

**DIRECTORATE FOR TECHNOLOGY, INNOVATION
AND PARTNERSHIPS (TIP)**

**\$879,870,000
+\$510,860,000 / 138.4%**

TIP Funding¹
(Dollars in Millions)

	FY 2021		FY 2022 (TBD)	FY 2023 Request	Change over	
	FY 2021 Actual	ARP Actual			FY 2021 Actual Amount	Percent
Technology Frontiers (TF)	-	-	-	\$145.00	\$145.00	N/A
Innovation and Technology Ecosystems (ITE)	74.89	2.00	-	265.00	190.11	253.8%
Translational Impacts (TI)	294.11	17.87	-	419.00	124.89	42.5%
Strategic Partnerships Office (SPO)	-	-	-	50.87	50.87	N/A
Total	\$369.01	\$19.87	-	\$879.87	\$510.86	138.4%

¹ FY 2021 funding is adjusted for comparability to reflect the movement of activities to TIP in FY 2022.

About TIP

TIP aims to advance emerging technologies to address societal and economic challenges and opportunities; accelerate the translation of research results from the lab to market and society; and cultivate new education pathways leading to a diverse and skilled future technical workforce comprising researchers, practitioners, technicians, and entrepreneurs. Building on NSF's longstanding leadership in science and engineering research and education, TIP serves as a crosscutting platform that leverages, energizes, and rapidly advances use-inspired research and innovation. Further, TIP opens new possibilities for research and education by catalyzing strategic partnerships that link academia; industry, including startups and small businesses; federal, state, local, and tribal governments; nonprofits and philanthropic organizations; civil society; and communities of practice to cultivate 21st-century innovation ecosystems that give rise to future jobs and enhance the Nation's long-term competitiveness.

TIP collaborates with NSF's other directorates and offices, as well as other agencies, to advance use-inspired, solutions-oriented research and innovation in critical and emerging technologies and industries (e.g., advanced materials, AI, biotechnology, clean energy technology, future manufacturing, next-generation networks and systems, microelectronics and semiconductors, and QIS). Through these investments, TIP addresses a dynamic range of societal and economic challenges including key priorities of the Administration and Congress (e.g., climate change, equity, bioeconomy, supply-chain resilience). In collaboration with CISE and SBE, TIP will advance democracy-affirming technologies, enabling practical privacy solutions. Of particular note, TIP supports the new NSF Regional Innovation Engines (NSF Engines), catalyzing regional-scale innovation ecosystems throughout the U.S.

TIP also accelerates the translation of fundamental science and engineering discoveries into innovative new technologies and solutions. TIP optimizes the NSF Lab-to-Market Platform, allowing researchers to pursue additional prototyping, demonstration, and scale-up work, giving rise to the startups and small businesses that are leading to new markets and economies of scale. In addition, TIP is introducing new translational pathways, for example, facilitating the adoption of NSF-funded research results as secure open-source ecosystems, affording the U.S. a competitive advantage in technology development.

Technology, Innovation and Partnerships

Across its full portfolio of investments, TIP includes equity as a fundamental design principle, seeking to provide opportunities for everyone to engage in the Nation’s research and innovation enterprise, regardless of background, organizational affiliation, or geographic location. For example, NSF will work with academia, state, local, and tribal governments, industry, and other educational partners to provide practical experiences to diverse learners at every stage of education, from first-time job seekers to experienced workers looking for new opportunities.

Finally, TIP serves as a central resource to catalyze and scale up public and private partnerships agency wide. Specifically, TIP provides expertise and support to build partnerships, along with co-funding to strategically advance high-impact relationships that deepen and advance NSF’s mission across all areas of science, engineering, and education. TIP’s efforts will expand the reach of, and increase the return on, NSF’s investments across all of its directorates and offices.

Across its portfolio, TIP develops future leaders in critical and emerging technologies capable of accelerating technology development, maturation, and deployment.

