



America's
SEED FUND
SBIR.STTR

America's Seed Fund powered by the National Science Foundation

Small Business Innovation Research (SBIR)/
Small Business Technology Transfer (STTR) program
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SOLICITATION TOPICS & SUBTOPICS

America's Seed Fund powered by NSF encourages proposals in nearly all technology and market sectors (with the exception of clinical trials and Schedule I controlled substances.) NSF routinely moves Project Pitches and proposals to the topic area that better describes the underlying technical innovation to ensure the best qualified program director manages the review process or project. An exact fit into one of these topics or subtopics is not required on submission.

For proposals due in 2023

For more than 40 years, America's Seed Fund powered by NSF has helped startups and small businesses transform their ideas into marketable products and services. We focus on technologies that are based on discoveries in fundamental science and engineering. Each year, we award more than \$200 million to startups across the country. Our goals are to support technological innovation and help create businesses and jobs in the United States. We are a congressionally mandated program — Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR).

Technology Topic Areas

- Advanced Manufacturing (M)
- Advanced Materials (AM)
- Advanced Systems for Scalable Analytics (AA)
- Agricultural Technologies (AG)
- Artificial Intelligence (AI)
- Augmented and Virtual Reality (AV)
- Biological Technologies (BT)
- Biomedical Technologies (BM)
- Chemical Technologies (CT)
- Cloud and High-Performance Computing (CH)
- Cybersecurity and Authentication (CA)
- Digital Health (DH)
- Distributed Ledger (DL)
- Energy Technologies (EN)
- Environmental Technologies (ET)
- Human-Computer Interaction (HC)
- Instrumentation and Hardware Systems (IH)
- Internet of Things (I)
- Learning and Cognition Technologies (LC)
- Medical Devices (MD)
- Mobility (MO)
- Nanotechnology (N)
- Other Topics (OT)
- Pharmaceutical Technologies (PT)
- Photonics (PH)
- Power Management (PM)
- Quantum Information Technologies (QT)
- Robotics (R)
- Semiconductors (S)
- Space (SP)
- Wireless Technologies (W)

Advanced Manufacturing (M)

The Advanced Manufacturing topic aims to support emerging innovations in manufacturing with the potential to stimulate the nation's manufacturing sector by improving efficiency, competitiveness and sustainability. Proposed technology should be environmentally friendly, compatible with human and planet health and driven by technological advancements. Regenerative designs using a circular economy approach (a systemic approach to economic development designed to benefit businesses, society and the environment) are encouraged.

M1. Building and Infrastructure

M2. Carbon Sequestration

M3. Cybermanufacturing

M4. Distributed Manufacturing

M5. Ecomanufacturing

M6. Modeling and Simulation

M7. Natural Resources and Critical Minerals

M8. Quantum Device Manufacturing

M9. Sustainable Chemical Manufacturing

M10. Other Manufacturing Technologies

Advanced Materials (AM)

The Advanced Materials topic addresses the development of new and improved materials for a wide variety of commercial and industrial applications. Proposals may focus on the creation of innovative material systems and/or on critical fabrication, processing or manufacturing challenges involved in the successful demonstration and commercialization of novel advanced materials. A broad range of applications areas will be considered as part of this topic.

AM1. Advanced Engineering Materials

AM2. Coatings and Surface Modifications

AM3. Metals and Ceramics

AM4. Novel Advanced Materials-based Sensors

AM5. Structural and Infrastructural Materials

AM6. Other Advanced Materials Technologies

Advanced Systems for Scalable Analytics (AA)

The Advanced Systems for Scalable Analytics topic focuses on innovations needed for building systems that organize and process large and ever-increasing volumes of structured, semi-structured and unstructured data to reveal actionable new insights. It also includes innovative knowledge management and data mining technologies that complement deep learning. Sample topics include data and knowledge management technologies for data acquisition, integration, annotation, governance and provenance; hardware and software for addressing the performance needs of analytical systems; technologies for continual learning in dynamic environments; technologies in data mining, visualization and optimization; and marketplaces for data and models.

