H.R.4346 - CHIPS and Science Act

117th Congress (2021-2022)

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Summary(8) Text(8) Actions(86) Titles(13) Amendments(45) Cosponsors(0) Committees(2) Related Bills(8)

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Public Law No: 117-167 (08/09/2022)

This act provides funds to support the domestic production of semiconductors and authorizes various programs and activities of the federal science agencies.

DIVISION A--CHIPS ACT OF 2022

CHIPS Act of 2022

(Sec. 102) The act establishes and provides funding for the Creating Helpful Incentives to Produce Semiconductors (CHIPS) for America Fund to carry out activities relating to the creation of incentives to produce semiconductors in the United States.

The act establishes and provides funding for the Creating Helpful Incentives to Produce Semiconductors (CHIPS) for America Defense Fund to carry out the National Network for Microelectronics Research and Development.

The act establishes and provides funding for the Creating Helpful Incentives to Produce Semiconductors (CHIPS) for America International Technology Security and Innovation Fund to (1) provide for international information and communications technology security and semiconductor supply chain activities, including to support the development and adoption of secure and trusted telecommunications technologies, secure semiconductors, secure semiconductors supply chains, and other emerging technologies; and (2) carry out the Multilateral Semiconductors Security Fund and the Multilateral Telecommunications Security Fund.

The act establishes and provides funding for the Creating Helpful Incentives to Produce Semiconductors (CHIPS) for America Workforce and Education Fund for the National Science Foundation (NSF) for microelectronics workforce development activities to accelerate the domestic development and production of microelectronics and strengthen the domestic microelectronics workforce.

(Sec. 103) This section expands the financial assistance program relating to semiconductor incentives to include production of semiconductors and equipment and material related to production of semiconductors.

The Department of Commerce shall establish within the financial assistance program an additional program that provides federal financial assistance to covered entities to incentivize investment in facilities and equipment in the United States for the fabrication, assembly, testing, or packaging of semiconductors at mature technology nodes. In awarding federal financial assistance to covered entities under such additional program, Commerce must give priority to covered entities that support the resiliency of semiconductor supply chains for critical manufacturing industries in the United States.

No funds made available under the program may be used to construct, modify, or improve a facility outside of the United States.

This section makes it an objective of the National Semiconductor Technology Center to grow the domestic semiconductor workforce. This section provides for the capitalization by the center of the investment fund to support startups and collaborations between startups, academia, established companies, and new ventures. This section revises the functions of the center to specify that its support to incentivize and expand participation in programs related to microelectronics shall be geographically diverse and include community colleges.

The National Institute of Standards and Technology (NIST) may establish not more than two more Manufacturing USA Institutes. Commerce may award financial assistance to any such institute for work related to semiconductor manufacturing.

(Sec. 104) The Department of Commerce shall establish activities within the financial assistance program relating to inclusion of economically disadvantaged individuals, minority-owned businesses, veteran-owned businesses, and women-owned businesses.

(Sec. 105) The Government Accountability Office (GAO) shall evaluate how the federal government could take specific actions to address shortages in the semiconductor supply chain, including (1) demand-side incentives, including incentives related to the information and communications technology supply chain; and (2) additional incentives, at national and global scales, to accelerate utilization of leading edge semiconductor nodes to address shortages in mature semiconductor nodes.

Under such review, the GAO shall describe how projects are supporting the semiconductor needs of critical infrastructure industries in the United States, including those industries designated by the Cybersecurity and Infrastructure Security Agency as essential industries.

Also under such review, drawing on data made available by the Department of Labor or other sources, an analysis of

- semiconductor industry data regarding businesses that are majority owned and controlled by minority individuals or women; or
- the number and amount of contracts and subcontracts awarded by each covered entity using funds made available under the financial assistance program disaggregated by recipients of each such contract or subcontracts that are majority owned and controlled by minority individuals or women; and
- aggregated workforce data, including data by race or ethnicity, sex, and job categories.

This section includes in the annual report to Congress on the Public Wireless Supply Chain Innovation Fund, in describing how and to whom amounts in such fund have been deployed, to include whether recipients are majority owned and controlled by minority individuals and majority owned and controlled by women.

(Sec. 106) This section provides funding for the Public Wireless Supply Chain Innovation Fund.

(Sec. 107) This section establishes an advanced manufacturing investment tax credit in an amount equal to 25% of the qualified investment for a taxable year for any advanced manufacturing facility of an eligible taxpayer. The section provides for the application of such credit to partnerships or S corporations.

DIVISION B--RESEARCH AND INNOVATION

Research and Development, Competition, and Innovation Act

TITLE I--DEPARTMENT OF ENERGY SCIENCE FOR THE FUTURE

(Sec. 10101) The Office of Science of the Department of Energy (DOE) shall carry out the construction, operation, and maintenance of user facilities to support the office's mission.

(Sec. 10102) The Office of Science shall carry out a research and development program in basic energy sciences to understand, model, and control matter and energy at the electronic, atomic, and molecular levels to provide the foundations for new energy technologies, address scientific grand challenges, and support the energy, environment, and national security missions of DOE.

In carrying out chemistry-related research and development activities, the Office of Science shall prioritize research and development of sustainable chemistry to support, clean, safe, and economic alternatives and methodologies to traditional chemical products and processes.

The basic energy sciences national user facilities in operation shall include autonomous chemistry and materials synthesis and characterization facilities that leverage advances in artificial intelligence.

DOE shall provide for the upgrade to the Advanced Photon Source, including the development of a multibend achromat lattice to produce a high flux of coherent x-rays within the hard x-ray energy region and a suite of beamlines optimized for such source.

DOE shall provide for the proton power upgrade to the Spallation Neutron Source. In addition, DOE shall provide for a second target station for the Spallation Neutron Source.

DOE shall provide for the upgrade to the Advanced Light Source, including the development of a multibend achromat lattice to produce a high flux of coherent x-rays within the soft x-ray energy region.

DOE shall provide for the upgrade to the Linac Coherent Light Source II facility, including the development of experimental capabilities for high energy x-rays to reveal fundamental scientific discoveries.

DOE shall provide for the construction of a cryomodule repair and maintenance facility to service the Linac Coherent Light Source II and subsequent upgrades.

DOE shall provide for the recapitalization of the Nanoscale Science Research Centers, to include the upgrade of equipment at each center supported by the office to accelerate advances in the various fields of science, including nanoscience, materials, chemistry, biology, and quantum information science.

DOE must provide for the development and construction of experimental stations to provide significant additional beamline and instrument capacity, complement the existing portfolio of beamlines, and complete the buildout of the National Synchrotron Light Source II.

The Office of Science shall support a program of research and development for the application of advanced computing practices to foundational and emerging research problems in chemistry and materials science.

The Office of Science shall support the development of a web-based platform to develop and provide access to a database of computed information on known and predicted materials properties and computational tools to accelerate breakthroughs in materials discovery and design.

This section authorizes funding for the Solar Fuels Research Initiative and the Electricity Storage Research Initiative.

The Office of Science shall support a program of research and development to bridge scientific barriers to, and expand theoretical and fundamental knowledge relevant to, understanding nuclear materials and matter for the benefit of commerce, medicine, and national security.

The Office of Science shall establish the Carbon Materials Science Initiative to expand the fundamental knowledge of coal, coal-wastes, and carbon ore chemistry useful for understanding the conversion of carbon to material products.

The Office of Science shall carry out under the initiative a program to support, and discover fundamental knowledge relevant to, carbon materials and carbon ore processing research.

DOE shall establish the Carbon Sequestration Research and Geologic Computational Science Initiative to expand the fundamental knowledge, data collection, data analysis, and modeling of subsurface geology to advance carbon sequestration in geologic formations.

DOE shall carry out under the initiative a program to support research needed for, and discover knowledge relevant to, the sequestration of carbon in geologic formations.

(Sec. 10103) As part of its duties, the office shall carry out a program of research and development in the areas of biological systems science and climate and environmental science relevant to the development of new energy technologies and to support the energy, environmental, and national security missions of DOE.

The Office of Science shall carry out research and development activities in genomic science, including fundamental research on plants and microbes to increase systems-level understanding of complex biological systems.

The Office of Science shall carry out research and development activities in biomolecular characterization and imaging science, including development of new and integrative imaging and analysis platforms and biosensors to understand the expression, structure, and function of genome information encoded within cells and for real-time measurements in ecosystems and field sites of relevance to the mission of DOE.

This section revises requirements for the Space Radiation Research Program to require research 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.

The section requires the Office of Science to carry out activities relating to Earth and environmental systems science research and support user facilities to enhance the collection and analysis of observational data related to complex biological, climate, and environmental systems.

The Office of Science shall carry out a research program to enhance the understanding of terrestrial-aquatic interface.

The DOE shall establish within the Biological and Environmental Research program an initiative focused on the development of engineered ecosystems through the application of artificial intelligence, novel sensing capabilities, and other emerging technologies.

(Sec. 10104) The Office of Science shall carry out a research and development program to, among other purposes, steward applied mathematics, computational science, and computer science research relevant to the missions of DOE and the competitiveness of the United States.

This section revises requirements for applied mathematics and software development for high-end computing systems.

DOE shall establish a program to develop and implement a strategy for achieving computing systems with capabilities beyond exascale computing systems.

DOE shall support a program of fundamental research and development of energy efficient computing and data center technologies relevant to advanced computing applications, including high-performance computing, artificial intelligence, and scientific machine learning.

DOE shall carry out a research and development program to accelerate innovation in quantum network infrastructure in order to, among other things (1) facilitate the advancement of distributed quantum computing systems through the internet and intranet, and (2) develop secure national quantum communications technologies and strategies.

DOE shall establish and carry out the Quantum User Expansion for Science and Technology program, or the QUEST program, to encourage and facilitate access to U.S. quantum computing hardware and quantum computing clouds for research purposes to enhance the U.S. quantum research enterprise, among other objectives.

(Sec. 10105) The Office of Science shall establish not less than two national teams that shall (1) develop conceptual pilot plant designs and technology roadmaps for fusion reactors, and (2) create an engineering design of a pilot plant that will bring fusion to commercial viability.

DOE shall carry out a program to conduct and support collaborative research and development of fusion energy technologies through high-performance computation modeling and simulation techniques in order to (1) support fundamental research in plasmas and matter at very high temperatures, (2) inform the development of a broad range of fusion energy systems, and (3) facilitate the translation of research results in fusion energy science to industry.

DOE shall provide for the upgrade to the Matter in Extreme Conditions endstation at the Linac Coherent Light Source.

(Sec. 10106) The Office of Science shall carry out a research program in elementary particle physics and advanced technology research and development to improve the understanding of the fundamental properties of the universe, including constituents of matter and energy and the nature of space and time.

