**The information below includes a summary of each section related to creation of new programs, appropriations of funds, and other significant information. Some sections of the Act have been removed or condensed for brevity and interest.**

**DIVISION A—CHIPS ACT OF 2022**

**Sec. 102.** Establishes funds and allocates budgets at multiple Federal agencies, to fund activities initially described in the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021.

Congressionally mandated priorities for this act include activities that:

1. strengthens the security and resilience of the semiconductor supply chain, including by mitigating gaps and vulnerabilities;
2. provides a supply of secure semiconductors relevant for national security;
3. strengthens the leadership of the United States in semiconductor technology;
4. grows the economy of the United States and supports job creation in the United States;
5. bolsters the semiconductor and skilled technical workforces in the United States;
6. promotes the inclusion of economically disadvantaged individuals and small businesses; and
7. improves the resiliency of the semiconductor supply chains of critical manufacturing industries.

**Department of Commerce & NIST Component:** Creating helpful incentives to produce semiconductors (CHIPS) for America fund. $50 billion allocated over 5 years, of which $2 billion is explicitly provided to focus solely on legacy chip (essential to the auto industry, the military, and other critical industries) production to advance economic and national security interests.

* FY22 – $24B ($19B to Incentives Fund, $2B for the National Semiconductor Technology Center, $2.5B National Advanced Packaging Manufacturing Program led by the National Institute of Standards and Technology, $500M for Microelectronics Research and Manufacturing USA programs)
* FY23 – $7B ($5B to Incentives Fund, $2B total for the National Semiconductor Technology Center, National Advanced Packaging Manufacturing Program, Microelectronics Research, and Manufacturing USA)
* FY24 – $6.3B ($5B to Incentives Fund, $1.3B total for the National Semiconductor Technology Center, National Advanced Packaging Manufacturing Program, Microelectronics Research, and Manufacturing USA)
* FY25 – $6.1B ($5B to Incentives Fund, $1.1B total for the National Semiconductor Technology Center, National Advanced Packaging Manufacturing Program, Microelectronics Research, and Manufacturing USA)
* FY26 – $6.6B ($5B to Incentives Fund, $1.6B total for the National Semiconductor Technology Center, National Advanced Packaging Manufacturing Program, Microelectronics Research, and Manufacturing USA)

**Department of Defense Component:** (CHIPS) for America Defense Fund. Authorizes $400M annually for FY23 – FY27 for this fund.

**Secretary of State Component:** (CHIPS) for America International Technology Security and Innovation Fund. $500 million would be allocated over 5 years to the Department of State, for the purposes of coordinating with foreign government partners to support international information and communications technology security and semiconductor supply chain activities, including supporting the development and adoption of secure and trusted telecommunications technologies, semiconductors, and other emerging technologies. Authorizes $100M annually for FY23-FY27 for this fund.

**National Science Foundation Component:** (CHIPS) for America Workforce and Education Fund. $200 million provided to the National Science Foundation, spread over five years, to promote growth of the semiconductor workforce (additional 90,000 workers by 2025). Authorizes $25M in FY23, $25M in FY24, and $50M annually for FY25 – FY27.

**Sec. 103. Semiconductor incentives.** This section has all the legal info about the incentives, loans repayments, business eligibility, etc.

**Sec. 104. Opportunity and inclusion.** This section includes a mandate to increase participation of and outreach to economically disadvantaged individuals, minority-owned businesses, veteran-owned businesses, and women-owned businesses; as related to the incentives program described above.

**Sec. 106.** Appropriations for the **Public Wireless Supply Chain Innovation Fund**- $150M for FY22, and $1.35B to be used between FY23 – FY32. This fund aims to spur movement towards open-architecture, software-based wireless technologies, funding innovative, ‘leap-ahead’ technologies in the U.S. mobile broadband market. The fund would be managed by the National Telecommunications and Information Administration (NTIA), with input from the National Institute of Standards and Technology, Department of Homeland Security, and the Intelligence Advanced Research Projects Activity, among others.

**Sec. 107.** This section revises sections of the Internal Revenue code with the updates related to the tax credits and incentives described above. Creates a 25 percent investment tax credit for investments in semiconductor manufacturing and includes incentives for the manufacturing of semiconductors, as well as for the manufacturing of the specialized tooling equipment required in the semiconductor manufacturing process. Taxpayers may elect to treat the credit as a payment against tax (“direct pay”). The credit is provided for property that is placed in service after December 31, 2022, and for which construction begins before January 1, 2027.

**DIVISION B—RESEARCH AND INNOVATION**

Research and Development, Competition, and Innovation Act

**TITLE I—DEPARTMENT OF ENERGY SCIENCE FOR THE FUTURE**

**Sec. 10102.** Includes provisions to revise existing language in a few other places and specify some priorities for investment in the research & development funding at DOE.