These subtopics are only meant to serve as examples. All proposals focused on the development of a new high-risk technical innovation and significant potential commercial and societal impact are welcome to apply, regardless of subtopic.

AA1. Building Analytical System for Learning from Dynamic Environments

AA2. Data Mining, Machine Learning (Non-deep learning-based), and Reinforcement Learning

AA3. Decision Support and Optimization

AA4. Knowledge and Data Management Technologies

AA5. Marketplaces for Data and Models

AA6. Novel Visualization Technologies

AA7. Software Technologies for Scalable Analytical Systems

AA8. Other Novel Technologies

Agricultural Technologies (AG)

The Agricultural Technologies topic supports innovations enabling farm production ecosystems that support the proper utilization of natural resources. Such technologies may encompass systems-level and multidisciplinary solutions to enable complex agricultural practices that support increased biodiversity balanced with yield production.

AG1. Carbon Neutrality

AG2. Climate Resiliency

AG3. Farming in Underserved Communities

AG4. Food Waste Mitigation

AG5. Permaculture

AG6. Precision Agriculture

AG7. Resilient Supply & Distribution

AG8. Other Agricultural Technologies

Artificial Intelligence (AI)

The Artificial Intelligence topic focuses on cutting-edge technologies in the field of deep learning-based AI systems and AI-based hardware. The recent successes in computer vision, machine translation, natural-language processing and speech recognition have led to widespread use of learning-based systems in production and an unprecedented growth in AI systems that interact frequently with and/or on behalf of humans in highly personalized contexts. This topic especially emphasizes next-generation AI technologies that are not only safe and reliable but also fair, robust against sophisticated adversaries, privacy preserving, and efficient in terms of computational resources, energy, training data size, etc. It also includes cutting-edge hardware technologies needed for sustainable AI (i.e., novel devices and architectures to support the tremendous processing power needed by AI technologies), edge devices (i.e., intelligent systems on a chip for applications such as voice assistants) and AI technologies that lead to better hardware systems.

These subtopics are only meant to serve as examples. All proposals that are focused on developing a new high-risk technical innovation and that have significant potential commercial and societal impact are welcome to apply, regardless of subtopic.

AI1. Cognitive Science-based Technologies

AI2. Computer Vision Based AI Technologies

AI3. Conversational AI Technologies

AI4. Language-Based AI Technologies

AI5. Novel AI Hardware Technologies (e.g.: Neuromorphic Computing, High-performance Technologies for AI, Smart and Secure Edge Devices, etc.)

AI6. Sustainable AI Technologies for Low Resource Environments

AI7. Technologies for Trustworthy AI (safe, fair, transparent, privacy-preserving, explainable, and/or secure)

AI8. Other Novel Technologies

Augmented and Virtual Reality (AV)

The Augmented and Virtual Reality topic aims to support the early-stage development of technological innovations in hardware, software, photonics, displays, communication processes and other augmented and virtual reality technologies. It also supports innovations that bring evidence-based academic discoveries to the public sphere via augmented and virtual reality technologies. Since augmented and virtual reality technology is applicable to multiple industries, proposals should clearly identify target markets, potential paths to commercialization success and competitive analysis demonstrating the need for the proposed solution in advancing the entire field.

AV1. Audio Augmentation and Interfaces

AV2. Computation and Data integration

AV3. Projection and Display Media

AV4. Tracking, Alignment, and Stabilization Technologies

AV5. Wearable Technologies

AV6. Other Augmented and Virtual Reality Technologies

Biological Technologies (BT)

The Biological Technologies topic covers a wide range of technology areas to advance engineering and science innovation across the biological spectrum. Biological technologies have disrupted decades-old chemical, agricultural and medical products and services, producing a new bioeconomy. Potential breakthroughs in this space are on course to make major socioeconomic contributions by boosting productivity in industrial and agricultural processes, improving human health, and making advances toward environmental sustainability.