The Office of Science shall (1) continue to leverage United States participation in the Large Hadron Collider and prioritize expanding international partnerships and investments in the Long-Baseline Neutrino Facility and Deep Underground Neutrino Experiment; and (2) prioritize engagement in collaborative efforts in support of future international facilities that would provide access to the most advanced accelerator facilities in the world to U.S. researchers.

The Office of Science shall carry out research activities on the nature of the primary contents of the universe, including the nature of dark energy and dark matter.

This section supports the construction or the fabrication of specified major items of equipment, including (1) second generation dark matter experiments, and (2) upgrades to detectors and other components of the Large Hadron Collider.

DOE shall support construction of a Long-Baseline Neutrino Facility to facilitate the international Deep Underground Neutrino Experiment to examine the fundamental properties of neutrinos, explore physics beyond the Standard Model, and better clarify the existence and nature of antimatter.

DOE shall support construction of the Proton Improvement Plan II, an upgrade to the Fermilab accelerator complex, to provide the world's most intense beam of neutrinos to the international Long Baseline Neutrino Facility, and to carry out a broad range of future high energy physics experiments.

DOE, in partnership with the NSF, shall support the construction of the Cosmic Microwave Background Stage 4 project to survey the cosmic microwave background to test theories of cosmic inflation.

(Sec. 10107) DOE shall carry out a research program and support relevant facilities to discover and understand various forms of nuclear matter.

DOE shall support the construction of an Electron Ion Collider in order to measure the internal structure of the proton and the nucleus and answer fundamental questions about the nature of visible matter.

(Sec. 10108) In carrying out the science laboratories infrastructure program, the Office of Science shall use all available approaches and mechanisms as determined appropriate, including capital line items and energy savings performance contracts.

(Sec. 10109) The Office of Science shall carry out a research program to

- advance accelerator science and technology relevant to DOE, other federal agencies, and U.S. industry;
- foster partnerships to develop, demonstrate, and enable the commercial application of accelerator technologies;
- support the development of a skilled, diverse, and inclusive accelerator workforce; and
- provide access to accelerator design and engineering resources.

(Sec. 10110) The Office of Science shall carry out a program for purposes such as

- the production of critical radioactive and stable isotopes, including the development of techniques to produce isotopes that are needed and of sufficient quality and quantity for research, medical, industrial, or related purposes;
- the production of critical radioactive and stable isotopes that are in short supply or projected to be in short supply in the future, including byproducts, surplus materials, and related isotope services; and
- the reduction of domestic dependency on the foreign supply of critical radioactive and stable isotopes to ensure national preparedness.

DOE shall establish an advisory committee in alignment with such program to carry out the activities previously executed as part of the Isotope Subcommittee of the Nuclear Science Advisory Committee and provide expert advice and assistance to the Office of Science in carrying out that program.

DOE shall evaluate the technical and economic feasibility of the establishment of an isotope demonstration subprogram of such program to support the development and commercial demonstration of critical radioactive and stable isotope production in existing commercial nuclear power plants.

(Sec. 10111) The Office of Science shall support the development of a scientific workforce through programs that facilitate collaboration between and among teachers at elementary schools and secondary schools served by local educational agencies, students at institutions of higher education, early-career researchers, faculty at institutions of higher education, and the National Laboratories, including through the use of proven techniques to expand the number of individuals from underrepresented groups pursuing and attaining skills or undergraduate degrees relevant to the mission of the Office of Science.

DOE shall

- expand opportunities to increase the number of highly skilled science, technology, engineering, and mathematics (STEM) professionals working in disciplines relevant to the mission of DOE; and
- broaden the recruitment pool to increase participation from Historically Black Colleges or Universities, Hispanic-serving institutions, Tribal Colleges or Universities, minority-serving institutions, institutions in eligible jurisdictions, emerging research institutions, community colleges, and scientific societies in those disciplines.

DOE shall develop programs that strengthen the research capacity relevant to Office of Science disciplines at emerging research institutions.

DOE shall establish a university-led Traineeship Program to address workforce development needs in STEM fields relevant to DOE.

(Sec. 10112) The Office of Science shall establish a high intensity laser research initiative. The initiative should include research and development of petawatt-scale and of high average power laser technologies necessary for future facility needs in discovery science and to advance energy technologies, as well as support for a user network of academic and National Laboratory high intensity laser facilities.

DOE shall establish a grant program to reduce the consumption of helium for DOE grant recipients and facilities and encourage helium recycling and reuse.

DOE shall establish within the Office of Science the Biological Threat Preparedness Research Initiative to leverage the innovative analytical resources and tools, user facilities, and advanced computational and networking capabilities of DOE in order to support efforts that prevent, prepare for, predict, and respond to biological threats to national security, including infectious diseases.

DOE shall establish and operate an Emerging Infectious Diseases High Performance Computing Research Consortium to support such initiative.

The Office of Science shall establish a midscale instrumentation and research equipment program to develop, acquire, and commercialize research instrumentation and equipment needed to meet the missions of DOE and to provide platform technologies for the broader scientific community.

(Sec. 10113) This section revises the Established Program to Stimulate Competitive Research (EPSCoR), including to award grants under EPSCoR to carry out nuclear energy research, support undergraduate scholarships, develop research clusters for particular areas of expertise, and diversify the future workforce.

(Sec. 10114) DOE shall develop and maintain tools and processes to manage and mitigate research security risks, such as a science and technology risk matrix, informed by threats identified by the Office of Intelligence and Counterintelligence, to facilitate determinations of the risk of loss of U.S. intellectual property or threat to the national security of the United States posed by activities supported by this division or the CHIPS Act of 2022.

No entity of concern, or an individual that owns or controls, is owned or controlled by, or is under common ownership or control with an entity of concern, may receive or perform work under any covered support. DOE may waive such prohibition if it is in the national interest.

TITLE II--NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY FOR THE FUTURE

Subtitle A--Authorization of Appropriations

(Sec. 10211) This section reauthorizes the National Institutes of Standards and Technology (NIST) through FY2027.

Subtitle B--Measurement Research

(Sec. 10221) NIST shall, among other activities

- support basic measurement science and technology research for engineering biology, biomanufacturing, and biometrology;
- convene industry, institutions of higher education, nonprofit organizations, federal laboratories, and other federal agencies engaged in engineering biology research and development to develop coordinated technical roadmaps for authoritative measurement of the molecular components of the cell; and
- support graduate and postgraduate research and training in biometrology, biomanufacturing, and engineering biology.

(Sec. 10222) NIST shall carry out a measurement research program to inform the development or improvement of best practices, benchmarks, methodologies, procedures, and technical standards for the measurement of greenhouse gas emissions and to assess and improve the performance of greenhouse gas emissions measurement systems in situ and on space-based platforms.

NIST shall establish a Center for Greenhouse Gas Measurements, Standards, and Information.

(Sec. 10223) In carrying out its functions, NIST may, among other things

- support information security measures for the development and lifecycle of software and the software supply chain,
- support information security measures;
- support research, development, and practical application to improve the usability of cybersecurity processes and technologies; and
- support privacy measures.

(Sec. 10224) NIST shall assign severity metrics to identified vulnerabilities with open source software and produce voluntary guidance to assist the entities that maintain open source software repositories to discover and mitigate vulnerabilities.

NIST shall carry out research and testing to improve the effectiveness of artificial intelligence-enabled cybersecurity.

NIST shall develop a set of security outcomes and practices, including security controls, to enable software developers and operators to identify, assess, and manage cybersecurity risks over the full lifecycle of software products.

(Sec. 10225) This section modifies requirements for identity management research and development, including the development of voluntary, consensus-based technical standards, best practices, benchmarks, and methodologies.

NIST shall develop and maintain a technical roadmap for digital identity management research and development focused on enabling the voluntary use and adoption of modern digital identity solutions that meeting certain criteria.

NIST shall develop common definitions and voluntary guidance for digital identity management systems, including identity attribute validation services provided by federal, state, and local governments.

(Sec. 10226) NIST shall establish a program to support measurement research to inform the development of best practices, benchmarks, methodologies, procedures, and voluntary, consensus-based technical standards for biometric identification systems, including facial recognition systems, to assess and improve the performance of such systems.

NIST shall carry out a test program to provide biometrics vendors the opportunity to test biometric identification technologies across a range of modalities.

The Government Accountability Office (GAO) shall report to Congress on the impact of biometric identification technologies on historically marginalized communities, including low-income communities and minority religious, racial, and ethnic groups. Such report should be made available to the public on an internet website.

(Sec. 10227) The NIST Computer Standards Program shall include performance standards and guidelines for high risk biometric identification systems, including facial recognition systems, accounting for various use cases, types of biometric identification systems, and relevant operational conditions.

(Sec. 10228) In carrying out activities to facilitate and support the development of a voluntary, consensus-based, industry-led set of standards, guidelines, best practices, methodologies, procedures, and processes to cost-effectively reduce cyber risks to critical infrastructure, NIST shall consider institutions of higher education.

(Sec. 10229) In carrying out such activities, NIST must disseminate and make available to the public tailored resources to help qualifying institutions (those that are awarded in excess of $50 million per year in total federal research funding) identify, assess, manage, and reduce their cybersecurity risk related to conducting research.

(Sec. 10230) NIST shall carry out a program of measurement research for advanced communications technologies.

In carrying out the activities under this section, NIST shall convene industry, institutions of higher education, nonprofit organizations, federal laboratories, and other federal agencies engaged in advanced communications research and development to develop coordinated technical roadmaps for advanced communications research in priority areas.

NIST shall operate a national network of government, academic, and commercial test capabilities and facilities to be known as the National Advanced Spectrum and Communications Test Network.

(Sec. 10231) NIST shall develop a strategic plan for the future of the NIST Center for Neutron Research after the current reactor is decommissioned.

(Sec. 10232) NIST shall continue to support the development of artificial intelligence and data science, and carry out the activities of the National Artificial Intelligence Initiative Act of 2020.

(Sec. 10233) NIST shall carry out activities in support of sustainable chemistry, including coordinating and partnering with academia, industry, nonprofit organizations, and other entities in activities to support clean, safe, and economic alternatives, technologies, and methodologies to traditional chemical products and processes.

(Sec. 10234) NIST shall create a program for premise plumbing research. The bill defines *premise plumbing* as the water distribution system located within the property lines of a property, including all buildings and permanent structures on such property. Such term includes building supply and distribution pipes, fixtures, fittings, water heaters, water-treating and water-using equipment, and all respective joints, connections, devices, and appurtenances.

(Sec. 10235) NIST shall carry out the Dr. David Satcher Cybersecurity Education Grant Program to provide grants for cybersecurity programs at minority-serving institutions of higher education and institutions that have an enrollment of needy students.