* Subsection (a) authorizes a research and development program in basic energy sciences, including materials sciences and engineering, chemical sciences, physical biosciences, geosciences, and other disciplines to provide the foundations for new energy technologies. This subsection authorizes sustainable chemistry research, as well as upgrades and related improvements to multiple user facilities, including: the Advanced Photon Source; the Spallation Neutron Source; the Advanced Light Source; the Linac Coherent Light Source II; the Cryomodule Repair and Maintenance Facility; the Nanoscale Science Research Center; and the National Synchrotron Light Source II. This subsection also authorizes computational material and chemical sciences research and development, including up to six centers. It authorizes development of a materials research database. Allocates $2,685,414,000 for FY23; $2,866,890,840 for FY24; $2,987,727,170 for FY25; $3,062,732,781 for FY26; and $3,080,067,167 for FY27 for the Basic Energy Sciences Program.
* Subsection (b) authorizes $50M annually for FY23 - FY27 to support basic research in artificial photosynthesis and $50M per year for FY23 - FY27 to support basic research in biochemistry, replication of natural photosynthesis, and related processes. It removes the existing statutory prohibition on the use of funds for commercial application of energy technology.
* Subsection (c) authorizes basic research and development activities to ensure U.S. competitiveness in energy storage; authorizes $50M annually for FY23 through FY27to support basic research in multivalent ion materials in electric energy storage systems, $50M annually for FY23 - FY27 to support electrochemistry modeling and simulation, and $20M annually for FY23 - FY27 to support mesoscale electrochemistry. It removes the existing statutory prohibition on the use of funds for commercial application of energy technology.
* Subsection (d) authorizes the Director of the Office of Science to support a program of basic research and development to bridge scientific barriers to expand knowledge relevant to nuclear matter for the benefit of commerce, medicine, and national security; authorizes $50M annually for FY23 - FY27.
* Subsections (e-h) establish a “Carbon Materials Research Initiative” to expand fundamental knowledge of coal, coal-wastes, and carbon ore chemistry which includes a basic research program and the establishment of a research center in each of the two major coal-producing regions of the United States; creates a “Carbon Sequestration Research and Geologic Computational Science Initiative” to expand fundamental knowledge, data collection, data analysis, and modeling of subsurface geology to advance understanding of carbon sequestration in geologic formations. Includes a basic research program; establishes at least two carbon storage research and geologic computational science centers to improve data collection, analysis, and modeling of subsurface geology to advance carbon sequestration in geologic formations; and allocates $50M annually for FY23 through FY27 for the carbon activities.

**Sec. 10103. Biological and environmental research**

* Subsection (a) authorizes an R&D program in biological systems science and climate and environment science relevant to the development of new energy technologies for the energy, environment, and national security missions of the Department (activities in phenomic/genomic science, including fundamental research on plants and microbes, and biomolecular characterization and imaging science).
* Subsection (b) authorizes $50M per year for FY26 and FY27 for the Low-Dose Radiation Research Program.
* Subsection (c) directs the Secretary to carry out a basic research program on the similarities and differences between the effects of exposure to low-dose radiation on Earth, in low Earth orbit, and in the space environment, in coordination with the Administrator of the National Aeronautics and Space Administration.
* Subsection (d) authorizes the Director of the Office of Science to carry out earth and environmental systems science research in consultation with the National Oceanic and Atmospheric Administration (NOAA) and other federal agencies. It also directs the development, construction, operation, and maintenance of user facilities to enhance the collection and analysis of observational data related to complex biological, climate, and environmental systems, including a microbial molecular phenotyping capability, and to carry out a research program, in consultation with NOAA and other federal agencies, to enhance the understanding of littoral ecosystems. The subsection also directs the Secretary to establish an initiative focused on the development of engineered ecosystems within the Biological and Environmental Research program. The subsection authorizes: $885,420,000 for FY23; $946,745,200 for FY24; $1,001, 149,912 for FY25; $1,068,818,907 for FY26; and $1,129,948,041 for FY27 for the Biological and Environmental Research Program.
* Subsection (e) authorizes up to six bioenergy research centers to conduct fundamental research in plant and microbial systems biology, biological imaging and analysis, and genomics, and to accelerate advanced research and development of advanced biofuels, bioenergy or biobased materials, chemicals, and products that are produced from a variety of regionally diverse feedstocks, and to facilitate the translation of research results to industry.

**Sec. 10104. Advanced scientific computing research program**

* Subsection (a) authorizes a program to steward applied mathematics, computational science, and computer science research relevant to the mission of the Department, including provisions for applied mathematics and software development for high-end computing systems and computer sciences research, an advanced computing program, guidance on mitigation of bias in high-performance computing capabilities, architectural research in heterogeneous computing systems, an energy efficient computing program, upgrades to the energy science network user facility, and a computational science graduate fellowship program. Allocates $1,126,950,000 for FY23; $1,194,109,500 for FY24; $1,265,275,695 for FY25; $1,340,687,843 for FY26; and $1,420,599,500 for FY27 for the Advanced Scientific Computing Research Program.
* Subsection (b) authorizes a research, development, and demonstration program to accelerate innovation to support quantum network infrastructure and authorizes $100M annually from FY23 - FY27 for this program. It also directs the Secretary to establish a Quantum User Expansion for Science and Technology program (QUEST) to encourage and facilitate access to the United States quantum computing hardware and clouds for research purposes. The subsection authorizes: $30M for FY23; $31.5M for FY24; $33.075M for FY25; $34,728,750 for FY26; and $36,465,188 for FY27 for the QUEST program.