Major Investments

TIP Investments¹ (Dollars in Millions)					
Area of Investment	FY 2021	FY 2022	FY 2023	Change over	
	Actual	(TBD)	Request	FY 2021 Actual Amount	Percent
Accelerating Public and Private Partnerships	-	-	\$50.87	\$50.87	N/A
Assessments for Science & Technology Investments	-	-	40.00	40.00	N/A
Convergence Accelerator	50.70	-	70.00	19.30	38.1%
NSF Entrepreneurial Fellows	-	-	25.00	25.00	N/A
NSF Lab-to-Market Platform:					
PFI	22.32	-	30.00	7.68	34.4%
I-Corps™	39.02	-	40.00	0.98	2.5%
SBIR/STTR, including Operations	232.28	-	283.06	50.78	21.9%
Technology & Innovation Internships for Experiential	-	-	20.00	20.00	N/A

¹ FY 2021 funding is adjusted for comparability to reflect the movement of activities to TIP in FY 2022.

- **Accelerating Public and Private Partnerships:** TIP, through the SPO, will provide seed funding to incentivize the scale-up of public and private partnerships, providing co-funding to specifically enable strategic, high-impact relationships that will deepen and advance NSF’s mission across all areas of science, engineering, and education. TIP will also nurture STEM talent by focusing on the engagement of populations long underrepresented in STEM, along with broad organizational changes in higher education and the inclusion of diverse institution types such as minority-serving institutions.
- **Assessments for Science & Technology Investments:** TIP will launch assessments of emerging technologies and industries to examine the alignment of federal science and technology research spending and programs with long-term U.S. competitiveness in these areas. As part of this enduring investment, TIP will conduct regular reviews evaluating effectiveness of major federal R&D spending, and whether it is optimized for advancing U.S. competitiveness.
- **Convergence Accelerator:** TIP will invest in new research tracks informed by community responses to a Request for Information, other external stakeholder input, and current national priorities. The

Convergence Accelerator will continue to leverage foundational advances by other NSF directorates and offices, nurture multi-disciplinary and multi-sector teams, and accelerate use-inspired, solutions-oriented research and piloting in specific areas of national importance such as emerging technologies and industries. Additionally, in FY 2023, the Convergence Accelerator will launch a regional-scale platform, supporting cohorts pursuing location-specific challenges in agriculture, energy, and transportation, to name a few.

- NSF Entrepreneurial Fellows: TIP will invest in NSF Entrepreneurial Fellowships for Ph.D.-trained scientists and engineers to forge connections between academic research and government, industry, and finance. The Fellows will receive training to become leaders capable of maturing promising ideas and technologies from lab to market.
- NSF Lab-to-Market Platform: TIP will optimize NSF's lab-to-market approach. Specifically:
 - Partnerships for Innovation (PFI): Provides researchers funded by NSF from all disciplines of science and engineering the opportunity to enter into partnerships, especially with industry, to accelerate the transition of discoveries from the laboratory to the marketplace for societal benefits. In addition to supporting prototyping, technology demonstration, and scale-up work, including licensing of NSF-funded research outputs, PFI will grow its support for patent expenses for intellectual property resulting from NSF-funded research.
 - NSF Innovation Corps (I-Corps™): Through a set of Hubs, I-Corps™ connects federally-funded science and engineering research with the technological, entrepreneurial, and business communities, linking scientific and engineering discovery with technology development, societal needs, and economic opportunities. I-Corps™ reduces the time and risk associated with translating promising ideas and technologies from the laboratory to the marketplace through entrepreneurial education including customer discovery.
 - SBIR/STTR: Provides the opportunity for startups and small businesses to undertake cutting-edge, high-quality scientific research and development to determine the scientific and technical feasibility of new concepts or innovations that could be developed into new products, processes, or services for profound societal and/or economic impacts. TIP will pilot a FastTrack option to accelerate the translation of deep technologies to the market.
- Technology & Innovation Internships for Experiential Learning (TIIEEL): TIP will connect companies, governments, and non-profits with STEM learners at all levels and from all backgrounds through paid internships to help the Nation grow its innovation capacity. These internships will be opportunities to develop mutually-beneficial relationships between mentors and learners, many of whom might be pursuing accredited degree programs (e.g., high schools, community colleges, vocational schools, four-year universities, graduate schools), in addition to providing STEM career choices.