Subtitle C--General Activities

(Sec. 10241) NIST shall (currently, may) carry out activities to support, promote, and coordinate activities and efforts to enhance public awareness and understanding of measurement sciences, standards, and technology at the national measurement laboratories and otherwise in fulfillment of the mission of NIST, including education and outreach activities to the general public, industry, and diverse types of institutions of higher education, including historically Black colleges and universities, Tribal Colleges and Universities, and minority-serving institutions, and community colleges (currently, academia).

NIST may conduct outreach to and develop research collaborations with historically Black colleges and universities, Tribal Colleges or Universities, and minority serving institutions, including through the recruitment of students and faculty at such

institutions to participate in the programs developed for graduate student internships and visiting faculty researchers.

NIST may conduct outreach to and develop collaborations with community colleges, including through the recruitment of students and faculty at such institutions to participate in the programs developed for graduate student internships and visiting faculty researchers.

NIST may carry out other activities to increase the participation of persons historically underrepresented in STEM in NIST's programs.

NIST may conduct outreach to and develop collaborations with nontraditional educational organizations, including those that offer training through nonprofit associations and professional associations or professional societies, to engage persons historically underrepresented in STEM through the programs developed under educational outreach activities.

(Sec. 10242) This section revises the other transactions authority for NIST and requires reporting on transactions carried out under such authority.

(Sec. 10243) NIST shall report to Congress on NIST's challenges in collaboration with other federal agencies.

(Sec. 10244) The Department of Commerce shall have the authority to make appointments of scientific, engineering, and professional personnel. NIST shall appoint no more than 15 personnel under such authority.

(Sec. 10245) NIST shall lead information exchange and coordination among federal agencies and communication from federal agencies to the private sector to ensure effective federal engagement in the development and use of international technical standards.

NIST shall support education and workforce development efforts to promote U.S. participation in international standards organizations.

NIST shall establish or enter into cooperative agreements with appropriate nongovernmental organizations to establish a five-year pilot program to award merit-reviewed, competitive grants to private sector entities, institutions of higher education, or nonprofit institutions based in the United States to support increased participation and leadership by small business and academic interests in international standards organizations.

(Sec. 10246) This section revises the authority for Commerce to provide support to foreign nationals to authorize direct support for activities of international organizations and foreign national metrology institutes with which NIST cooperates.

NIST must submit the standards, guidelines, and recommendations it develops under the computer standards program to Commerce for promulgation instead of the Office of Management and Budget (OMB).

The recommendations of the Information Security and Privacy Advisory Board shall likewise be submitted to Commerce instead of OMB.

The list of categories under which the Malcolm Baldridge National Quality Award shall be awarded is expanded to include community.

This section repeals the requirement for the GAO to conduct a biennial review of Commerce's program to provide federal loan guarantees to small- or medium-sized manufacturers for the use or production of innovative technologies in manufacturing.

This section repeals certain requirements related to the Director of Security for NIST.

This section grants the authority to the Consumer Product Safety Commission over the marking of imitation firearms.

The section rewrites provisions relating to federal information system standards.

Where practicable, a national construction safety team shall cooperate with civil litigants without compromising a team's investigation or the evidence preservation activities where a building failure has occurred. A team investigation shall have priority

over any investigation of a civil suit or civil action.

(Sec. 10247) The GAO shall study NIST's policies and protocols to protect its research and combat undue foreign influence. The GAO shall brief Congress on its findings.

(Sec. 10248) NIST shall establish a competitive grant program for nongovernmental standards development organizations to be used for the development, approval, dissemination, maintenance, and review of forensic science voluntary consensus standards and best practices that shall be available to the public free of charge.

Subtitle D--Hollings Manufacturing Extension Partnership

(Sec. 10251) NIST shall establish, as a part of the Hollings Manufacturing Extension Partnership, a pilot program of expansion awards among manufacturing extension centers or a consortium of centers, for various purposes, including to expand advanced technology services to U.S. based small- and medium-sized manufacturers.

Of the amounts authorized for the Hollings Manufacturing Extension Partnership program, Commerce shall optimize funding across the Partnership, the awards program, and the pilot program in order to maximize center participation as well as competitiveness, productivity, and technological performance in U.S. manufacturing.

(Sec. 10252) This section allows other federal departments and agencies to transfer amounts to NIST and Commerce and NIST to accept and make available cash donations from the private sector to be used to strengthen U.S. manufacturing.

This section provides that Hollings Manufacturing Extension Partnership program support shall be for entities based in the United States.

(Sec. 10253) NIST shall establish a voluntary National Supply Chain Database. The purpose of such database shall be to assist the federal government and industry sectors in minimizing disruptions to the U.S. supply chain by having an assessment of U.S. manufacturer's capabilities.

This section specifies that businesses in the Hollings Manufacturing Extension Partnership program shall be automatically enrolled in the GSA Advantage! program only if they so desire.

Subtitle E--Manufacturing USA Program

(Sec. 10261) In awarding financial assistance for planning or establishing a Manufacturing USA Institute, an agency shall give special consideration to such institutes that

- contribute to the geographic diversity of the Manufacturing USA program,
- are located in an area with a low per capita income,
- are located in an area with a high proportion of socially disadvantaged residents, or
- are located in small and rural communities.

(Sec. 10262) Commerce shall coordinate with existing and new Manufacturing USA Institutes to integrate certain entities, such as minority serving institutions, as active members of the institutes, including through the development of preferences in selection criteria for proposals to create new institutes or renew existing institutes that include one or more of such entities.

(Sec. 10263) Federal agencies must establish policies to promote the domestic production of technologies developed by the Manufacturing USA Network.

This section bars the participation of Chinese companies in the Manufacturing USA Program without a waiver as specified in this act.

The program shall establish or designate a council of heads of any institute receiving federal funding at any time to foster collaboration between the institutes.

The strategic plan to guide the program shall include a strategy for retaining domestic public benefits from the institutes once federal funding has been discontinued.

In providing support services to promote workforce development activities, the program must include the development of industry credentials.

Commerce must seek advice from the U.S. Manufacturing Council of the International Trade Administration of the Department of Commerce on matters concerning investment in and support of the manufacturing workforce within the program.

TITLE III--NATIONAL SCIENCE FOUNDATION FOR THE FUTURE

Subtitle A--Preliminary Matters

(Sec. 10303) This section reauthorizes the NSF through FY2027.

Subtitle B--STEM Education

(Sec. 10311) The NSF shall enter into an agreement with the National Academies to conduct a study to review the research literature and identify research gaps regarding the interconnected factors that foster and hinder successful implementation of promising, evidence-based PreK-12 STEM education innovations at the local, regional, and national level.

The NSF shall make awards on a merit-reviewed, competitive basis for research on effective approaches to engaging students in PreK-12, including students from groups historically underrepresented in STEM and rural students.

This section authorizes the NSF to establish a National STEM Teacher Corps 10-year pilot program. The NSF may use existing NSF programs to establish and execute this program.

(Sec. 10312) The NSF shall make competitive awards to support research and development activities related to STEM education and workforce matters, including activities to encourage greater collaboration and coordination between institutions of higher education and industry to enhance education, foster hands-on learning experiences, and improve alignment with workforce needs.

This section modifies requirements for national centers of scientific and technical education.

The NSF shall make awards to advance research on the nature of learning and teaching at community colleges and to improve outcomes for students who enter the workforce upon completion of their STEM degree or credential or transfer to four-year institutions.

The NSF shall make awards to support career and technical education in STEM and computer science related fields. In making such awards, the NSF must give priority to institutions that demonstrate effective strategies to recruit and provide career and technical education to veterans and members of the Armed Forces transitioning to the private sector workforce.

The NSF shall carry out a four-year pilot program under which the NSF shall make awards to establish a total of not fewer than five centers to develop and scale up successful models for providing undergraduate students with hands-on course-based experiences.

This section revises the National Advanced Scientific and Technical Education Program. It also renames the program as the National Advanced STEM Education Program.

(Sec. 10313) This section requires grant applications for support for graduate students include a description of the mentoring activities that will be provided for such individuals.

The NSF shall make awards for the development of innovative approaches for facilitating career exploration of academic and nonacademic career options and for providing opportunity-broadening experiences, including work-integrated opportunities, for graduate students and postdoctoral scholars that can then be considered, adopted, or adapted by other institutions and to carry out research on the impact and outcome of those activities.

The NSF shall require that annual project reports for awards that support graduate students and postdoctoral scholars include certification by the principal investigator that each graduate student and postdoctoral scholar receiving substantial support from

such award has developed and annually updated an individual development plan to map educational goals, career exploration, and professional development.

The NSF shall carry out a five-year pilot initiative to award up to 2,500 administrative supplements of up to $2,000 to existing research awards annually to support professional development experiences for graduate students and postdoctoral researchers who receive a substantial portion of their support under such award. Not more than 10% of supplements awarded may be used to support professional development experiences for postdoctoral researchers.

The NSF shall make awards to support research on the graduate education system and outcomes of various interventions and policies.

The awards under the Graduate Research Fellowship Program for scholarships and graduate fellowships for study and research in the sciences or in engineering will also address national workforce demand in critical STEM fields. This section increases the amount of the cost of education allowance from $12,000 to at least $16,000.

The NSF shall ensure that students pursuing master's degrees and doctoral degrees in fields related to cybersecurity are eligible to apply for scholarships and graduate fellowships under such program.

The NSF must report to Congress on the need for and feasibility of a program to recruit and train the next generation of artificial intelligence professionals to meet the needs of federal, state, local, and tribal governments.

Upon submitting such report, the NSF is authorized to establish a federal artificial intelligence scholarship-for-service program to recruit and train artificial intelligence professionals to lead and support the application of artificial intelligence to the missions of federal, state, local, and tribal governments.

(Sec. 10314) The NSF shall conduct a full portfolio analysis of the NSF's skilled technical workforce investments across all directorates in the areas of education research, infrastructure, data collection, and analysis.

To meet evolving needs for data on the state of the science and engineering workforce, the NSF shall assess the feasibility and benefits of incorporating questions or topic modules into existing National Center for Science and Engineering Statistics surveys that vary from cycle to cycle.

The NSF shall submit to Congress and the National Science Board the results of an assessment of the feasibility and benefits of incorporating new questions or topic modules into existing National Center for Science and Engineering Statistics surveys on

- the skilled technical workforce,
- working conditions and work life balance,
- harassment and discrimination, and
- immigration and emigration.

The GAO shall submit a report to Congress that (1) evaluates NSF processes for ensuring the data and analysis produced by the National Center for Science and Engineering Statistics meets current and future needs, and (2) includes such recommendations that are appropriate to improve such processes.

(Sec. 10315) The NSF shall make awards for the carrying out of research on the cyber workforce.

(Sec. 10316) This section expands the fields of study eligible for support under the Federal Cyber Scholarship-for-Service Program to include fields such as artificial intelligence, quantum computing, and aerospace.

(Sec. 10317) The National Center for Science and Engineering shall establish a specified cybersecurity workforce data initiative.