**Sec. 10105. Fusion energy research.** Authorizes $50M annually for FY23 – FY27 for the Fusion Energy Research program; authorizes $35M for FY23, $50M for FY24, $65M for FY25, and $80M annually in FY26 and FY27 for the Fusion Reactor System Design program; establishes a national High-Performance Computing for Fusion Innovation Center in partnership with the Innovation Network for Fusion Energy; authorizes ~$25M for the Material Plasma Exposure experimental facility; authorizes over $1B annually through FY27 for the Matter in Extreme Conditions endstation at the Linac Coherent Light Source;

**Sec. 10106. High energy physics program.** This addresses the findings and recommendations of the 2014 Particle Physics Project Prioritization Panel (P5) report entitled ‘Building for Discovery’, support construction or fabrication of— (A) an international Long-Baseline Neutrino Facility based in the United States ($1.35B); (B) the Proton Improvement Plan II ($595M through FY27); (C) Second Generation Dark Matter experiments; ‘‘(D) the Legacy Survey of Space and Time camera; ‘‘(E) upgrades to detectors and other components of the Large Hadron Collider; and ‘‘(F) the Cosmic Microwave Background Stage 4 project ($255M); and ‘‘(G) other high priority projects recommended in the most recent report of the Particle Physics Project Prioritization Panel of the High Energy Physics Advisory Panel (~$6.92B through FY27).

**Sec. 10107. Nuclear physics program**. This authorizes appropriations ranging from $840M to $1.2B for office activities and $1.088B for construction of an Electron Ion Collider.

**Sec. 10108. Science laboratories infrastructure program.** Authorizes $550M annually from FY23 – FY27 for this program and amends some existing language.

**Sec. 10109. Accelerator research and development.** Authorizes $1.075B from FY23 – FY27 for this program, and amends some existing language.

**Sec. 10110. Isotope research, development, and production. Authorizes** $934M from FY23 – FY27 for isotope R&D; authorizes $336M through FY27 for construction of a radioisotope processing facility to provide for the growing radiochemical processing capability needs associated with the production of critical radioactive isotopes; establishes a stable isotope production and research center and funds it with $199M through FY27.

**Sec. 10111. Increased collaboration with teachers and scientists.** This section authorizes the Director of the Office of Science to support the development of a scientific workforce. It authorizes programs that foster collaboration between teachers at elementary schools and secondary schools, students and faculty at institutions of higher education, early-career researchers, and the National Laboratories. Authorizes the use of proven techniques to expand the number of individuals from underrepresented groups pursuing and attaining skills or undergraduate and graduate degrees relevant to the mission of the Office of Science; authorizes minimum $2M per year for FY23 through FY27 to support the activities.

**Sec. 10112. High intensity laser research initiative; helium conservation program; Office of Science emerging biological threat preparedness research initiative; midscale instrumentation and research equipment program; authorization of appropriations.** Establishes a high intensity laser research initiative and authorizes $50M in FY23, $100M in FY24, $150M in FY25, $200M in FY26, and $250M in FY27 to support it; establishes a grant program to reduce the consumption of helium; establishes within the Office of Science a cross-cutting research initiative, to be known as the ‘Biological Threat Preparedness Research Initiative’; creates an Emerging Infectious Diseases High Performance Computing Research Consortium; authorizes $50M annually from FY23 – FY27 for the helium grants, bio threat initiative, and emerging infectious disease HPCRC.

**Sec. 10113. Established program to stimulate competitive research (EPSCoR).**

This expands DOE’s EPSCoR program to improve its integration with Office of Science programs, and improve the research capacity and capabilities at universities in EPSCoR states, including with scholarships and fellowships, grants for early career faculty, and funding to institutions to support collaboration and expertise-building. The section authorizes: $50M for FY23; $50M for FY24; $75M for FY25; $100M for FY26; and $100M for FY27 to support the activities. Authorizes an additional $25M annually for FY23 through FY27 for research instrumentation and equipment that range in cost from $500,000 to $20M. Requires that not less than 10% of the university R&D funds awarded by the Office of Science be awarded to institutions in EPSCoR states to further enhance their participation in and contributions to Office of Science programs. To further improve coordination, the Undersecretary for Science is directed to ensure robust participation of representatives from EPSCoR universities on Office of Science Advisory Committees.

**Sec. 10114. Research security**. Calls for the Secretary of Energy to develop and maintain tools and processes to mitigate research security risks and coordinate with the Director of the Office of Intelligence and Counterintelligence and protect intellectual property.

**TITLE II—NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY FOR THE FUTURE**

**Subtitle A—Authorization of Appropriations**

Sec. 10211. Authorization of appropriations. Authorizes $9.68 billion for the National Institute of Standards and Technology (NIST) over five years, including $2.23 billion for the Hollings Manufacturing Extension Partnership and $829 million for the Manufacturing USA program. Authorizes NIST appropriations- $1,551,450,000 for FY23, $1,651,600,000 in FY24, $2,039,900,000 in FY25, $2,158,400,000 in FY26, and $2,283,360,000 for FY27 for a variety of programs.

**Subtitle B—Measurement Research**

These sections define a number of initiatives and programs related to the section topic, to be established or moved to NIST.

Sec. 10221. Engineering biology and biometrology.

Sec. 10222. Greenhouse gas measurement research.

Sec. 10223. NIST authority for cybersecurity and privacy activities.

Sec. 10224. Software security and authentication.

Sec. 10225. Digital identity management research.

Sec. 10226. Biometrics research and testing.

Sec. 10227. Federal biometric performance standards.

Sec. 10228. Protecting research from cybersecurity theft.

Sec. 10229. Dissemination of resources for research institutions.

Sec. 10230. Advanced communications research.

Sec. 10231. Neutron scattering.

Sec. 10232. Artificial intelligence.

Sec. 10233. Sustainable chemistry research and education.

Sec. 10234. Premise plumbing research.

Sec. 10235. Dr. David Satcher Cybersecurity Education Grant Program.

**Subtitle C—General Activities**

The following sections outline a number of requirements and guidelines that impact the business operations of NIST. Some also revise existing language about specific standards.