Proposed projects should be focused on using or modifying living organisms, systems or biological processes to develop new technologies to produce biochemicals and medical and agricultural products. They may involve bioengineering to improve function in molecules, cells and tissues in humans, plants, animals and microbes. NSF also encourages proposals for enabling new technologies, such as new tools for genomics, proteomics and drug discovery; instruments for biological applications; computational and bioinformatic tools; and new manufacturing technologies for cells, tissues, organs and biologics (with the exception of clinical trials and schedule I substances).

Subtopics are not aimed at supporting or conducting clinical trials, clinical efficacy or safety studies, the development pre-clinical or clinical-stage drug candidates or medical devices, or work performed primarily for regulatory purposes. Limited studies with human subjects may be acceptable to the extent that they are performed in support of feasibility, such as proof-of-concept studies of early-stage technologies. **Proposals that request support for clinical studies will be deemed noncompliant with the SBIR/STTR solicitations and returned without review.**

BT1. Animal Biotechnology

BT2. Aquaculture

BT3. Bio-Inspired Technologies

BT4. Bioinstruments and Biosensors

BT5. Cell and Tissue Engineering

BT6. Fermentation

BT7. Life Science Research Tools

BT8. Microbiome and Microbial Diversity

BT9. Plant Biotechnology

BT10. Synthetic Biology and Metabolic Engineering

BT11. Other Biological Technologies

Biomedical Technologies (BM)

The Biomedical Technologies topic aims to support the early-stage development of novel products, processes or services that will enable the delivery of high-quality, economically efficient healthcare.

Subtopics are not aimed at supporting or conducting clinical trials, clinical efficacy or safety studies, the development pre-clinical or clinical-stage drug candidates or medical devices, or work performed primarily for regulatory purposes. Limited studies with human subjects may be acceptable to the extent that they are performed in support of feasibility, such as proof-of-concept studies of early-stage technologies. **Proposals that request support for clinical studies will be deemed noncompliant with the SBIR/STTR solicitations and returned without review.**

BM1. Diagnostics

BM2. Drug Delivery Methods

BM3. Health in Underserved Communities

BM4. Materials for Biomedical Applications

BM5. Medical Imaging

BM6. Monitoring Devices

BM7. Women's Health

BM8. Other Biomedical Technologies

Chemical Technologies (CT)

The Chemical Technologies topic covers a wide range of technology areas of current and emerging commercial significance to many areas, including the broad chemical industry; food processing and technology; agrochemicals; chemical alternatives and organics; green chemicals; water treatment and separations; advanced catalysts and materials; and biochemicals. Sensing, data and advanced analytics technologies relevant to these fields are also appropriate for this topic area. Beyond improvement on technical specifications, it is important to also clearly identify the competitive landscape of what is currently possible and why the proposed innovation will have an impact commercially and/or from a societal benefit standpoint.

CT1. Biochemicals

CT2. Catalysts, Advanced Chemicals and Materials

CT3. Chemical and Environmental Sensing and Data

CT4. Food Processing, Chemicals and Agriculture

CT5. Green Chemicals and Chemical Alternatives

CT6. Separations and Water Treatment

CT7. Other Chemical Technologies

Cloud and High-Performance Computing (CH)

The Cloud and High-Performance Computing (HPC) topic focuses on innovations that result in substantial improvements to cloud computing or high-performance computing platforms. These improvements may be to computing power and efficiency, energy management, data storage, latency, data integrity and availability, cost, or any other factor of importance in such platforms, and may result from software- or hardware-based innovations. These subtopic areas are meant to serve as examples; all proposals with technical innovation and significant commercial potential are welcome, regardless of the specific area of focus of the project.