(Sec. 10318) The NSF shall make awards for research, development, and related activities to advance innovative approaches to developing, improving, and expanding evidence-based education and workforce development activities and learning experiences at all levels of education in fields and disciplines related to microelectronics.

The NSF shall establish traineeship programs for graduate students pursuing microelectronics research to provide assistance that includes funding and opportunities for research experiences in government or industry.

The NSF shall make awards under the Scientific and Advanced Technology Act of 1992 to support programs for skilled technical workers in STEM disciplines that are aligned with skilled workforce needs of the microelectronics industry and lead to an associate's degree, or equivalent certification, by providing funding and other assistance, including opportunities for internships and other hands-on experiences in industry.

The NSF shall seek to increase opportunities for microelectronics research for students and trainees at all levels through existing programs.

The NSF shall make awards to establish partnerships to enhance and broaden participation in microelectronics education.

The NSF shall make an award to establish a national network of partnerships (the National Network for Microelectronics Education) to coordinate activities, best practice sharing, and access to facilities across the partnerships to enhance and broaden participation in microelectronics education.

(Sec. 10319) Grants awarded by the NSF to establish mathematics and science education partnership programs to improve elementary and secondary mathematics and science instruction may be used for developing a science, technology, engineering and mathematics educational curriculum that incorporates art and design to promote creativity and innovation.

The bill revises requirements for NSF informal STEM education grants to require support for the integration of art and design in STEM educational programs and design and testing of programming that integrates art and design in STEM education to promote creativity and innovation.

(Sec. 10320) Cost-sharing requirements for the Major Research Instrumentation Program and for teaching fellowships administered within the Robert Noyce Teacher Scholarship Program are waived for five years.

The NSF shall submit to Congress an assessment that includes feedback from the research community of the impacts of such waivers.

(Sec. 10321) The NSF shall issue undergraduate scholarships, postdoctoral awards, and other awards to address STEM workforce gaps, including for programs that recruit, retain, and advance students to a bachelor's degree in a STEM discipline concurrent with a secondary school diploma.

Subtitle C--Broadening Participation

(Sec. 10321) This section increases from 108 to 110 the number of Presidential Awards for Excellence in Mathematics and Science Teaching the President is authorized to make to kindergarten through grade 12 school teachers who have demonstrated outstanding teaching ability in the field of teaching mathematics or science.

In selecting teachers for such an award, the President shall select at least one teacher from

- the Northern Mariana Islands,
- American Samoa,
- the U.S. Virgin Islands, and
- Guam.

(Sec. 10322) To increase the diversity of participants in the Robert Noyce Teacher Scholarship program, the NSF must support symposia, forums, conferences, and other activities to expand and enhance outreach to

- historically Black colleges and universities;
- Tribal Colleges or Universities;
- minority-serving institutions;
- institutions of higher education that are near to or serve rural communities, including EPSCoR institutions;
- labor organizations;
- emerging research institutions; and
- higher education programs that serve or support veterans.

(Sec. 10323) The NSF shall make awards to carry out a comprehensive national initiative to facilitate the development of networks and partnerships to build on and scale up effective practices in broadening participation in STEM studies and careers of groups historically underrepresented in such studies and careers. This initiative shall be known as the Eddie Bernice Johnson

Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science Initiative or the Eddie Bernice Johnson INCLUDES Initiative.

(Sec. 10324) The NSF shall require organizations seeking a cooperative agreement for the management of the operations and maintenance of an NSF project to have the capacity 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) Each agency that administers an EPSCoR Program shall consider modifications to EPSCoR award structures to increase the capacity of rural communities to provide quality STEM education and STEM workforce development programming to students and teachers.

The NSF shall make awards to eligible institutions to implement and study innovative approaches for building research capacity in order to engage and retain students from a range of institutions and diverse backgrounds in STEM.

The NSF shall establish a five-year pilot program for awards to research partnerships that involve emerging research institutions and may involve institutions classified as very high research activity by the Carnegie Classification of Institutions of Higher Education at the time of application.

(Sec. 10326) The NSF shall make awards 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) The NSF shall appoint a Chief Diversity Officer to provide advice on policy, oversight, guidance, and coordination on matters of the NSF related to diversity and inclusion, including ensuring geographic diversity of NSF programs.

(Sec. 10328) The NSF shall make awards to enable institutions of higher education or nonprofit organizations (or consortia of them) to increase the participation of women and underrepresented minorities in STEM studies and careers.

(Sec. 10329) The NSF shall make awards 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.

The NSF shall make awards to institutions of higher education (or a consortium of such institutions) to implement or expand research-based reforms in undergraduate STEM education to recruit and retain students from minority groups who are underrepresented in STEM fields.

This section states that all awards made pursuant to this section must include an education research component that will support the design and implementation of a system for data collection and evaluation of proposed reform efforts in order to build the knowledge base on promising models for increasing recruitment and retention of students from underrepresented minority groups in STEM education at the undergraduate level across a diverse set of institutions.

(Sec. 10330) This section authorizes the NSF to conduct multiple pilot programs within the NSF to expand the number of institutions of higher education (including community colleges), and other eligible entities that the NSF determines are appropriate, that are able to successfully compete for NSF awards.

Subtitle D--NSF Research Security

(Sec. 10331) The NSF shall maintain a Research Security and Policy office within the Office of the Director of the NSF with not fewer than four full-time equivalent positions, in addition to the Chief of Research Security established pursuant to the following section. The function of the Research Security and Policy office shall be to coordinate all research security policy issues across the NSF.

(Sec. 10332) The Director of the NSF shall appoint a senior agency official within the Office of the Director of the NSF as a Chief of Research Security, whose primary responsibility shall be to manage the Research Security and Policy office.

(Sec. 10333) The NSF must provide a report to Congress on the resources and the number of full-time employees needed to carry out the functions of the Research Security and Policy office.

(Sec. 10334) The NSF shall develop an online resource hosted on the NSF's website that shall contain up-to-date information, tailored for institutions and individual researchers, including, among other things

- an explanation of NSF research security policies, and
- unclassified guidance on potential security risks that threaten research integrity and other risks to the research enterprise.

(Sec. 10335) The NSF shall continue to make awards to support research on the conduct of research and the research environment, including research on research misconduct or breaches of research integrity and detrimental research practices.

(Sec. 10336) The Research Security and Policy office, in coordination with the NSF's Office of Inspector General, shall have the authority to conduct risk assessments of research and development award applications and disclosures to the NSF.

(Sec. 10337) This section expands requirements for NSF grant applicants to plan to provide training and oversight in the responsible and ethical conduct of research. The section requires such training and oversight to be provided to postdoctoral researchers, faculty, and other senior personnel and requires the training and oversight to include (1) mentor training and mentorship; (2) training to raise awareness of potential research security threats; and (3) federal export control, disclosure, and reporting requirements.

(Sec. 10338) The NSF shall enter into an agreement with a qualified independent organization to establish a research security and integrity information sharing analysis organization (RSI-ISAO).

(Sec. 10339) The NSF shall develop a plan to

- identify research areas supported by the NSF, including key technology focus areas, that may involve access to controlled unclassified or classified information; and
- exercise due diligence in granting access, as appropriate, to the controlled unclassified information or classified information identified to individuals working on such research who are employees of the NSF or covered individuals on research and development awards funded by the NSF.

(Sec. 10339A) This section prohibits any of the funds made available to the NSF under this division or Division A, or an amendment made by this division or Division A, from being obligated or expended to an institution of higher education that maintains a contract or agreement between the institution and a Confucius Institute, unless the NSF determines a waiver in accordance with this section is appropriate.

The NSF may issue a waiver for an institution of higher education that maintains such a contract or agreement if the contract or agreement includes specified, clear provisions, including the protection of academic freedom at the institution.

This section shall not apply to an institution of higher education if that institution has fulfilled the requirements for a waiver from the Department of Defense as described under the National Defense Authorization Act for Fiscal Year 2021.

The prohibition shall not apply to amounts provided to students as educational assistance.

(Sec. 10339B) The NSF must request annually from a recipient institution of higher education a disclosure of any current financial support that is $50,000 or more, including gifts and contracts, received directly or indirectly from a foreign source associated with a foreign country of concern.

Subtitle E--Fundamental Research

(Sec. 10341) The NSF shall enter into an agreement with a qualified independent organization to assess how the Broader Impacts review criterion is applied across the NSF and make recommendations improving the effectiveness of the criterion.

(Sec. 10343) The NSF must revise proposal instructions to require that ethical and societal considerations are included as part of a proposal for funding.

(Sec. 10344) The NSF shall facilitate public access to research products, including data, software, and code, developed as part of NSF projects. The NSF shall require that every proposal for funding for research include a data management plan that includes a description of how the awardee will archive and preserve public access to data, software, and code developed as part of the proposed project.

The NSF shall develop and disseminate a set of criteria for trusted open repositories to be used by NSF-funded researchers and make awards for the development and maintenance of such repositories.

The NSF shall support research and development of tools and infrastructure that support reproducibility and support the education and training of researchers on computational methods, tools, and techniques to improve the quality and sharing of data, code, and supporting metadata to produce reproducible research.

(Sec. 10345) The NSF shall make awards to support research to improve our understanding of the climate system and related human and environmental systems.

(Sec. 10346) The NSF shall

- communicate opportunities and solicit proposals for social, behavioral, and economic science researchers to participate in cross-cutting and interdisciplinary programs; and
- ensure social, behavioral, and economic science researchers are represented on relevant merit review panels for such activities.

(Sec. 10347) The NSF shall make awards to improve our understanding of the impacts of federally funded research on society, the economy, and the workforce, including domestic job creation.

(Sec. 10348) The NSF shall make awards to, among other things

- support research to significantly advance our understanding of the food-energy-water system through quantitative and computational modeling, and
- support research that will lead to innovative solutions to critical food-energy-water system problems.

(Sec. 10349) The NSF shall continue to support enhancing, repairing, and maintaining research instrumentation, laboratories, telecommunications, and housing at biological field stations and marine laboratories.

(Sec. 10350) The NSF shall carry out activities in support of sustainable chemistry.

(Sec. 10351) The NSF shall make awards to advance knowledge of risk assessment and predictability and to support the creation of tools and technologies, including advancing data analytics and utilization of artificial intelligence.

(Sec. 10352) The NSF shall carry out a program of research and related activities related to unmanned aircraft system technologies.

(Sec. 10353) The NSF shall issue awards to support research that will accelerate innovation to advance unmanned maritime systems to provide greater maritime domain awareness to the nation.

(Sec. 10354) The NSF shall explore and advance opportunities for leveraging international capabilities and resources that align with the NSF and U.S. research community priorities and have the potential to benefit U.S. prosperity, security, health, and well-being, including binational research and development organizations.