* Sec. 10241. Educational outreach and support for underrepresented communities.
* Sec. 10242. Other transactions authority.
* Sec. 10243. Report to Congress on collaborations with government agencies.
* Sec. 10244. Hiring critical technical experts.
* Sec. 10245. International standards development.
* Sec. 10246. Standard technical update.
* Sec. 10247. GAO study of NIST research security policies and protocols.

**Sec. 10248. Standards development organization grants.** establish a competitive program of grants for nongovernmental standards development organizations to develop, approve, disseminate, maintain, and review forensic science voluntary consensus standards and best practices that shall be available to the public free of charge; authorizes $2M annually from FY22 – FY26 for this grant program.

**Subtitle D—Hollings Manufacturing Extension Partnership**

The sections below update the existing language related to the MEP program, including eligibility criteria and program guidelines.

* Sec. 10251. Establishment of expansion awards pilot program as a part of the Hollings Manufacturing Extension Partnership.
* Sec. 10252. Update to Hollings Manufacturing Extension Partnership.
* Sec. 10254. Hollings Manufacturing Extension Partnership activities.
* Sec. 10255. Amendment to the Hollings Manufacturing Extension Partnership relating to institutions of higher education.

**Sec. 10253. National Supply Chain Database.** This establishes a voluntary National Supply Chain Database, through the Hollings Manufacturing Extension Partnership, to assist the Federal Government and industry sectors in minimizing disruptions to the United States supply chain by having an assessment of United States manufacturers’ capabilities.

**Subtitle E—Manufacturing USA Program**

**Sec. 10261. Supporting geographic diversity.** This requires an Agency head, when planning or establishing a Manufacturing USA program, to give consideration to geographic diversity, areas with low per capita income, areas with a high proportion of socially disadvantaged residents, or areas that are located in small and rural communities.

**Sec. 10262. Expanding opportunities through the Manufacturing USA Program.** Directs Federal agencies to increase participation of minority serving institutions, minority business enterprises, and rural-serving institutions in Manufacturing USA institutes.

**TITLE III—NATIONAL SCIENCE FOUNDATION FOR THE FUTURE**

**Subtitle A—Preliminary Matters**

**Sec. 10301. Sense of Congress.** It is the sense of Congress that—

1. the National Science Foundation, the Department of Energy and its National Laboratories, and other key Federal agencies have carried out vital work supporting basic and applied research to create knowledge that is a key driver of the economy of the United States and a critical component of national security;
2. openness to diverse perspectives and a focus on freedom from censorship and political bias will continue to make educational and research institutions in the United States beacons to thousands of students from across the world;
3. increasing research and technology transfer investments, building regional capacity and reducing geographic disparity, strengthening supply chains, and increasing capabilities in key technology focus areas will enhance the competitive advantage and leadership of the United States in the global economy;
4. the Federal Government must utilize the full talent and potential of the entire Nation by avoiding undue geographic concentration of research and STEM education funding, encouraging broader participation of populations underrepresented in STEM, and collaborating with nongovernment partners to ensure the leadership of the United States in technological innovation; and
5. authorization and funding for investments in research, education, technology transfer, intellectual property, manufacturing, and other core strengths of the United States innovation ecosystem, including at the National Science Foundation and the Department of Energy, should be done on a bipartisan basis.

**Sec. 10303. Authorization of appropriations.** This section outlines the agency’s appropriations request for all NSF awards and operations from FY23- FY27.

**Subtitle B—STEM Education**

**Sec. 10311. PreK–12 STEM education.** Supports National Academies study on barriers to the widespread implementation of STEM education innovations. Supports research and development to improve informal STEM education. Establishes a ten-year National STEM Teacher Corps pilot program to recruit and retain high-quality STEM teachers to increase STEM student achievement and participation rates.

**Sec. 10312. Undergraduate STEM education.** Supports research and development to improve the alignment of undergraduate STEM education and training with workforce needs. Updates the Advanced Technological Education program to establish a network of centers for science and technical education and supports research and development to improve STEM education at community colleges. Supports awards to advance research on effective STEM education practices at community colleges, provide students with hands-on training and research experiences, and support career and technical education in STEM fields. Establishes a pilot program to develop and scale up successful models for providing students with hands-on course-based research experiences.

**Sec. 10313. Graduate STEM education.** Expands requirement for funding proposals to include a mentoring plan for graduate students. Supports activities to facilitate career exploration for graduate students and postdoctoral researchers. Creates a requirement for funding proposals to include individual development plans for graduate students and postdoctoral researchers and provides supplemental funding to facilitate professional development activities. Supports research on the graduate education system. Updates the Graduate Research Fellowship Program to increase the number of new graduate fellows supported annually, address workforce demand, increase the cost of education allowance, and recruit a more diverse pool of applicants. Requires an evaluation of mechanisms for supporting graduate student education and training. Requires a report on the need and feasibility of a program to recruit and train the next generation of artificial intelligence professionals and authorizes NSF to establish a Federal AI scholarship-for-service program, which would run in addition to existing programs such as CyberCorps Scholarship-for-Service.

**Sec. 10314. STEM workforce data.** Requires a portfolio analysis of Foundation investments in the skilled technical workforce. Requires an assessment of the feasibility and benefits of adding rotating questions/topic modules to existing National Center for Science and Engineering Statistics (NCSES) surveys. Requires an assessment of the feasibility and benefits of incorporating new questions to existing NCSES surveys on a range of topics related to the nature of the STEM workforce and the workforce environment. Requires a Government Accountability Office evaluation of the capacity of NCSES to meet current and future needs for data on the STEM workforce.