TIP Funding for Centers Programs

TIP Funding for Centers Programs					
(Dollars in Millions)					
	FY 2021	FY 2022	FY 2023	Change over	
	Actual	(TBD)	Request	FY 2021 Actual Amount	Percent
NSF Regional Innovation Engines (NSF Engines) (TF, ITE)	-	-	\$200.00	\$200.00	N/A

NSF Regional Innovation Engines (NSF Engines): TIP will aim to create regional-scale innovation ecosystems throughout the U.S. and spur economic growth by harnessing the Nation’s rich science and technology research enterprise and regional-level resources to address societal and economic challenges and promote national competitiveness. The NSF Engines work to catalyze new business and economic growth in those regions of America that have not fully participated in the technology boom of the past several decades. In collaboration with other NSF directorates and offices, TIP will provide funding to support activities focused on use-inspired research, entrepreneurship, and workforce development to nurture and accelerate regional industries.

TIP Funding for NSF-Wide Investments

TIP aims to advance science and engineering research and innovation in emerging technologies to sustain and enhance U.S. competitiveness. TIP funding contributing to NSF-wide investments in emerging technologies and industries are shown in the table below.

TIP Funding for NSF-Wide Investments¹					
(Dollars in Millions)					
Area of Investment ^{2,3}	FY 2021	FY 2022	FY 2023	Change over	
	Actual	(TBD)	Request	FY 2021 Actual Amount	Percent
Advanced Manufacturing	\$44.30	-	\$54.63	\$10.33	23.3%
Advanced Wireless Research	0.75	-	30.55	29.80	3973.3%
Artificial Intelligence	86.79	-	101.55	14.76	17.0%
Biotechnology	11.84	-	69.06	57.22	483.3%
Climate: Clean Energy Technnology ⁴	37.21	-	52.47	15.26	41.0%
Microelectronics and Semiconductors	12.78	-	50.23	37.45	293.0%
Quantum Information Science	20.53	-	38.42	17.89	87.1%

¹ FY 2021 funding is adjusted for comparability to reflect the movement of activities to TIP in FY 2022.

² NSF-Wide investments may have funding overlap and thus should not be summed.

³ This table reflects this directorate's support for selected areas of investment. In other directorate narratives, areas of investment displayed in this table may differ and thus should not be summed across

⁴ Funding includes resources for agency-wide initiatives.

People Involved in TIP Activities

Number of People Involved in TIP Activities				
	FY 2021	FY 2021		
	Actual	ARP Actual	FY 2022	FY 2023
	Estimate	Estimate	(TBD)	Estimate
Senior Researchers	2,458	81	-	5,800
Other Professionals	1,688	103	-	3,000
Postdoctoral Associates	117	-	-	700
Graduate Students	262	-	-	3,600
Undergraduate Students	215	9	-	3,000
Total Number of People	4,740	193	-	16,100

DIVISION OF TECHNOLOGY FRONTIERS (TF)

\$145,000,000
+\$145,000,000 / N/A

TF Funding					
(Dollars in Millions)					
	FY 2021	FY 2022	FY 2023	Change over	
	Actual	(TBD)	Request	FY 2021 Actual Amount	Percent
Total	-	-	\$145.00	\$145.00	N/A
Research	-	-	125.00	125.00	N/A
Centers Funding (total)	-	-	50.00	50.00	N/A
NSF Regional Innovation Engines (NSF Engines)	-	-	50.00	50.00	N/A
Education	-	-	20.00	20.00	N/A

About TF

TF works to accelerate breakthroughs in emerging technology areas to sustain and grow U.S. competitiveness and security. These investments spur high-priority innovations in advanced materials, AI, biotechnology, clean energy technology, future manufacturing, next-generation networks and systems, microelectronics and semiconductors, and QIS, among other areas. As part of this investment, TF will advance democracy-affirming technologies, including privacy-preserving technologies, in collaboration with CISE and SBE. TF additionally focuses on nurturing diverse talent by engaging individuals of all backgrounds, organizational affiliations, and geographic locations, thereby ensuring sustained leadership.