(Sec. 10355) The NSF shall continue to (1) support databases, tools, methods, and other activities that secure and improve existing physical and digital biological research collections; (2) improve the accessibility of collections and collection-related data for research and educational purposes; (3) develop capacity for curation and collection management; and (4) transfer ownership of collections that are significant to the biological research community, including to museums and universities.

The NSF shall make awards to facilitate coordination and data sharing among communities of practice for research, education, workforce training, evaluation, and business model development, including by establishing an Action Center for Biological Collections.

(Sec. 10356) The NSF shall make awards to address water availability, quality, and security, including to support transdisciplinary research to significantly advance our understanding of water availability, quality, and dynamics and the impact of human activity and a changing climate on urban and rural water and wastewater systems, including in low-income, underserved, and disadvantaged communities.

(Sec. 10357) The NSF shall make awards for research and development 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; and
- explore the role of social media and consumer technology in rising rates of mental health and substance use disorder issues, including within communities experiencing long-term economic distress.

(Sec. 10358) Research areas under the grant program to support fundamental research leading to transformative advances in manufacturing technologies, processes, and enterprises that support U.S. manufacturing may include artificial intelligence and machine learning and additive manufacturing, including new material design and rapid printing techniques.

(Sec. 10359) The NSF shall make awards to support basic research that will accelerate innovation to advance critical minerals mining strategies and technologies to make better use of domestic resources and eliminating national reliance on minerals and mineral materials that are subject to supply disruptions.

(Sec. 10360) The NSF shall study or support a study on artificial intelligence research capacity at U.S. institutions of higher education.

Advancing IoT for Precision Agriculture Act of 2021

(Sec. 10361) In making awards under the sensor systems and networked systems programs of the NSF, the NSF must include in considering portfolio balance research and development on sensor connectivity in environments of intermittent connectivity and intermittent computation.

In considering applications for grants for junior or community colleges to develop or improve associate degree or certificate programs in STEM fields with an in-demand workforce, the NSF must prioritize applications that incorporate distance learning tools and approaches.

In considering applications for the awarding of grants to institutions of higher education partnering with private sector employers or private sector employer consortia, or industry or sector partnerships, that commit to offering apprenticeships, internships, research opportunities, or applied learning experiences to students enrolled in identified STEM baccalaureate degree programs, the NSF must prioritize applications that incorporate distance learning tools and approaches.

The GAO must provide (1) a technology assessment of precision agriculture technologies; and (2) a review of federal programs that provide support for precision agriculture research, development, adoption, education, and training.

(Sec. 10362) The NSF shall support research into and design, development, and testing of mitigation measures to address the potential impact of satellite constellations on NSF scientific programs.

(Sec. 10363) The NSF may make awards to support research to improve our understanding of the impact of inflation.

(Sec. 10364) The NSF shall facilitate access by recipients of NSF awards to the microgravity environment, including private sector platforms, for the development of science, engineering, and technology relevant to the award.

Subtitle F--Research Infrastructure

(Sec. 10371) The NSF shall continue the Facility Operational Transition pilot program for a total of five years.

Such program shall provide funding for 10%-50% of the operations and maintenance costs for major research facilities that are within the first five years of operation.

(Sec. 10372) The NSF shall periodically carry out reviews within each of the directorates and divisions to assess the cost and benefits of extending the operations of research facilities that have exceed their planned operational lifespan.

(Sec. 10373) The NSF shall support, through the Major Research Instrumentation Program, proposal requests that include the purchase, installation, operation, and maintenance of equipment and instrumentation to reduce consumption of helium.

The NSF may waive the cost-sharing requirement for helium conservation measures for non-Ph.D.-granting institutions of higher education and Ph.D.-granting institutions of higher education that are not ranked among the top 100 institutions that receive federal research and development funding.

(Sec. 10374) To gather information about the computational needs of NSF-funded projects, the NSF must require award proposals submitted to the NSF, as appropriate, to include estimates of computational resource needs for projects that require the use of advanced computing.

The NSF shall develop and regularly update a five-year advanced computing roadmap to set priorities and guide strategic decisions regarding investments in advanced computing capabilities.

This section requires the Networking and Information Technology Research and Development Program to provide for improving the security, reliability, and resiliency of computing and networking systems used by institutions of higher education and other nonprofit research institutions for the processing, storage, and transmission of sensitive federally funded research and associated data.

The NSF shall establish a pilot program to make awards to ensure the security of federally supported research data and to assist regional institutions of higher education and their researchers in compliance with regulations regarding the safeguarding of sensitive information and other relevant regulations and federal guidelines.

(Sec. 10375) The NSF shall establish a National Secure Data Service demonstration project to develop, refine, and test models to inform the full implementation of a governmentwide data linkage and access infrastructure for statistical activities conducted for statistical purposes. The National Secure Data Service must maintain a public website with up-to-date information on supported projects.

Subtitle G--Directorate for Technology, Innovation, and Partnerships

(Sec. 10381) This section establishes within the NSF the Directorate of Technology, Innovation, and Partnerships to advance research and development, technology development, and related solutions to address U.S. societal, national, and geostrategic challenges, for the benefit of all Americans.

(Sec. 10383) The directorate must award grants to

- support transformational advances in use-inspired and translational research and technology development;
- encourage the translation of research into innovations, processes, and products;
- develop mutually beneficial research and technology development partnerships and collaborations among entities such as institutions of higher education, nonprofit organizations, labor organizations, for-profit entities, government entities, and international entities;
- build capacity and infrastructure for use-inspired and translational research at institutions of higher education;
- support the education, mentoring, and training of undergraduate students, graduate students, and postdoctoral researchers, to both advance use-inspired and translational research and to address workforce challenges; and
- identify social, behavioral, and economic drivers and consequences of technological innovations that could enable advances in the challenges and key technology focus areas.

(Sec. 10386) The NSF shall establish an advisory committee to assess and make recommendations regarding the activities carried out under this subtitle.

(Sec. 10387) The NSF shall identify, annually review, and update, as appropriate, a list of

- not more than five U.S. societal, national, and geostrategic challenges that may be addressed by technology to guide activities under this subtitle; and
- not more than 10 key technology focus areas to guide activities under this subtitle.

The section specifies the initial challenges and focus areas. Not later than five years after enactment of this act, the NSF shall contract with the National Academies of Sciences, Engineering, and Medicine to conduct a review of the focus areas and challenges.

(Sec. 10388) The NSF shall make awards to plan, establish, and support Regional Innovation Engines. Two of the purposes of Regional Innovation Engines shall be to

- advance multidisciplinary, collaborative, use-inspired and translational research, and technology development in key technology focus areas; and
- address regional, national, societal, or geostrategic challenges.

(Sec. 10389) The NSF shall establish Translation Accelerators to further the research, development, and commercialization of innovation in the key technology focus areas.

(Sec. 10390) The NSF shall establish a program in the directorate to make awards to establish and operate test beds to advance the development, operation, integration, deployment, and, as appropriate, demonstration of new, innovative critical technologies.

(Sec. 10391) The NSF shall make awards to advance the development, adoption, and commercialization of technologies, consistent with the purposes of the directorate.

The NSF shall make awards to establish collaborative innovation resource centers that promote regional technology transfer and technology development activities available to more than one institution of higher education and to other entities in a region.

(Sec. 10392) The directorate shall award 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.

(Sec. 10393) The directorate shall fund undergraduate scholarships (including at community colleges), graduate fellowships and traineeships, and postdoctoral awards in the key technology focus areas.

The NSF shall award scholarships to low-income individuals to enable them to pursue associate, undergraduate, or graduate degrees in STEM fields.

(Sec. 10394) The NSF shall make awards for research and technology development within the key technology focus areas, including investments that advance solutions to the identified societal, national, and geostrategic challenges.

The NSF shall also make awards, including through the Small Business Innovation Research Program (SBIR) and the Small Business Technology Transfer Program (STTR), to expedite short-term technology deployment within a period of no longer than 24 months.

(Sec. 10395) The NSF shall make awards to establish multidisciplinary Centers for Transformative Education Research and Translation to support research and development on widespread and sustained implementation of STEM education innovations.

(Sec. 10396) The NSF may provide awards under this subtitle as grants, contracts, cooperative agreements, cash prizes, and other transactions.

The NSF may carry out a program of personnel management authority as provided under this section, in order to facilitate recruitment of eminent experts in science or engineering for research and development projects and to enhance the administration and management of the NSF.

The NSF may carry out a program using specified authority to attract highly qualified experts in needed occupations.

The NSF shall contract with the National Academy of Public Administration to study the organizational and management structure of the NSF to evaluate and make recommendations to efficiently and effectively implement the directorate.

This section grants the NSF the authority to provide for the widest practicable and appropriate dissemination of information within the United States concerning the NSF's activities and the results of those activities.

(Sec. 10397) This section requires the directorate to coordinate and collaborate with other federal agencies and ensure its activities are not duplicative of other federal government activities.

(Sec. 10398) The NSF shall engage, as appropriate, experts in the social dimensions of science and technology and set up formal avenues for public input, as appropriate, to ensure that ethical, legal, and societal considerations are taken into account

in the priorities and activities of the directorate, including the selection of challenges and key technology focus areas, the award-making process, and throughout all stages of supported projects.

(Sec. 10399) The NSF shall provide to the relevant congressional authorizing and appropriations committees annual reports describing projects supported by the directorate during the previous year.

The NSF shall provide to Congress a roadmap that describes the strategic vision that the directorate will use to guide investment decisions over the next three years.

(Sec. 10399A) After the directorate has been in operation for six years, the NSF shall enter into an agreement with the National Academies to provide an evaluation of how well the directorate is achieving its purposes.

Subtitle H--Administrative Amendments

This subtitle makes revisions to various administrative provisions regarding the NSF.

TITLE IV--BIOECONOMY RESEARCH AND DEVELOPMENT

(Sec. 10402) The Office of Science and Technology Policy (OSTP) shall implement a National Engineering Biology Research and Development Initiative to advance societal well-being, national security, sustainability, economic productivity, and competitiveness. The initiative shall, among other activities, provide support for engineering biology research and development, education and training for undergraduate and graduate students, and a national network of testbeds.

(Sec. 10403) The OSTP shall designate an interagency committee to coordinate activities of the initiative.

The President shall establish an Initiative Coordination Office to, among other things (1) provide technical and administrative support to the interagency committee; and (2) serve as the point of contact on federal engineering biology activities for government organizations, academia, industry, professional societies, state governments, interested citizen groups, and others to exchange technical and programmatic information.

(Sec. 10404) The interagency committee shall designate or establish an advisory committee on engineering biology research and development to provide advice on the initiative.

(Sec. 10405) The NSF shall seek to enter into an agreement with the National Academies of Sciences, Engineering, and Medicine to review, and make recommendations with respect to, the ethical, legal, environmental, safety, security, and other appropriate societal issues related to engineering biology research and development.