**Sec. 10315. Cyber workforce development research and development.** Supports research on the cyber workforce, including paths to entry and re-entry into the cyber workforce.

**Sec. 10316. Federal cyber scholarship-for-service program. Clarifies** that cybersecurity-related aspects of artificial intelligence, quantum computing, aerospace, and other fields are within the scope of the NSF CyberCorps Scholarship-for-Service program.

**Sec. 10317. Cybersecurity workforce data initiative.** Establishes a data initiative through the NCSES to measure the cybersecurity workforce.

**Sec. 10318. Microelectronics workforce development activities.** Directs the National Science Foundation to make awards, including through existing programs, supporting the development and expansion of microelectronics education and workforce development activities at all levels of education, including traineeships. Establishes a National Network for Microelectronics Education to enhance and broaden participation in microelectronics education in coordination with industry, led by a network coordination hub.

**Sec. 10321. Programs to address the STEM workforce.** Provides for scholarships, fellowships, traineeships, and postdoctoral awards, and authority for Federal research agencies to hire recipients of such awards.

**Subtitle C—Broadening Participation**

**Sec. 10322. Robert Noyce Teacher Scholarship program update.** Calls for expanded outreach to underserved populations to increase the diversity of participants in the program.

**Sec. 10324. Broadening participation on major facilities awards.** Requires proposers seeking a cooperative agreement for the management of the operations and maintenance of an NSF project to demonstrate prior experience and current capabilities in, or, to have a plan for employing best practices in broadening participation in science and engineering and ensure implementation of such practices is considered in oversight of the award.

**Sec. 10325. Expanding geographic and institutional diversity in research.**

* Subsection (a) Increases the amount allocated at NSF for EPSCoR to 15.5% in FY23, 16% in FY24, 16.5% in FY25, 17% in FY26, 18% in FY27, 19% in FY28, and 20% in FY20. These are percentages of the agency’s annual budget for those years, minus the polar research and operations line item. Also mandates a percentage of all scholarship, fellowship, and traineeship awards reserved for awardees at EPSCoR institutions of 16% in FY23, 18% in FY24, and 20% in FY25-FY29. This section also freezes the EPSCoR eligibility for five years, allowing no new jurisdictions.
* Subsection (b) establishes a new program to foster STEM research diversity and capacity, and authorizes $150M annually from FY23 – FY27 for a variety of activities under the program.
* Subsection (c) establishes a five-year pilot program to support partnerships among emerging research institutions and institutions classified as very high research activity (Carnegie R1). R1 applicants submitting multi-institutional collaborative proposals over $1M will require a description of how the applicants will support substantive, meaningful, sustainable, and mutually beneficial partnerships with one or more emerging research institutions; direct no less than 35% of the total award to one or more emerging research institutions; and assigns reporting requirements.

**Sec. 10326. Diversity in tech research.** Requires NSF to make awards, on a competitive basis, to institutions of higher education or nonprofit organizations (or consortia of such institutions or organizations) to support basic, applied, and use-inspired research that yields a scientific evidence base for improving the design and emergence, development and deployment, and management and ultimate effectiveness of entities involved in technology research, including research related to diversity and inclusion in the technology sector.

**Sec. 10327. Chief Diversity Officer of the NSF.** Establishes a new position at NSF who will be responsible for providing advice on policy, oversight, guidance, and coordination with respect to matters of the Foundation related to diversity and inclusion, including ensuring the geographic diversity of the Foundation programs. Other duties may include— (1) establishing and maintaining a strategic plan that publicly states a diversity definition, vision, and goals for the Foundation; (2) defining a set of strategic metrics that are directly linked to key organizational priorities and goals; actionable; and actively used to implement the strategic plan under paragraph (1); (3) advising in the establishment of a strategic plan for diverse participation by individuals and institutions of higher education, including community colleges, historically Black colleges and universities, Tribal Colleges or Universities, minority serving institutions, institutions of higher education with an established STEM capacity building program focused on Native Hawaiians or Alaska Natives, and EPSCoR institutions); (4) advising in the establishment of a strategic plan for outreach to, and recruiting from, untapped locations and underrepresented populations; (5) advising on a diversity and inclusion strategy for the Foundation’s portfolio of PreK–12 STEM education focused programs and activities, including goals for addressing barriers to participation; (6) advising on the application of the Foundation’s broader impacts review criterion.

**Sec. 10328. Research and dissemination to increase the participation of women and underrepresented minorities in STEM fields.** Requires NSF to make awards on a competitive, merit-reviewed basis, to institutions of higher education or non-profit organizations (or consortia of such institutions or organizations), to enable such entities to increase the participation of women and underrepresented minorities in STEM studies and careers. Authorizes $5M annually from FY23 – FY27 for a variety of activities in this program.

**Sec. 10329. Activities to expand STEM opportunities.**

* Subsection (a) establishes a new program for the development and assessment of innovative reform efforts designed to increase the recruitment, retention, and advancement of individuals from underrepresented minority groups in academic STEM careers, which may include implementing or expanding successful evidence-based practices. Authorizes $8M annually from FY23 – FY27 for this program.
* Subsection (b) establishes a program to expand research-based reforms in undergraduate STEM education for the purpose of recruiting and retaining students from minority groups who are underrepresented in STEM fields. Authorizes $15M annually for FY23 – FY27 for this program.