CH1. Algorithms and Applications

CH2. Computational Architecture

CH3. Convergence of AI and Cloud/HPC

CH4. Edge Computing

CH5. Energy Efficiency and Sustainability

CH6. In-memory Processing

CH7. Interconnects

CH8. Middleware

CH9. Performance Monitoring

CH10. Processing on Encrypted Data

CH11. Processor Architecture and Design

CH12. Resilience and Resource Management

CH13. Other Cloud and High-Performance Computing Technologies

Cybersecurity and Authentication (CA)

The Cybersecurity and Authentication topic focuses on innovations related to the security and integrity of data and data processing and the authentication of people and devices. These subtopic areas are meant to serve as examples; all proposals with technical innovation and significant commercial potential are welcome, regardless of the specific area of focus of the project.

CA1. Computation on Encrypted Data

CA2. Cryptography, including Post-quantum Cryptography

CA3. Data Privacy and Integrity

CA4. Device Authentication

CA5. Encryption, including Homomorphic Encryption

CA6. Network and Device Security

CA7. Personal Authentication

CA8. Secure and Trusted Computing

CA9. Secure Machine-to-Machine Communication

CA10. Security of Cloud and High Performance Computing (HPC) Platforms

CA11. Other Cybersecurity and Authentication Technologies

Digital Health (DH)

The Digital Health topic aims to support the early-stage development of novel devices, components, systems, algorithms, networks, applications or services that will enable the transformation of healthcare from reactive, hospital-centered and indemnity-based to proactive, person-centered, preventive and cost-efficient.

Subtopics are not aimed at supporting clinical trials, the clinical validation of information technologies, or medical devices or studies performed primarily for regulatory purposes. Limited studies with human subjects may be acceptable to the extent that they are performed in support of feasibility, such as proof-of-concept studies of early-stage technologies. **Proposals that request support for clinical studies will be deemed noncompliant with the SBIR/STTR solicitations and returned without review.**

DH1. Assistive, Enabling and Rehabilitative technologies

DH2. Health and Biomedical informatics

DH3. Health in Underserved Communities

DH4. Healthcare Workflow, Economics and Delivery

DH5. Medical Diagnostics and Devices

DH6. Physical, Mental and Behavioral Health

DH7. Other Digital Health Technologies

Distributed Ledger (DL)

The Distributed Ledger topic area covers a wide range of technology areas of current and emerging commercial significance and impact spanning all areas of distributed ledgers, including blockchains, directed acyclic graphs (DAGs) and related capabilities (cryptography, smart contracts, etc.). Applications of these technologies and approaches across any range of industries and commercial uses are appropriate for this topic area. Proposed projects should involve novel, distinctive approaches and/or disruptive innovations with high potential impact and competitive advantages in their field of use. These subtopic areas are meant to serve as examples of what entrepreneurs may propose in this space; all distributed ledger proposals with technical innovation and significant commercial potential are welcome, regardless of the specific area of focus of the project.

DL1. Autonomous Systems and Economies, and Smart Contracts

DL2. Blockchain, DAGs, and Next-Gen Protocols

DL3. Convergence with Big Data, and Artificial Intelligence

DL4. Convergence with Internet of Things, Crowdsourcing and Crowdsensing

DL5. Cryptography, Security, and Cybersecurity

DL6. Digital Assets

DL7. Distributed Consensus and Fault Tolerance Mechanisms

DL8. Distributed Ledger in Edge and Cloud Computing

DL9. Distributed Ledger Interoperability

DL10. Distributed Ledger in Network Architecture and Management

DL 11. Financial Technologies

DL12. Human-to-Technology Interfaces and Decentralized Applications (dApps)

DL13. Scalability Solutions and Accumulators

DL14. Trusted Identity and Identity Management

DL15. Other Distributed Ledger Technologies

Energy Technologies (EN)

The Energy Technologies topic covers new energy sources and resources, power generation, energy storage and electronic systems for energy sources used in mobile technologies and off-grid applications. Proposals in all areas of energy generation are welcome, with an emphasis on how the new idea competes favorably with existing solutions. Proposals in carbon conversion and disruptive technologies in conventional resources (natural gas exploration and production) are also welcome. Proposals that focus on the intersection of energy technologies and data are welcome across all areas where integration with energy technology applications is the primary thrust (including computational technologies). Proposals with ideas on nature-inspired processes for sustainable energy solutions and carbon storage, reducing the carbon and resource intensity of hydrocarbon extraction, energy conversion, and their uses are also sought. Proposals involving energy storage from the scale of wearable devices to power plants and energy conversion are encouraged.