To achieve the above outcomes, TF partners with the other TIP units, other NSF directorates and offices, and other agencies, private industry, philanthropy, state and local governments, civil society, and investors. Specifically, TF pursues innovative partnerships and collaborations across sectors, along with transformative mechanisms to accelerate research activities and scale up outputs and impacts.

Finally, TF will lead the assessment of emerging technologies and industries to examine the alignment of federal science and technology research spending and programs with long-term U.S. competitiveness in these areas. Relatedly, TF will conduct regular reviews evaluating the implementation of major federal R&D spending, and whether that implementation is optimized for advancing U.S. competitiveness.

DIVISION OF INNOVATION AND TECHNOLOGY ECOSYSTEMS (ITE)

\$265,000,000
+\$190,110,000 / 253.8%

ITE Funding
(Dollars in Millions)

	FY 2021 Actual	FY 2022 (TBD)	FY 2023 Request	Change over	
				FY 2021 Actual Amount	Percent
Total	\$74.89	-	\$265.00	\$190.11	253.8%
Research	74.89	-	255.00	180.11	240.5%
Centers Funding (total)	-	-	150.00	150.00	N/A
Regional Innovation Engines (NSF Engines)	-	-	150.00	150.00	N/A
Education	-	-	10.00	10.00	N/A

About ITE

ITE strengthens the unique U.S. innovation ecosystem, engaging a broad, diverse set of individuals and organizations spanning government, academia, industry, philanthropy, civil society, and investors in the Nation’s research, innovation, and education enterprise. ITE specifically brings together researchers, practitioners, and users to catalyze iterative co-design and co-creation, developing breakthrough technologies and addressing societal challenges. In this way, ITE enhances U.S. competitiveness and paves the way for new, high-wage, good-quality jobs.

Among its investments, ITE supports efforts that accelerate use-inspired, convergent research in areas aligned with Administration and Congressional priorities. The Convergence Accelerator builds upon NSF investments in fundamental research and discovery to accelerate solutions toward societal impact. The Convergence Accelerator funds and synergizes teams together in cohorts to work interactively toward solving national-scale societal challenges that require novel ideas, approaches, and techniques from a wide range of diverse disciplines, experts, and sectors. For example, the Convergence Accelerator is advancing the frontiers of quantum technology, the networked blue economy, and worker reskilling and upskilling platforms. Additionally, in FY 2023, the Convergence Accelerator will launch a regional-scale platform, supporting regionalized cohorts pursuing location-specific challenges in agriculture, energy, and transportation, to name a few.

ITE also supports NSF Regional Innovation Engines (NSF Engines). ITE will provide funding to support activities focused on use-inspired research, entrepreneurship, and workforce development to nurture and accelerate regional industries. The NSF Engines program specifically emphasizes the meaningful engagement of the consumers of research outcomes in motivating that research as well as in the subsequent prototyping and piloting of research-based solutions (i.e., co-design and co-creation), along with the translation of research results to practice, entrepreneurship, and direct economic growth.

ITE also seeks to develop inclusive workforce-training pathways for the innovation-driven jobs of the future. For example, ITE connects a highly diverse set of aspiring students and professionals interested in deep-technology disciplines with internship opportunities across the country that match their interests, providing them with much-needed experience to land well-paying jobs.

DIVISION OF TRANSLATIONAL IMPACTS (TI)

\$419,000,000
+\$124,890,000 / 42.5%

TI Funding
(Dollars in Millions)

	FY 2021 Actual	FY 2022 (TBD)	FY 2023 Request	Change over	
				FY 2021 Actual Amount	Percent
Total	\$294.11	-	\$419.00	\$124.89	42.5%
Research	294.11	-	404.00	109.89	37.4%
Education	-	-	15.00	15.00	N/A

About TI

TI investments aims to accelerate the translation of scientific excellence and technological innovation from the laboratory to society. By investing federal funds in a portfolio of universities, startups, small businesses, and open-source communities, TI will stimulate the creation of novel products, services, and solutions that grow the national economy; catalyze public-private partnerships that increase the depth and relevance of research activities; and nurture and grows the US workforce, especially by fostering and encouraging participation by socially- and economically-disadvantaged individuals and groups.