(Sec. 10406) This section requires, as part of the initiative, the NSF, Department of Commerce, National Oceanic and Atmospheric Administration, Department of Energy, Department of Defense, National Aeronautics and Space Administration, Department of Agriculture, Environmental Protection Agency, and Department of Health and Human Services to carry out specified engineering biology activities suited to their agency.

TITLE V--BROADENING PARTICIPATION IN SCIENCE

Subtitle A--STEM Opportunities

(Sec. 10501) The OSTP must provide guidance to each federal research agency to establish policies that provide flexibility under research grants to principal investigators of such research and their trainees, including postdoctoral researchers and graduate students, who have caregiving responsibilities, including care for a newborn or newly adopted child and care for an immediate family member who has a disability or a serious health condition.

(Sec. 10502) Each federal research agency shall collect, for all applications for its merit-reviewed research and development awards, specified information, including demographic information, award type, and review rating.

(Sec. 10503) Federal research agencies shall regularly assess, and update as necessary, policies and practices to remove or reduce cultural or institutional barriers limiting the recruitment, retention, and success of groups historically underrepresented in STEM research careers, including policies and practices relevant to the unbiased review of federal research applications.

(Sec. 10504) Every five years, the NSF shall carry out a survey to collect data from award recipients on the demographics of STEM faculty at different types of institutions of higher education that receive federal research funding.

(Sec. 10505) The OSTP shall broadly disseminate to entities that receive federal research funding best practices for

- conducting periodic climate surveys of STEM departments and divisions with a focus on identifying and addressing any cultural or institutional barriers to the recruitment, retention, or advancement of groups historically underrepresented in STEM; and
- providing educational opportunities, including workshops, for STEM professionals to learn about current research on effective practices for unbiased recruitment, evaluation, and promotion of undergraduate and graduate students and research personnel.

Subtitle B--Rural STEM Education Research

(Sec. 10512) The NSF shall make awards for research and development activities to advance innovative approaches to support and sustain high-quality STEM teaching in rural schools.

The NSF shall establish a pilot program of regional cohorts in rural areas that will provide peer support, mentoring, and hands-on research experiences for rural STEM educators, principals, and other school leaders of students in prekindergarten through grade 12, in order to build an ecosystem of cooperation among educators, principals, other school leaders, researchers, academia, and local industry.

The NSF shall make awards for

- research and development of programming to identify the barriers rural students face in accessing high-quality STEM education, and
- development of innovative solutions to improve the participation and advancement of rural students in prekindergarten through grade 12 in STEM studies.

As part of the first report on equal opportunities in science and engineering at the NSF to be transmitted to Congress, the Committee on Equal Opportunities in Science and Engineering must include

- a description of past and present policies and activities of the NSF to encourage full participation of students in rural communities in science, mathematics, engineering, and computer science fields;
- an assessment of trends in participation of rural students in prekindergarten through grade 12 in NSF activities; and
- an assessment of the policies and activities of the NSF, along with proposals for new strategies or the broadening of existing successful strategies towards facilitating the goal of increasing participation of rural students in prekindergarten through grade 12 in NSF activities.

(Sec. 10513) The NSF shall make awards for research on online STEM education courses for rural communities.

(Sec. 10514) The NSF shall enter into an agreement under which the National Academies of Science, Engineering, and Medicine agree to conduct an evaluation and assessment that, among other things

- evaluates the quality and quantity of current federal programming and research directed at examining STEM education for students in prekindergarten through grade 12 and workforce development in rural areas; and
- in coordination with the Federal Communications Commission, assesses the impact that the scarcity of broadband connectivity in rural communities, and the affordability of broadband connectivity, have on STEM and technical literacy for students in prekindergarten through grade 12 in rural areas.

(Sec. 10515) The GAO shall conduct a study and report to Congress on the engagement of rural populations in federal STEM education programs.

(Sec. 10516) The Department of Commerce shall carry out a program to award prizes to stimulate research and development of creative technologies to support the deployment of affordable and reliable broadband connectivity in rural communities, including unserved rural communities.

Subtitle C--MSI STEM Achievement
(Sec. 10521) The GAO shall report to Congress

- an inventory of competitive funding programs and initiatives carried out by federal research agencies that are targeted to Historically Black Colleges or Universities (HBCUs), Tribal Colleges or Universities (TCUs), and Minority Serving Institutions (MSIs) or partnerships with HBCUs, TCUs, and MSIs;
- an assessment of federal research agency outreach activities to increase the participation and competitiveness of HBCUs, TCUs, and MSIs in the funding programs and initiatives identified; and
- recommendations of the GAO to increase the participation and the rate of success of HBCUs, TCUs, and MSIs in competitive funding programs offered by federal research agencies.

(Sec. 10522) The OSTP shall develop a uniform set of policy guidelines for federal research agencies to carry out a sustained program of outreach activities to increase clarity, transparency, and accountability for federal research agency investments in STEM education and research activities at HBCUs, TCUs, and MSIs, including such institutions in rural areas.

The OSTP must submit to Congress a report containing a strategic plan which reflects the plans of each federal research agency to increase the capacity of HBCUs, TCUs, and MSIs to compete effectively for grants, contracts, or cooperative agreements and to encourage HBCUs, TCUs, and MSIs to participate in federal programs.

The report on the coordination of federal STEM education must include

- an account of federal research agency investments in HBCUs, TCUs, and MSIs, including, to the degree practicable, data on the level of participation of HBCUs, TCUs, and MSIs as prime recipients, contractors, subrecipients, or subcontractors of an award, or reasonable estimates thereof; and
- a description of material changes to the implementation of this section.

(Sec. 10523) The NSF shall make awards

- for the conduct of research on the contribution of HBCUs, TCUs, and MSIs to the education and training of underrepresented minority students in STEM fields and to the meeting of national STEM workforce needs; and
- to identify and broadly disseminate effective models for programs and practices at HBCUs, TCUs, and MSIs that promote the education and workforce preparation of minority students pursuing STEM studies and careers in which such students are underrepresented.

(Sec. 10524) The NSF shall make awards to support the mission of the NSF and to build institutional research capacity at minority institutions as specified in this act.

Awards under this section may fund the establishment of not more than five MSI Centers of Innovation to leverage successes of HBCUs, TCUs, and MSIs in STEM education and research training of underrepresented minority students as models for other institutions, including both HBCUs, TCUs, and MSIs and institutions of higher education that are not HBCUs, TCUs, or MSIs. Such centers will be located on campuses of selected HBCUs, TCUs, or MSIs, and serve as incubators to allow institutions of higher education to experiment, pilot, evaluate, and scale up promising practices.

The National Science and Technology Council shall submit a report that (1) identifies challenges and barriers to federal research and development awards for high research activity status HBCUs, and (2) identifies recommendations for federal research agencies to sustainably boost the research capacity of high research activity status HBCUs through awards-making authorities.

(Sec. 10525) As part of the Tribal Colleges and University Program, the NSF shall make awards to eligible entities to increase the participation of tribal populations in computer science and computational thinking education programs to enable students to develop skills and competencies in coding, problem-solving, critical thinking, creativity and collaboration.

Subtitle D--Combatting Sexual Harassment in Science

(Sec. 10534) The NSF shall make awards to

- expand research efforts to better understand the factors contributing to, and consequences of, sex-based and sexual harassment affecting individuals in the STEM workforce, including students and trainees; and
- examine approaches to reduce the incidence and negative consequences of such harassment.

(Sec. 10535) The NSF shall enter into an agreement with the National Academies of Science, Engineering, and Medicine to update the report entitled *On Being a Scientist: A Guide to Responsible Conduct in Research* issued by the National Academies.

(Sec. 10536) The OSTP's National Science and Technology Council shall establish or designate an interagency working group for the purpose of coordinating federal research agency efforts to reduce the prevalence of sex-based and sexual harassment

involving award personnel. Among other duties, the working group must develop policy guidelines for federal research agencies. Agencies must implement policies regarding sex-based and sexual harassment that are consistent with the guidelines.

(Sec. 10537) The NSF shall enter into an agreement with the National Academies to undertake a study and issue a report on the influence of sex-based and sexual harassment in institutions of higher education on the career advancement of individuals in the STEM workforce.

(Sec. 10538) The GAO shall study the degree to which federal research agencies have implemented the policy guidelines developed concerning sexual harassment and the effectiveness of that implementation.

TITLE VI--MISCELLANEOUS SCIENCE AND TECHNOLOGY PROVISIONS

Subtitle A--Supporting Early-Career Researchers

(Sec. 10601) The NSF may establish a two-year pilot program to make awards to highly qualified early-career investigators to carry out an independent research program at the institution of higher education or participating federal research facility chosen by such investigator, to last for a period not greater than two years. The NSF shall give special consideration and priority to applications from individuals who graduated from or are intending to carry out research at certain institutions, such as minority-serving institutions.

Subtitle B--National Science and Technology Strategy

(Sec. 10611) The OSTP shall, in coordination with the National Science and Technology Council, develop and submit to Congress a comprehensive national science and technology strategy of the United States to meet national research and development objectives for the following four years.

The OSTP shall provide biannually a briefing to the relevant congressional committees on the status and development of the national science and technology strategy, including any significant changes.

(Sec. 10612) After the transmission of each national security strategy, the OSTP shall review such strategy and submit to Congress a national strategy to improve the national competitiveness of United States science, technology, research, and innovation to support the national security strategy.

(Sec. 10613) Every four years, the OSTP shall complete a review of the science and technology enterprise of the United States.

Subtitle C--Regional Innovation

(Sec. 10621) Commerce shall carry out a program to, among other objectives

- encourage new and constructive collaborations among local, state, tribal, and federal government entities, institutions of higher education, the private sector, economic development organizations, labor organizations, nonprofit organizations, and community organizations that promote broad-based regional innovation initiatives;
- support eligible consortia in the development and implementation of regional innovation strategies;
- designate eligible consortia as regional technology and innovation hubs and facilitate hubs implementing their regional innovation strategies.

Within the Regional Technology and Innovation Hub Program, Commerce is authorized to establish the Recompete Pilot Program to provide grants to alleviate persistent economic distress and support long-term comprehensive economic development and job creation in eligible areas.

Commerce shall award at least 10 strategy implementation grants to carry out coordinated and comprehensive economic development programs and activities in an eligible area in accordance with a recompete plan approved by Commerce.

(Sec. 10622) DOE shall establish a Regional Clean Energy Innovation Program, a research, development, demonstration, and commercial application program designed to enhance the economic, environmental, and energy security of the United States and accelerate the pace of innovation of diverse clean energy technologies through the formation or support of regional clean energy innovation partnerships.

Subtitle D--Research Security

(Sec. 10631) The OSTP shall publish and widely distribute a uniform set of guidelines for federal research agencies regarding foreign talent recruitment programs.