EN1. Advanced Nuclear Energy Tech

EN2. CO₂ and Methane Conversion, Petrochemicals, Oil and Gas

EN3. Directed Energy

EN4. Electromagnetics

EN5. Energy Efficiencies and Data Technologies

EN6. Energy Production and Power Generation

EN7. Energy Storage

EN8. Fusion

EN9. Hydrogen Technologies

EN10. Renewable Energy Generation & Storage

EN11. Other Energy Technologies

Environmental Technologies (ET)

Environmental Technologies cover a range of innovations focused on sustainability, high commercial impacts and societal and environmental benefits. The topic covers a variety of technology areas of current and emerging commercial significance that improve environmental and or environmental health outcomes. Sensing, data, and advanced analytics technologies relevant to these fields are also appropriate. Please highlight any aspects of the proposed technology or approach that address a problem without a current solution, or one which is underdeveloped.

ET1. Climate Change Adaptation, Mitigation and Reversal

ET2. Digital Ecosystem for the Environment

ET3. Emission or Waste Reduction and the Circular Economy

ET4. Environmental and Societal Impact Measurement

ET5. Environmental Technologies for Achieving [Sustainable Development](#)

ET6. Food, Regenerative Agriculture, and Energy

ET7. Habitat Conservation, Adaptation and Restoration

ET8. Social and Behavioral Science Based Environmental Technologies

ET9. Sustainable Community Systems

ET10. Water Treatment, Resilience, and Sanitation

ET11. Other Environmental Technologies

Human-Computer Interaction (HC)

The Human-Computer Interaction (HC) topic aims to support the early-stage development and prototyping of unproven technologies that increase the usability of high-intensity human-computer interactive tasks. Intradisciplinary approaches to sustainable products in this topic are encouraged as HC is an intersection of multiple disciplines, including computer science, behavioral sciences, human-centered design, media studies and several other fields of study. Subtopics include but are not limited to:

HC1. Analytics

HC2. Conversational Interfaces

HC3. Dynamic and Smart Spaces

HC4. Embodied and Wearable Computing

HC5. Optometry and Human Vision

HC6. Tactile Technologies

HC7. Technology Aids for Disabilities

HC8. Other Human-Computer Interaction Technologies

Instrumentation and Hardware Systems (IH)

The Instrumentation and Hardware Systems topic addresses the research and development of new and improved instrumentation and related systems for a wide variety of commercial and industrial applications. Proposals in this topic may deal with new instruments for use in scientific, industrial, engineering or manufacturing environments, among others. Systems and tools designed for the purposes of detection, manipulation, characterization, measurement, processing, control or monitoring will be considered. A wide variety of applications areas will be considered as part of this topic.

IH1. Instrumentation or Hardware Systems for Actuation, Control, and Manipulation

IH2. Instrumentation or Hardware Systems for Detection and Characterization

IH3. Instrumentation or Hardware Systems for Imaging

IH4. Other Instrumentation or Hardware Systems Technologies

Internet of Things (I)

The Internet of Things (IoT) is a rapidly evolving field that involves the interconnection and interaction of smart objects (objects or devices with embedded sensors, onboard data processing capability, and a means of communication) to provide automated services that would otherwise not be possible. IoT is not a single technology, but rather involves the convergence of sensor, actuator, information and communication technologies. Emerging IoT implementations will use smaller and more energy-efficient embedded sensor technologies, more sophisticated actuators, enhanced communications and advanced data analytics to collect and aggregate information. These new tools will enable intelligent systems that understand context, track and manage complex interactions and anticipate requirements. Market verticals that are potentially impacted by innovations in this area include connected cities and homes, smart transportation, smart agriculture, industrial IoT, and retail IoT.