**Sec. 10330. Intramural emerging research institutions pilot program.** Establishes multiple pilot programs, including through existing programs or other programs authorized in this division or division A, within the Foundation to expand the number of institutions of higher education (including such institutions that are community colleges), and other eligible entities that the Director determines appropriate, that are able to successfully compete for Foundation awards. (GRANTED)

**Subtitle D—NSF Research Security**

This subtitle contains a number of sections related to establishment and operations of an Office of Research Security and Policy at NSF, including reporting requirements and authorization of $6M annually from FY23 – FY27 to support the office.

**Subtitle E—Fundamental Research**

**Sec. 10341. Broader impacts.** Requires NSF and CEOSE to assess the effectiveness of the Broader Impacts criterion and make recommendations for improvement.

**Sec. 10342. Sense of Congress.** Encourages NSF to continue to identify opportunities to reduce the administrative burden on researchers.

**Sec. 10343. Research ethics.** Encourages NSF to incorporate ethical, social, safety, and security implications in research design and the review process of awards, conduct a study with the National Academies to make recommendations on research governance, and work with stakeholders to promote best practices for governance of research in emerging technologies at every stage of research.

**Sec. 10344. Research reproducibility and replicability.** Contains a number of subsections related to ensuring public access to research products, including data, software, and code, developed as part of NSF-supported projects. This includes data management plans, use of public access repositories, open-source tools and infrastructure, computational reproducibility, consensus on data sharing, and more.

**Sec. 10345. Climate change research. Requires** NSF to support research to improve our understanding of the climate system and related human and environmental systems.

**Sec. 10346. Social, behavioral, and economic sciences.** Requires NSF to facilitate involvement of social, behavioral, and economic science researchers in cross-cutting and interdisciplinary programs, including the Convergence Accelerator and agency priority activities, and the Mid-Scale Research Infrastructure program; and ensure representation from those fields on review panels.

**Sec. 10347. Measuring impacts of Federally funded research and development.** Support research and development of data, models, indicators, and associated analytical tools to improve our understanding of the impacts of Federally funded research on society, the economy, and the workforce, including domestic job creation.

**Sec. 10348. Food-energy-water research**. Supports research to significantly advance our understanding of the food-energy-water system through quantitative and computational modeling, including support for relevant cyberinfrastructure; development of real-time, cyber-enabled interfaces that improve understanding of the behavior of food-energy-water systems and increase decision support capability; supports research that will lead to innovative solutions to critical food-energy-water system problems; and growth of the scientific workforce capable of studying and managing the food-energy-water system, through education and other professional development.

**Sec. 10349. Biological Field Stations and Marine Laboratories**. Supports enhancing, repairing and maintaining research instrumentation, laboratories, telecommunications and housing at biological field stations and marine laboratories.

**Sec. 10350. Sustainable chemistry research and education**. Establishes a program to support research and educational activities related to integrating sustainable chemistry principles into elementary, secondary, undergraduate, and graduate chemistry and chemical engineering curriculum and research training, as appropriate to that level of education and training.

**Sec. 10351. Risk and resilience research.** Prioritizes research in a number of fields related to resilience and utilizing artificial intelligence and data analytics, including extreme events, natural hazards, interdependence of infrastructure, resilient instrumentation, community detection and perception of risks, wildfire science, and more.

**Sec. 10352. Unmanned aircraft systems technologies.** Establishes a program of research and related activities related to unmanned aircraft system technologies, which may include a prize competition and support for undergraduate and graduate curriculum development.

**Sec. 10353. Accelerating unmanned maritime systems technologies.** Supports advances in marine science, maritime domain awareness, and national security.

**Sec. 10355. Biological research collections.** Includes a provision to require a specimen management plan in relevant proposals, as part of the data management plan, and establishes an Action Center for Biological Collections.

**Sec. 10356. Clean water research and technology acceleration.** Supports research to advance our understanding of water availability and quality, hydrology, wastewater systems, related impact in low-income or disadvantaged communities, increase workforce training in these areas, and work with communities to develop and deploy innovative water technologies.

**Sec. 10357. Technology and behavioral science research.** Supports research to increase understanding of social media and consumer technology access and use patterns and related mental health, behavioral, and substance use disorder issues, particularly for children and adolescents; including within communities experiencing long-term economic distress.

**Sec. 10359. Critical minerals mining research and development.** Supports research on critical minerals mining strategies and innovative mining technologies to strengthen the US supply chain and reduce reliance on minerals that are subject to supply disruptions.

**Sec. 10360. Study of AI research capacity.** Calls for a comprehensive study on where AI research is being conducted and published, AI educational programs, computational resources, and other information related to institutions and people participating in AI research.

**Sec. 10361. Advancing IoT for Precision Agriculture Capabilities Act.** Promotes scientific research and development opportunities for connected technologies that advance precision agriculture capabilities, through a number of initiatives and specific research priorities.

**Sec. 10362. Astronomy and satellite constellations.** Supports research and workshops on potential impacts of satellites on ground-based optical, infrared, and radio astronomy, and wireless spectra.

**Sec. 10363. Research on the impact of inflation**. Supports research to improve our understanding of the impact of inflation, particularly on US global competitiveness and on rural and underserved communities.

**Sec. 10364. Microgravity utilization policy.** Requires NSF to provide access to the microgravity environment for relevant NSF awardees.

**Sec. 10365. Recognition of the Arecibo Observatory.** This section acknowledges the significance of both the historical scientific contributions provided by Arecibo in Puerto Rico, and the implications of the loss of the instrument due to its collapse in 2021. It also encourages NSF to explore how the site can continue to be utilized for education or other research purposes.