(Sec. 10632) Each federal research agency shall establish a policy that, as part of a proposal for a research and development award from the agency

- each covered individual listed in such proposal certify that each such individual is not a party to a malign foreign talent recruitment program in the proposal submission and annually afterwards for the duration of the award; and
- each institution of higher education or other organization applying for such an award certify that each covered individual who is employed by such institution of higher education or other organization has been made aware of the requirements under this section and complied with the requirement listed above.

(Sec. 10633) In addition to existing authorities for preventing waste, fraud, abuse, and mismanagement of federal funds, each federal research agency shall have the authority to

- require, upon request, the submission to such agency, by an institution of higher education or other organization applying for a research and development award, of certain supporting documentation;
- require such institution of higher education or other organization to review any documents requested for compliance with the federal research agency's award terms and conditions; and
- upon receipt and review of the information provided, initiate the substitution or removal of a covered individual from a research and development award, reduce the award funding amount, or suspend or terminate the award if the agency head determines such contracts, grants, or agreements include obligations that interfere with the capacity for agency-supported activities to be carried out or create duplication with agency-supported activities.

(Sec. 10634) Each federal research agency shall establish a requirement that, as part of an application for a research and development award from the agency

- each covered individual listed on the application for a research and development award certify that each such individual has completed within one year of such application research security training that meets the guidelines developed under this section, and
- each institution of higher education or other organization applying for such an award certify that each covered individual who is employed by such institution or organization and listed on the application has completed such training.

The OSTP shall enter into an agreement or contract with a qualified entity for the development of online research security training modules for the research community and participants in the U.S. research and development enterprise to ensure compliance with National Security Presidential Memorandum-33 (relating to strengthening protections of the U.S. government-supported research and development against foreign government interference and exploitation) or any successor documents.

(Sec. 10635) The GAO shall conduct a study on federal funding made available to foreign entities of concern (e.g., a person on the SDN List) for research during a five-year study period beginning on the enactment of this act.

(Sec. 10636) Certain persons and foreign entities of concern or any other country determined to be a country of concern may not receive or participate in any grant, award, program, support, or other activity under specified programs or activities, including the Manufacturing USA Program.

Subtitle E--Coastal and Ocean Acidification Research and Innovation

Coastal and Ocean Acidification Research and Innovation Act of 2021

(Sec. 10642) This subtitle expands certain federal ocean acidification research and monitoring activities to include coastal acidification.

(Sec. 10644) This section adds departments and agencies to the interagency working group on ocean acidification.

The section establishes an Ocean Acidification Advisory Board.

Any federal agency with a representative serving on the interagency working group may, either individually or in cooperation with one or more agencies, carry out a program to award prizes competitively in accordance with the Stevenson-Wydler Technology

Innovation Act of 1980. Any prize competition carried out under this act shall be for the purposes of stimulating innovation to advance our nation's ability to understand, research, or monitor ocean acidification or its impacts, or the development of management or adaptation options for responding to ocean and coastal acidification.

(Sec. 10645) This section makes revisions regarding the strategic research plan on ocean acidification. Such plan shall include federal research and monitoring on coastal acidification.

(Sec. 10646) This section includes coastal acidification activities in addition to NOAA ocean acidification activities.

NOAA shall serve as the lead agency for coordinating the federal response to ocean and coastal acidification.

Commerce shall support the long-term stewardship of, and access to, data relating to ocean and coastal acidification by providing the data on a publicly accessible data archive system.

(Sec. 10647) This section includes coastal acidification activities in addition to NSF ocean acidification activities.

(Sec. 10648) This section includes coastal acidification activities in addition to the National Aeronautics and Space Administration (NASA) ocean acidification activities.

Subtitle F--Interagency Working Group

(Sec. 10651) The OSTP's National Science and Technology Council shall establish or designate an interagency working group to coordinate specified activities of the NSF, Commerce, and DOE.

Subtitle G--Quantum Networking and Communications

(Sec. 10661) The Quantum Networking Working Group within the Subcommittee on Quantum Information Science of the National Science and Technology Council shall submit to Congress a report detailing a plan for the advancement of quantum networking and communications technology in the United States, building on the report entitled *A Strategic Vision for America's Quantum Networks and A Coordinated Approach for Quantum Networking Research*.

As part of the National Quantum Initiative, NIST shall

- carry out research to facilitate the development and standardization of quantum cryptography and post-quantum classical cryptography;
- carry out research to facilitate the development and standardization of quantum networking, communications, and sensing technologies and applications; and
- for quantum technologies determined by NIST to be at a readiness level sufficient for standardization, provide technical review and assistance to such other federal agencies for the development of quantum networking infrastructure standards.

The NSF shall enter into an agreement with the National Academies of Sciences, Engineering, and Medicine to conduct a study to evaluate and make recommendations for the quantum information science workforce.

The NSF shall, through programs it carries out or supports, seek to increase the integration of quantum information science and engineering (QISE) into the STEM curriculum at all education levels, including community colleges.

The NSF shall make awards to carry out a pilot program, to be known as the Next Generation Quantum Leaders Pilot Program for the education and training of the next generation of students and teachers in the fundamental principles of quantum mechanics.

Subtitle H--Blockchain Specialist

The OSTP shall establish or designate a blockchain and cryptocurrencies advisory specialist position within the OSTP to coordinate federal activities and advise the President on matters of research and development relating to blockchain, cryptocurrencies, and distributed ledger technologies.

Subtitle I--Partnerships for Energy Security and Innovation

(Sec. 10691) DOE shall establish a nonprofit organization to be known as the Foundation for Energy Security and Innovation to support DOE and to advance collaboration with energy researchers, institutions of higher education, industry, and nonprofit and philanthropic organizations to accelerate the commercialization of energy technologies.

The foundation may award fellowships and grants for activities related to research, development, demonstration, maturation, or commercialization of energy and other DOE-supported technologies.

The foundation shall provide support to and collaborate with laboratory-associated foundations.

The foundation may solicit and accept gifts, grants, and other donations, establish accounts, and invest and expend funds in support of its activities.

The foundation shall submit to Congress a strategic plan for the foundation.

The GAO shall submit to Congress an evaluation of the extent to which the foundation is achieving its mission, the operation of the foundation, and any recommendations on how the foundation may be improved.

The National Energy Technology Laboratory may establish, or enter into an agreement with a nonprofit organization to establish, a laboratory-associated foundation to support the mission of the National Energy Technology Laboratory.

Subtitle J--Energizing Technology Transfer

Part 1--National Clean Energy Technology Transfer Programs

(Sec. 10713) DOE's Office of Technology Transitions shall establish a Clean Energy Incubator Program to competitively award grants to clean energy incubators.

(Sec. 10714) DOE shall establish a program, known as the Clean Energy Technology University Prize, to award funding for eligible entities to carry out regional and national clean energy technology prize competitions. In carrying out such prize competitions, students shall compete to develop a business model for furthering the commercial application of an innovative clean energy technology.

(Sec. 10715) The Office of the Chief Commercialization Officer shall support the coordination of technology transfer programs that advance the commercial application of clean energy technologies nationally and across all energy sectors.

Part 2--Supporting Technology Development at the National Laboratories

(Sec. 10716) This section authorizes the Lab Partnering Service Pilot Program through FY2025.

(Sec. 10717) DOE shall award grants to National Laboratories for the purpose of establishing or supporting Lab-Embedded Entrepreneurship Programs.

(Sec. 10718) This section revises requirements related to small business advocates at the National Laboratories. The section expands the requirement for National Laboratories to designate small business advocates to apply to single-purpose research facilities.

DOE shall establish a program to provide small businesses with vouchers to be used at National Laboratories and single-purpose research facilities for research, development, demonstration, technology transfer, skills training and workforce development, or commercial application activities or any other activities that are determined appropriate.

(Sec. 10719) DOE shall delegate to the National Laboratories and single-purpose research facilities the authority to carry out an entrepreneurial leave program to allow National Laboratory employees to take a full leave of absence from their position, with the option to return to that or a comparable position up to three years later, or a partial leave of absence, to advance the commercial application of energy and related technologies relevant to the mission of DOE.

(Sec. 10720) DOE shall delegate to Directors of National Laboratories the authority to allow their nonfederal employees to engage in outside employment, including start-up companies, and to engage in outside activities related to their areas of expertise at a National Laboratory.

Part 3--Department of Energy Modernization

(Sec. 10722) This section authorizes the Office of Technology Transitions through FY2027 and provides certain hiring authorities.

(Sec. 10723) This section gives DOE additional authority under the Office of Clean Energy Demonstrations, including the authority to terminate projects receiving an unfavorable review.

(Sec. 10724) DOE shall report annually on a description of any prize competitions carried out using the authority under this section, the total amount of prizes awarded along with any private sector contributions, the methods used for solicitation and evaluation, and a description of how each prize competition advanced the mission of DOE.

(Sec. 10725) This section extends the waiver of the nonfederal cost share for a research or development activity performed by an institution of higher education or nonprofit institution.

(Sec. 10726) This section gives DOE's Office of Science certain hiring authorities, including the authority to make appointments of not more than 60 scientific, engineering, and professional personnel, without regard to civil service laws, to assist DOE in meeting specific project or research needs.

(Sec. 10727) As part of the updated technology transfer execution plan required each year under the Energy Policy Act of 2005, DOE shall also submit to Congress a report on the progress and implementation of specified programs established by this act.

Every three years the DOE must also submit to Congress an evaluation on the extent to which the specified programs established by this act are achieving success based on relevant short-term and long-term metrics.

Subtitle K--Micro Act

(Sec. 10731) DOE shall carry out a crosscutting program of research, development, and demonstration of microelectronics relevant to the missions of DOE to enable advances and breakthroughs that will (1) accelerate underlying research and development for design, development, and manufacturability of next-generation microelectronics; and (2) ensure the global competitiveness of the United States in the field of microelectronics.

In carrying out the program, DOE's Office of Science shall establish not more than four Microelectronics Science Research Centers to (1) conduct mission-driven research to address foundational challenges in the design, development, characterization, prototyping, demonstration, and fabrication of microelectronics; and (2) facilitate the translation of research results to industry.

Subtitle L--National Nuclear University Research Infrastructure Reinvestment

National Nuclear University Research Infrastructure Reinvestment Act of 2021

(Sec. 10743) This section revises the program to support university nuclear science and engineering, including to allow support for revitalizing and upgrading existing nuclear science and engineering infrastructure that supports the development of advanced nuclear technologies and applications.

(Sec. 10744) Under the program to support university nuclear science and engineering, DOE shall carry out an Advanced Nuclear Research Infrastructure Enhancement Subprogram in order to (1) demonstrate various advanced nuclear reactor and nuclear microreactor concepts; (2) establish medical isotope production reactors or other specialized applications; and (3) advance other research infrastructure that is consistent with DOE's mission.