I1. IoT Communications

I2. IoT Integrated Systems

I3. IoT Sensors and Actuators

I4. Networking

I5. Other IoT Technologies

Learning and Cognition Technologies (LC)

The Learning and Cognition Technologies topic aims to cover all learning and cognitive innovations that require research and development to advance the field of STEM education from "pre-K to gray." This topic supports the development of prototypes or proofs-of-concept and does not support curriculum development or incremental work on existing technologies. Subtopics include but are not limited to:

LC1. Asynchronous and Remote Learning

LC2. Collaborative Networking

LC3. Digital Learning

LC4. Learning and Workforce Development

LC5. Learning Disabilities and Difficulties

LC6. Learning Modalities

LC7. Mental Health Assessment and Support

LC8. Neuroscience-based Technologies

LC9. Scalable Educational Enterprise Systems

LC10. Statistical and Heuristic Analysis

LC11. Other Learning and Cognition Technologies

Medical Devices (MD)

The Medical Devices topic aims to develop novel medical device platforms, introduce innovative medical technologies or translate emerging scientific principles into health practice. Proposals should be considered leading edge innovations, typically based on a discovery, new approach or new scientific principle to medical devices or technologies.

Limited human subject clinical studies may be acceptable if they are performed in support of feasibility or proof-of-concept objectives. The program does not support proposals to conduct clinical trials for sample size calculations, statistically demonstrate safety or efficacy or the development of pre-clinical or clinical-stage drug candidates. Clinical work performed primarily for regulatory purposes or post market surveillance are also not allowed. **Proposals requesting support for clinical trials are noncompliant with the SBIR/STTR solicitation and returned without review.**

MD1. General Medical Devices

MD2. Implantables or Procedures

MD3. Materials, Processes, Prototyping Methods or Enablers

MD4. Monitoring or Instrumentation

MD5. Rehabilitation

MD6. Wearables and External Sensors

MD7. Women's Health

Mobility (MO)

The Mobility topic encourages novel innovations in the land, air, and sea-based movement of goods and people that improve sustainability and resiliency. Proposals responsive to this topic may include technical breakthroughs that address infrastructure and flow issues in global, urban and rural environments. Interdisciplinary and collaborative innovations to address multiple mobility grand challenges are welcome. All proposed innovations must be capable of a sustainable business model.

MO1. Aviation

MO2. Behavioral Transitions

MO3. Hypersonic

MO4. Infrastructure and Flow

MO5. Marine

MO6. Personal Transportation

MO7. Resiliency and Sustainability

MO8. Other Mobility Topics

Nanotechnology (N)

The Nanotechnology topic addresses the creation and manipulation of functional materials, devices and systems with novel properties that are achieved through the control of matter at a submicroscopic scale (from a fraction of nanometer to about 100 nanometers). This includes, but is not limited to, innovative hierarchical nanostructures, nanolayered structures, nanowires, nanotubes, quantum dots, nanoparticles, nanofibers and other nanomaterials and biomaterials and their composite structures.

N1. Nanotechnology

Other Topics (OT)

For projects that do not seem to fit into one of the other technology topic areas, but still meet the NSF SBIR/STTR goals of supporting research and development of deep technology with commercial viability and the potential to benefit society, please pick Other Topics and subtopic OT1. Project pitches and proposals submitted to Other Topics are typically transferred and reviewed in the topic area that best matches the underlying technical innovation. The program does not reject Project Pitches or proposals based on a non-ideal choice of topic areas. The program routinely moves Project Pitches or proposals internally among topic areas that seem to best describe the underlying technical innovation and to ensure the right program officer and reviewer panel sees the project.