**Subtitle F—Research Infrastructure**

**Sec. 10373. Helium conservation.** Supports MRI awards for equipment and instrumentation to reduce consumption of helium.

**Sec. 10374. Advanced computing.** Requires relevant proposals to include estimates of computational resource needs for the proposed work, and development of a 5-year advanced computing roadmap including resource needs for the research community. Authorizes $38M to be used between FY23 – FY25 for a computing enclave pilot program.

Sec. 10375. National secure data service. Establishes a demonstration project to develop, refine, and test models to inform the full implementation of the Commission on Evidence-Based Policymaking recommendation for a governmentwide data linkage and access infrastructure for statistical activities conducted for statistical purposes. Authorizes $9M annually from FY23 – FY27 for the project.

**Subtitle G—Directorate for Technology, Innovation, and Partnerships**

**Sec. 10381 – 10387.** These sections establish a new directorate at NSF, the first in several decades, and assign 7 priorities for it. The TIP directorate will house a number of initiatives related to advances in use-inspired and translational research and technology development, advancing novel approaches and reducing barriers to technology transfer, entrepreneurial support, and more.

**Sec. 10388. Regional Innovation Engines.** Establishes a new program at the TIP directorate to advance use-inspired research, translation of innovation to practice, workforce development, and broad partnerships.

**Sec. 10389. Translation accelerator.** Establishes a program to support Translation Accelerators comprised of partners from academia, industry, nonprofit, and government. Authorizes $6.5B for this program and the Regional Innovation Engines to be used between FY23 – FY27.

**Sec. 10390. Test beds.** Establishes a new program in collaboration with NIST to support the development, operation, integration, deployment, and, as appropriate, demonstration of new, innovative critical technologies, which may include hardware or software.

**Sec. 10391. Planning and capacity building awards.** Establishes planning grant program to advance the development, adoption, and commercialization of technologies not to exceed $1M/year/award for up to 3 years, allocates $3.1B from TIP’s budget for this program through FY27.

**Sec. 10392. Entrepreneurial fellowships.** Establishes TIP fellowships to scientists and engineers to help develop leaders capable of maturing promising ideas and technologies from lab to market or other use and forge connections between academic research and the government, industry, financial sectors, and other end users. Authorizes $125M annually from FY23 – FY27 for this program.

**Sec. 10393. Scholarships and fellowships.** Requires NSF to fund undergraduate scholarships (including at community colleges), graduate fellowships and traineeships, and postdoctoral awards in the key technology focus areas. Also requires NSF to increase the participation of populations that are underrepresented in STEM. Encourages innovation in graduate education, including through encouraging institutions of higher education to offer graduate students opportunities to gain experience in industry or Government as part of their graduate training, and through support for students in professional master’s programs related to the key technology focus areas or to the societal, national, and geostrategic challenges. Requires that at least 10% of the budget for this program go to community colleges and populations underrepresented in STEM.

**Sec. 10394. Research and development awards**. Includes provisions for TIP to expedite short-term technology deployment through programs like SBIR, STTR, etc. Allocates $1B through FY27 from TIP budget for this activity.

**Sec. 10395. Scaling innovations in PreK–12 STEM education.** Establishes multidisciplinary Centers for Transformative Education Research and Translation to support research and development on widespread and sustained implementation of STEM education innovations.

**TITLE IV—BIOECONOMY RESEARCH AND DEVELOPMENT**

Sec. 10402 - 10407. These sections establish a National Engineering Biology Research and Development Initiative, and defines 9 key priorities for the initiative. Also outlines specific activities and roles under the new initiative for NSF, NIST, NOAA, DOE, DOD, NASA, USDA, EPA, and DHHS.

**TITLE V—BROADENING PARTICIPATION IN SCIENCE**

**Subtitle A—STEM Opportunities**

**Sec. 10501. Federal research agency policies for caregivers.** Mandates policies to support investigators and trainees with caregiving responsibilities to provide flexibility and support, including no-cost extensions, timing of awards, and supplements as needed.

**Sec. 10504. Collection of data on demographics of faculty.** Authorizes $4M to be used in FY23 – FY25 for a large scale survey of faculty in the US.

**Subtitle B—Rural STEM Education Research**

**Sec. 10512. National Science Foundation rural STEM activities.** Authorizes $20M annually from FY23 – FY27 for activities to support broadening participation in rural STEM and preparing rural educators in STEM.

**Subtitle C—MSI STEM Achievement**

**Sec. 10524. Capacity-building program for developing universities.** Establishes a new program to build institutional research capacity at eligible institutions. Authorizes $200M for FY23 and $250M annually for FY24 – FY27 for the program.

**TITLE VI—MISCELLANEOUS SCIENCE AND TECHNOLOGY PROVISIONS**

**Subtitle A—Supporting Early-career Researchers**

Sec. 10601-10602. Early-career research fellowship program. Establishes a two-year pilot program for fellowships and authorizes $250M for each year FY23 and FY24 for the program.

**Subtitle C—Regional Innovation**

**Sec. 10621. Regional innovation capacity.** Establishes the Regional Technology and Innovation Hub program at the Department of Commerce. Authorizes the following amounts for specific elements of the program: $50M to be used from FY23 – FY27 for the strategy development grants; $2.95B for FY23-FY24 and $7B for FY25-FY27 for strategy implementation grants. Authorizes $1B to be used from FY22-FY26 for Recompete program.