(Sec. 10745) Amounts made available under the University Nuclear Leadership Program may be used to provide assistance for nontechnical nuclear research.

Subtitle M--Steel Upgrading Partnerships and Emissions Reduction

(Sec. 10751) DOE shall establish a program of research, development, demonstration, and commercial application of advanced tools, technologies, and methods for low-emissions steel manufacturing.

DOE shall develop a five-year strategic plan identifying research, development, demonstration, and commercial application goals for the program.

DOE shall support the development of standardized testing and technical validation of advanced and commercially available steelmaking and low-emissions steel manufacturing.

DOE, in carrying out the program and in collaboration with industry partners, institutions of higher education, and the National Laboratories, shall support an initiative for the demonstration of low-emissions steel manufacturing.

Subtitle N--Applied Laboratories Infrastructure Restoration and Modernization

(Sec. 10761) DOE shall fund priority deferred maintenance and lab modernization projects at National Laboratories as needed to address the deferred maintenance, critical infrastructure needs, and modernization of National Laboratories.

Subtitle O--Department Of Energy Research, Development, And Demonstration Activities

(Sec. 10771) This section authorizes specified activities for the Office of Energy Efficiency and Renewable Energy through FY2026, including research, development, and demonstration activities related to building technologies, sustainable transportation, advanced manufacturing, advanced materials, and renewable power.

Subtitle P--Fission for the Future

(Sec. 10781) DOE shall establish a program to provide federal financial assistance to support the research, development, and demonstration of advanced nuclear reactors.

TITLE VII--NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT

National Aeronautics and Space Administration Authorization Act of 2022

Subtitle A--Exploration

(Sec. 10811) NASA shall establish within the Exploration Systems Development Mission Directorate a Moon to Mars Program Office to lead and manage the Moon to Mars program established pursuant to this section, including Artemis missions and activities.

(Sec. 10812) After the first crewed lunar landing of NASA's Moon to Mars activities, NASA shall, to the extent practicable, seek to carry out a flight rate of two integrated Space Launch System and Orion crew vehicle missions annually until the lunar activities needed to enable a human mission to Mars are completed so as to maintain the critical human spaceflight production and operations skills necessary for the safety of human spaceflight activities in deep space.

This section authorizes NASA to maintain two operational mobile launch platforms to enable the launch of multiple configurations of the Space Launch System.

To meet the capability requirements, NASA shall continue development of the Exploration Upper Stage for the Space Launch System on a schedule consistent with the Artemis IV lunar mission.

NASA must brief Congress on the development and scheduled availability of the Exploration Upper Stage for such lunar mission.

(Sec. 10813) NASA shall, to the extent practicable, continue to carry out a program to modernize rocket propulsion test infrastructure at NASA facilities to (1) support propulsion development and testing, and (2) foster the improvement of government and commercial space transportation and exploration.

NASA must submit to Congress a report on the use of the authority to promote increased use of NASA rocket propulsion test infrastructure for research, development, testing, and evaluation activities by other federal agencies, firms, associations, corporations, and educational institutions.

(Sec. 10814) NASA shall coordinate with the U.S. Army Corps of Engineers on a comprehensive plan to ensure the continued navigability of the Pearl River and Little Lake channels sufficient to support NASA barge operations surrounding Stennis Space Center and the Michoud Assembly Facility.

(Sec. 10815) NASA shall continue full operations of the International Space Station (ISS) through at least FY2030.

This section extends the period of time until 2028 for the submission of the biennial reports on deep space human exploration and various other matters.

NASA shall conduct a comprehensive assessment of the viability of the ISS to operate safely and support full and productive use through FY2030, including all necessary analyses to certify ISS operations through FY2030.

NASA shall submit to the Aerospace Safety Advisory Panel an assessment of (1) the root cause of cracks and air leaks in the Russian Service Module Transfer Tunnel; (2) the certification of all U.S. systems and modules to operate through FY2030; (3) an inventory of spares or replacements for elements, systems, and equipment, including certified systems that are currently produced, in inventory, or on order; and (4) any other relevant data, information, or analysis relevant to the safe and productive use of the ISS through FY2030.

(Sec. 10816) NASA shall assess ISS research activities and shall ensure that crew time and resources allocated to NASA for use on the ISS prioritize specified activities, including the research of the Human Research Program.

Subtitle B--Science

(Sec. 10821) NASA shall pursue the goal of establishing annual funding for Research and Analysis in the Science Mission Directorate that reaches a level of not less than 10% of the total annual funding of relevant divisions of such directorate by FY2025.

(Sec. 10822) NASA shall continue to implement a collaborative, multidisciplinary science and technology development program to search for evidence of the existence or historical existence of life beyond Earth in support of (1) the scientific priorities of the most recent decadal surveys on planetary science and astrobiology and astronomy and astrophysics of the National Academies of Sciences, Engineering, and Medicine; and (2) the search for life's origin, evolution, distribution, and future in the universe.

(Sec. 10823) NASA shall continue development of the Nancy Grace Roman Space Telescope (commonly known as the Roman telescope and formerly known as the Wide Field Infrared Survey Telescope) in the configuration established through critical design review, to meet the objectives prioritized in the 2010 decadal survey of astronomy and astrophysics of the National Academies of Sciences, Engineering, and Medicine.

(Sec. 10824) With respect to the missions and programs of the Earth Science Division, NASA shall, to the maximum extent practicable, follow the recommendations and guidance provided by the scientific community through the decadal survey for Earth science and applications from space of the National Academies of Sciences, Engineering, and Medicine.

NASA shall pursue an Earth System Observatory to (1) address the recommendations of the 2018 Earth science and applications decadal survey of the National Academies titled *Thriving on our Changing Planet*; and (2) achieve the goal of the Earth Science Program of NASA.

NASA shall arrange for the conduct of a survey of the use of NASA Earth observation data by states, tribal organizations, and territories.

NASA shall (1) maintain a comprehensive, strategic Climate Architecture Plan for Earth Observations and Applications from Space that describes an integrated and balanced program to advance science, policy, and applications and societal benefits; and (2) update such plan every five years so as to align with the release of the decadal surveys in Earth science and applications from space and the mid-decade assessments of the National Academies.

(Sec. 10825) NASA shall maintain an office within the Planetary Science Division of the Science Mission Directorate, to be known as the Planetary Defense Coordination Office, to (1) plan, develop, and implement a program to survey threats posed by near-Earth objects equal to or greater than 140 meters in diameter; (2) identify, track, and characterize potentially hazardous near-Earth objects, issue warnings of the effects of potential impacts of such objects, and investigate strategies and technologies for mitigating the potential impacts of such objects; and (3) assist in coordinating government planning for response to a potential impact of a near-Earth object.

NASA shall continue the development of a dedicated space-based infrared survey telescope mission, known as the Near-Earth Object Surveyor, on a schedule to achieve a launch-readiness date not later than March 30, 2026, or the earliest practicable date, to detect, track, catalogue, and characterize the physical characteristics of near-Earth objects equal to or greater than 140 meters in diameter in order to assess the threat of such near-Earth objects to the Earth.

NASA shall submit annual reports through 90% completion of the catalogue of such near-Earth objects.

Subtitle C--Aeronautics

(Sec. 10831) NASA shall carry out experimental aircraft demonstrations, including a subsonic demonstrator to demonstrate the performance and feasibility of advanced, ultra-efficient, and low emissions subsonic flight demonstrator configurations.

NASA may establish an advanced materials and manufacturing technology program.

(Sec. 10832) NASA shall (1) research and test capabilities and concepts, including unmanned aircraft systems communications, for integrating unmanned aircraft systems into the national airspace system; (2) leverage the partnership NASA has with industry focused on the advancement of technologies for future air traffic management systems for unmanned aircraft systems; and (3) continue to leverage the research and testing portfolio of NASA to inform the integration of unmanned aircraft systems into the national airspace system, consistent with public safety and national security objectives.

(Sec. 10833) NASA shall establish an initiative to research, develop, and demonstrate new technologies and concepts to (1) reduce greenhouse gas emissions from aviation, (2) reduce aviation noise emissions, and (3) enable associated aircraft performance characteristics.

Subtitle D--Space Technology

(Sec. 10841) NASA shall establish a space nuclear propulsion program to carry out research and development, ground-based testing and in-space testing, and other associated activities to enable the use of space nuclear propulsion in NASA robotic and human exploration activities, including in cargo missions to Mars in the late 2020s and crewed missions to Mars in the 2030s.

NASA shall establish a program for research, testing, and development of a space nuclear surface power reactor design.

NASA shall carry out a needs assessment for facilities and technical capabilities required to support ground-based testing of a full-scale, full-power integrated nuclear propulsion system.

(Sec. 10842) NASA shall prioritize the use of low-enriched uranium, including high-assay low-enriched uranium, for space nuclear research and development, including ground and in-space testing and other related demonstration activities carried out under this title.

Subtitle E--STEM Engagement

(Sec. 10851) NASA shall establish an Office of STEM Engagement for the purpose of advancing progress toward the STEM education goals of the United States by enhancing STEM literacy, increasing diversity, equity, and inclusion in STEM, and preparing the STEM workforce for the future.

The office shall be responsible for coordinating efforts and activities among organizations across NASA, including NASA's headquarters, mission directorates, and centers.

The section changes the name of the Experimental Program to Stimulate Competitive Research to the Established Program to Stimulate Competitive Research.

Subtitle F--Miscellaneous

(Sec. 10861) NASA must submit a report to Congress on the U.S. industrial base for NASA civil space missions and operations.

NASA shall enter into an arrangement with the National Academies of Sciences, Engineering, and Medicine to carry out a comprehensive review of the workforce, skills-base, and modeling and test facilities of NASA.

NASA shall develop a policy and procedure for assessment, not less frequently than every five years, of its strategic capabilities, including infrastructure and facilities, and workforce skills and capabilities.

NASA shall establish within NASA an Independent Program Analysis and Evaluation Office for independently assessing program performance; making programmatic, technical risk mitigation, and institutional recommendations; performing cost estimates and analyses; and conducting strategic planning activities, among other functions. The office must submit to Congress an independent estimate of the cost of continuing International Space Station operations through FY2030.

(Sec. 10862) This section extends until December 31, 2032, the authority of NASA to enter into leases of any non-excess real property and related personal property under the jurisdiction of NASA.

The section revises the annual reporting of such leases, including the estimated cost savings to NASA resulting from reduced maintenance, operating, and associated costs in the previous fiscal year.

NASA must submit a report to Congress on existing requirements for applicants seeking such a lease.

DIVISION C--SUPPLEMENTAL APPROPRIATIONS TO ADDRESS THREATS TO THE SUPREME COURT OF THE UNITED STATES

Supreme Court Security Funding Act of 2022

This division authorizes additional funding for salaries and expenses of the U.S. Marshals Service and the U.S. Supreme Court to address threats to the Supreme Court.