate. Stipulates that no funding may be used for construction. No new awards can be made by the Directorate unless the total appropriation for NSF—not including T&I funding— exceeds the previous fiscal year, as adjusted for inflation.	See attached funding tables. In addition, no funding may be appropriated to SES unless: • A specific appropriation is made for the Directorate (essentially an earmark within R&RA), AND • The amount appropriated to NSF activities—not including SES—exceeds the FY 2021 level, as adjusted for inflation.

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Annual Report on Unfunded Priorities	Sec. 3 (p.50) • Following the release of the President's budget request, the NSB shall submit a report to Congress on the unfunded priorities of NSF. • For each directorate, the report should include the proposal success rate, percentage and total funding of proposals not funded that met funding criteria, and, of those, the "most promising research areas."	
Broader Impacts		Sec. 7 (p.34) • Enter into agreement with an outside organization to assess how BI review criterion is applied across NSF and make recommendations for improving effectiveness. • Award grants to support activities to increase the efficiency, effectiveness, and availability of resources for implementing the BI review criterion (e.g., training and workshops; repositories and clearinghouses for sharing best practices and facilitating collaboration; and tools for evaluating and documenting societal impacts of research).
Research Integrity and Security *Office of Research Security and Policy; Chief of Research Security*		Sec. 7 (p.36) • Maintain a research security and policy office in the Office of the NSF Director with at least 4 FTEs. • Coordinate all research security policy issues across agency. • Includes position of Chief of Research Security.
Online Resources		Develop an online resource on the NSF website that includes: • Research security policies • Unclassified guidance on potential security risks • Other information
Responsible Conduct of Research		Update the NASEM report, "On Being a Scientist: A Guide to Responsible Conduct in Research."
Research Ethics		Sec. 7 (p.41)

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		• Amend award proposal instructions to include a requirement for an **ethics statement** to be included. • Award **research grants** to assess potential ethical and societal implications of NSF research and technologies.
Climate Change Research		Sec. 7 (p.48) Included in the list of activities are: • "research on climate-related human behaviors and institutions" • "research on climate-related risk, vulnerability, resilience, and adaptive capacity of coupled human-environment systems, including risks to ecosystem stability and risks to vulnerable populations"
Violence Research		Sec. 7 (p.50) • Award grants on research to improve understanding of the nature, scope, causes, consequences, prevention, and response to all forms of violence.
Social, Behavioral and Economic Sciences		Sec. 7 (p.51) States that the NSF director shall: • "Actively communicate opportunities and solicit proposals for social, behavioral, and economic science researchers to participate in cross-cutting and interdisciplinary programs, including the Convergence Accelerator and Big Ideas activities, and the Mid-Scale Research Infrastructure programs; and • Ensure social, behavioral, and economic science researchers are represented on relevant merit review panels for such activities.
STEM Education/ Workforce		Sec. 5. STEM Education (p.13)
PreK-12 STEM		• **Decadal Survey of STEM Education Research** – Calls on NASEM to review and assess PreK-12 STEM ed research and make recommendations for research priorities over next 10 years. (p.13) • Grant program to fund at least 3 multidisciplinary **Centers for Transformative Education Research and Translation.** (p.14)

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		• **NASEM Study** – Review research literature and identify research gaps on the interconnected factors that foster and hinder implementation of PreK-12 STEM innovations, present compendium of promising practices, models, programs and technologies. (p.17) • **National Coordination Network for Science and Technical Education** – Establish a network of centers to coordinate research, training and best practices, serve as a clearinghouse for resources, and develop partnerships between PreK-12 schools, 2- and 4-year institutions, and industry. (p.19)
Undergraduate STEM		• Support research on STEM education and workforce needs, including greater collaboration with industry to enhance education and improve alignment with workforce needs. • And others. (p. 18)
Graduate STEM	**Specific to the new directorate:** • Encourage innovation in graduate education, including through encouraging opportunities to gain experience in industry or government as part of graduate training, specific to the key technology focus areas. (p.28)	• Adds "graduate students" to existing NSF **mentoring plan** requirements for grants. • Award grants to facilitate "career exploration of academic and non-academic career options and for providing opportunity-broadening experiences for graduate students and postdoctoral scholars that can be considered, adopted, or adapted by other institutions…" • Support research grants on the graduate education system, including effects of traineeships, fellowships, and other factors. • Calls for an independent evaluation of NSF's role in supporting graduate student education and training. (p.20)
Graduate Research Fellowship Program		• Increase the number of fellowships to **3,000** annually over the next **5 years**. • Increase the **cost-of-education allowance** to institutions from $12,000 to $16,000. • Directs NSF to ensure outreach is made to applicants from fields of study that are in areas of critical national need, from all regions of the country, and from historically underrepresented populations.