**Sec. 10622. Regional Clean Energy Innovation Program.** Updates some language about the existing program and authorizes $50M annually from FY23 – FY27 for the program.

**Subtitle G—Quantum Networking and Communications**

**Sec. 10661. Quantum networking and communications.** Authorizes $15M annually from FY23 – FY27 for NIST for the National Quantum Initiative Act research and standardization. Authorizes $8M annually for FY23- FY27 for the Q–12 Education Partnership.

**Subtitle J—Energizing Technology Transfer (Department of Energy)**

**PART 1—NATIONAL CLEAN ENERGY TECHNOLOGY TRANSFER PROGRAMS**

**Sec. 10713 - 10715.** These sections establish and fund a number of activities related to clean energy research and development. Establishes a Clean Energy Incubator program and authorizes $15M annually from FY23 – FY27 for it. Authorizes $1M annually for FY23 – FY27 for a University prize competition, and authorizes $3M annually for clean energy tech transfer activities.

**PART 2—SUPPORTING TECHNOLOGY DEVELOPMENT AT THE NATIONAL LABORATORIES**

**Sec. 10717. Lab-embedded entrepreneurship program.** Authorizes $25M annually for FY23 – FY27 for an entrepreneurial fellowship program at the national labs.

**Sec. 10718. Small business voucher program.** Establishes a program to provide to small business concerns vouchers to be used at National Laboratories and single-purpose research facilities for R&D, authorizes $25M annually for FY23 – FY27 to support the vouchers.

**Sec. 10719. Entrepreneurial leave program.** Enables National Lab employees to take leave for up to 3 years with no penalty to advance commercial applications of energy and related technologies.

**Sec. 10720. National Laboratory non-Federal employee outside employment authority.** Enables National Lab employees to work for start-up companies or serve as scientific advisors for startups without penalty.

**Subtitle K—Micro Act (Department of Energy)**

**Sec. 10731. Microelectronics research for energy innovation.** Establishes programs to support Microelectronics research ($75M for FY23, $100M annually for FY24 – FY27) and building up to 4 research centers (up to $25M annually from FY23 – FY27).

**Subtitle L—National Nuclear University Research Infrastructure Reinvestment (Department of Energy)**

**Sec. 10743. University infrastructure collaboration.** Authorizes $55M annually for FY23 – FY27 to support university collaborations with nuclear reactor facilities, for R&D and for workforce training.

**Sec. 10744. Advanced nuclear research infrastructure enhancement subprogram.** Authorizes $45M in FY23, $60M in FY24, $65M in FY25, $80M in FY26, and $140M in FY27 to support construction or enhancement of nuclear reactor facilities for research and development purposes.

**Subtitle N—Applied Laboratories Infrastructure Restoration and Modernization**

**Sec. 10761** Establishes a fund to address the deferred maintenance, critical infrastructure needs, and modernization of National Laboratories. Authorizes $800M annually for FY23 – FY27 for this program.

**Subtitle O—Department of Energy Research, Development, and Demonstration Activities**

**Sec. 10771. Department of Energy research, development, and demonstration activities.** Authorizes the following amounts for a number of R&D/demonstration activities to be used between FY23 – FY26-

* $1.2B to Office of Energy Efficiency and Renewable Energy for building technologies
* $1.2B to Office of Energy Efficiency and Renewable Energy for sustainable transportation; $1B for advanced manufacturing
* $1B to Office of Energy Efficiency and Renewable Energy for section 454 of the Energy Independence and Security Act of 2007
* $600M to Office of Energy Efficiency and Renewable Energy for advanced materials, including relating to upcycling, recycling, and biobased materials
* $800M to Office of Energy Efficiency and Renewable Energy for renewable power
* $1B for the Office of Electricity for electric grid modernization and security
* $800M to the Office of Cybersecurity, Energy Security, and Emergency Response for related R&D
* $400M to Office of Nuclear Energy for advanced materials
* $200M to the Office of Environmental Management for R&D including on artificial intelligence and information technology
* $600M to the Office of Fossil Energy and Carbon Management for clean industrial technologies
* $200M to the Office of Fossil Energy and Carbon Management for alternative fuels
* $1B to the Office of Fossil Energy and Carbon Management for carbon removal
* $1.2B for ARPA-E

**Subtitle P—Fission for the Future**

**Sec. 10781. Advanced nuclear technologies Federal research, development, and demonstration program.** Establishes and funds a new program to support R&D and demo activities for advanced nuclear reactors - $75M for FY23, $100M for FY24, $150M for FY25, $225M for FY26, and $250M for FY27.

**TITLE VII—NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT**

**Subtitle A—Exploration**

**Sec. 10811 – 10817.** These sections outline a number of priorities and activities for NASA related to the Artemis missions, R&D to support shuttle launches, and the International Space Station. No specific funds are described.

**Subtitle B—Science**

**Sec. 10821 - 10825.** The sections describe some priorities for R&D investments at NASA, including the search for life, observatories, earth science, and includes language to support the Planetary Defense Coordination office which tracks near-earth objects in space. No specific funds are described.

**Subtitle C—Aeronautics**

**Sec. 10831 - 10833.** Describes R&D priorities related to Experimental aircraft projects, Unmanned aircraft systems, and Cleaner, quieter airplanes. No specific funds are described.

**Subtitle D—Space Technology**

**Sec. 10841. Space nuclear capabilities.** Asks NASA to develop a plan to achieve an in-space flight test of a nuclear propulsion system that could support the first crewed mission to Mars in the 2030’s.