In particular, TI aims to provide an effective “lab-to-market” platform comprising the NSF Innovation Corps (I-Corps™), Partnerships for Innovation (PFI), Small Business Innovation Research (SBIR), and Small Business Technology Transfer (STTR) programs.

I-Corps™ connects federally-funded science and engineering research with technological, entrepreneurial, and business communities, addressing the skill and knowledge gaps associated with the transformation of fundamental research into deep technology ventures. I-Corps™ reduces the time and risk associated with translating promising ideas and technologies from the laboratory to the marketplace through entrepreneurial education including customer discovery.

The PFI program offers researchers the opportunity to accelerate commercialization by entering into partnerships, especially with industry, to develop proof-of-concept work that leverages NSF-funded research. PFI additionally includes an option to defray costs associated with evaluation and protection of intellectual property, thereby combatting disparities in patent budgets across institutions of higher education and enabling the participation of the entire country in the innovation ecosystem.

The SBIR and STTR programs further transform scientific discovery into societal and/or economic benefits by catalyzing private-sector commercialization of technological innovations. The SBIR and STTR programs provide the opportunity for startups and small businesses to undertake cutting-edge, high-quality science and engineering research and development to determine the scientific and technical feasibility of new concepts or innovations that could be developed into new products, processes, or services for societal and/or economic impacts. SBIR and STTR technology topics draw upon the full breadth of NSF scientific and engineering research disciplines and are aligned with national and societal priorities, such as advanced materials, AI, biotechnology, clean energy

technology, future manufacturing, next-generation networks and systems, microelectronics and semiconductors, and QIS.

TI also supports entrepreneurial education through the NSF Entrepreneurial Fellowships. The NSF Entrepreneurial Fellowships provide Ph.D.-trained scientists and engineers with resources, including lab space, to mature promising ideas and technologies from lab to market. Along the way, the NSF Entrepreneurial Fellows become leaders in technology translation.

Additionally, TI supports new pathways for translation, impacting government services, policy making, and education. For example, through the new Pathways to enable Open-Source Ecosystems (POSE) program, TI facilitates the creation and growth of sustainable, high-impact collaborative environments that produce tools and products designed to be publicly accessible, modifiable, and distributable by anyone at no cost. Benefiting communities far beyond the initial applications, the resulting open-source ecosystems are expected to catalyze broad adoption across academia, industry, government, non-profits, and other sectors, and result in a growing, civic-minded community of users and developers.

Finally, TI fosters cultural change within institutions of higher education, supporting the adoption of use-inspired research, translational research, and entrepreneurial training. Through novel prize competitions, inventors' camps and hackathons, and Entrepreneurs-in-Residence programs, TI combines workforce development with mentorship and educational activities focusing on experiential customer discovery as a linchpin linking deep technology with societal benefits.

STRATEGIC PARTNERSHIPS OFFICE (SPO)

\$50,870,000
+\$50,870,000 / N/A

SPO Funding
(Dollars in Millions)

	FY 2021 Actual	FY 2022 (TBD)	FY 2023 Request	Change over	
				FY 2021 Actual Amount	Percent
Total	-	-	\$50.87	\$50.87	N/A
Research	-	-	50.87	50.87	N/A

About SPO

SPO serves as an agency-wide resource to catalyze and scale up public and private partnerships in order to amplify and further the impact of NSF investments in research, innovation, and education. Specifically, SPO provides expertise and support to build partnerships, along with co-funding to strategically advance high-impact relationships that will deepen and advance NSF’s mission across science, engineering, and education. SPO assists these partnerships in expanding the reach of, and increasing the return on, NSF’s investments across its directorates and offices.

NSF’s partnerships unite broad and diverse communities and coalitions in the pursuit of discovery and innovation by leveraging unique experiences and strengths of government, industry, academia, philanthropy, civil society, and investors to motivate the understanding of research problems and iteratively pilot research-based solutions through co-design. In addition to advancing the Nation’s research enterprise, SPO-facilitated partnerships nurture STEM talent by focusing on the engagement of populations long underrepresented in or underserved by STEM, along with the inclusion of diverse organization types such as minority-serving institutions. SPO also advances testbeds and other infrastructure critical to furthering the research and education enterprise.