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Workforce Data		• Calls for a **portfolio analysis of NSF's skilled technical workforce investments**. (p.26) • Assess the feasibility and benefits of **adding new questions or topics to NCSES surveys** on the skilled technical workforce, working conditions and work-life balance, harassment and discrimination, sexual orientation and general identity, and immigration and emigration. (p.27)
Broadening Participation	Sec. 3 • Requires NSF Director to appoint a **Chief Diversity Officer**. (p.48) • Establish a **5-year pilot program** "for awarding grants to eligible partnerships to build research and education capacity at '**emerging research institutions**.'" (p.51)	• Codifies the NSF INCLUDES Initiative. Establish a **5-year pilot program** to enhance partnerships between "**emerging research institutions**" and institutions classified as "very high research activity." (p.31)
Science, Technology and Security Strategies	Sec. 5 (p.56) • OSTP director, working with other agency heads, shall annually review strategies, programs, and resources pertaining to U.S. national competitiveness in science, research, innovation, and technology transfer to support the national security strategy, and **develop or revise a strategy for improving U.S. competitiveness**. • The strategy should include an assessment of public and private investment in civilian and military science and technology and its implications for the geostrategic position and national security of the U.S., an assessment of workforce needs in key technology areas, and federal support needed to expand student pathways and improve workforce development, among others. Sec. 11 (p. 154) • The Secretary of Commerce shall contract with the National Academies on a study to identify the 10 most critical emerging science and technology challenges facing the U.S. and develop recommendations for legislation or	

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	administrative actions to ensure U.S. leadership. (Earlier draft called for a similar report from the Director of National Intelligence).	

Appendix A: Funding Tables for the *Endless Frontier Act* (S. 1260)

Table 1: Technology & Innovation Directorate Authorization Levels, FY 2022-FY2026

…	FY 2021 Enacted	FY 2022	%	FY 2023	%	FY 2024	%	FY 2025	%	FY 2026	%	2026-2021
T&I Directorate	0	5,000,000,000	--	10,000,000,000	100%	20,000,000,000	100%	30,000,000,000	50%	35,000,000,000	16.7%	100,000,000,000

Appendix B: Funding Tables for the *NSF for the Future Act* (H.R. 2225)

Table 1: Authorization Levels, FY 2022-FY2026

…	FY 2021 Enacted	FY 2022	%	FY 2023	%	FY 2024	%	FY 2025	%	FY 2026	%	2026-2021
NSF, total	8,486,759,000	11,469,200,000	35.1%	12,668,000,000	10.5%	14,148,200,000	11.7%	16,036,900,000	13.3%	18,325,020,000	14.3%	115.9%
R&RA	6,909,800,000	9,444,100,000	36.7%	10,367,460,000	9.8%	11,702,420,000	12.9%	13,440,840,000	14.9%	15,549,390,000	15.7%	125.0%
SES (NEW)	*0*	*1,000,000,000*		*1,500,000,000*	*50.0%*	*2,250,000,000*	*50.0%*	*3,375,000,000*	*50.0%*	*5,062,500,000*	*50.0%*	
Mid-scale	*0*	*55,000,000*		*60,000,000*	*9.1%*	*70,000,000*	*16.7%*	*75,000,000*	*7.1%*	*80,000,000*	*6.7%*	
EHR	968,000,000	1,333,860,000	37.8%	1,391,320,000	4.3%	1,457,590,000	4.8%	1,522,890,000	4.5%	1,601,470,000	5.2%	65.4%
MREFC	241,000,000	190,000,000	-21.2%	355,000,000	86.8%	370,000,000	4.2%	372,000,000	0.5%	375,000,000	0.8%	55.6%
Mid-scale		*65,000,000*		*75,000,000*	15.4%	*85,000,000*	13.3%	*90,000,000*	5.9%	*100,000,000*	11.1%	
AOAM	345,640,000	473,500,000	37.0%	522,940,000	10.4%	582,380,000	11.4%	661,830,000	13.6%	756,270,000	14.3%	118.8%
NSB	4,500,000	4,620,000	2.7%	4,660,000	0.9%	4,700,000	0.9%	4,740,000	0.9%	4,780,000	0.8%	6.2%
OIG	17,850,000	23,120,000	29.5%	26,610,000	15.1%	31,110,000	16.9%	34,610,000	11.3%	38,110,000	10.1%	113.5%

Table 2: SES Directorate as a percentage of R&RA

	R&RA Total	SES Auth	%
2021	6,909,800,000	-	0.0%
2022	9,444,100,000	1,000,000,000	10.6%
2023	10,367,460,000	1,500,000,000	14.5%
2024	11,702,420,000	2,250,000,000	19.2%
2025	13,440,740,000	3,375,000,000	25.1%
2026	15,549,390,000	5,062,500,000	32.6%

Table 3: Total Mid-Scale Infrastructure Funding

	(R&RA + MREFC)
2022	120,000,000
2023	135,000,000
2024	155,000,000
2025	165,000,000
2026	180,000,000