OT1. Other Topics

Pharmaceutical Technologies (PT)

The Pharmaceutical Technologies topic covers a wide range of technology areas that advance the discovery, early-stage development and characterization, formulation, delivery and manufacture of novel drugs, moieties, compounds, products, processes, platforms or services that will improve the selection, quality or price of pharmaceutical and biologic therapies.

The Pharmaceutical Technologies topic is not aimed at supporting or conducting clinical trials, clinical efficacy and safety studies, the development of clinical-stage drug candidates, work on medical devices or schedule I substances, or work performed primarily for regulatory purposes. Limited studies with human subjects may be acceptable if they are performed in support of feasibility, proof-of-concept studies of early-stage technologies and must follow NSF policies on research on human subjects

(<https://www.nsf.gov/bfa/dias/policy/human.jsp>). **Proposals that request support for clinical studies are noncompliant with the SBIR/STTR solicitations and returned without review.**

PT1. Drug Discovery

PT2. Pharmaceutical and Biologic Manufacturing

PT3. Therapeutic Molecules

PT4. Other Pharmaceutical Technologies

Photonics (PH)

The Photonics topic addresses the research and development of new materials, devices, components, and systems that have the potential for revolutionary change in the optics and photonics industries. Photonic technologies can include anything generally operating in or using photons in the electromagnetic spectrum, from gamma rays down to long radio waves. Examples include lasers, various light emitting diode technologies (LED, OLED, QLED), radiation detectors, photonic integrated circuits, optical systems and novel communications technologies.

PH1. Advanced Metrology and Sensors

PH2. Advanced Optical Components and Systems

PH3. Communications, Information, and Data Storage

PH4. Lighting and Displays

PH5. Photonic Devices

PH6. Photonic Energy Conversion

PH7. Photonic Materials

PH8. Photonic Metamaterials and Plasmonics

PH9. Quantum Optics and Nanophotonics

PH10. Silicon Photonics and Photonic Integrated Circuits

PH11. Other Photonics Technologies

Power Management (PM)

The Power Management topic address the development of novel technologies that enable new power and thermal management solutions. Innovations supported could range from device-scale breakthroughs to embedded or standalone systems or grid-scale technologies.

PM1. Energy Harvesting Devices and Systems

PM2. Materials and Devices for Power Electronics

PM3. Materials and Devices for Thermal Management

PM4. Novel Power and Thermal Management Sensors

PM5. Power Electronics Circuits and Control Systems

PM6. Power Management Infrastructure and Smart Grid Systems

PM7. Systems for Thermal Management

PM8. Other Power Management Technologies

Quantum Information Technologies (QT)

This topic focuses on innovations in information and communications technologies that rely fundamentally on quantum mechanical properties and interactions. Typically, such innovations will involve the generation, detection, or manipulation of quantum states to provide faster, more efficient or more secure information processing and communications. Proposals may include innovations at the component, sub-system or system level that result in substantial and usable improvements in the generation, transmission, detection, storage or processing of information, or the security and privacy of information. Proposed innovations must offer the potential for robustness, reliability, scalability and operation at temperatures that are practical within the constraints of the intended application. Innovations at the component and sub-system level should aim for compactness and energy efficiency, consistent with the requirements of the application.

Examples of technology innovations in the quantum computing subtopic could include qubit generation and detection, development of computational models (quantum circuits, etc.), error correction, software, hardware sub-systems and systems and Noisy Intermediate-Scale Quantum (NISQ) computers. Examples of technology innovations in the quantum communications subtopic could include components such as sources, memories, repeaters, detectors, hardware sub-systems and systems, networks, cryptography and key distribution.

QT1. Quantum Algorithms

QT2. Quantum Communications

QT3. Quantum Computing

QT4. Quantum Sensing and Metrology

QT5. Quantum Simulation

QT6. Other Quantum Information Technologies

Robotics (R)

The Robotics topic covers robot intelligence and experiential learning, particularly in the areas of high-performance processors or hardware that provides situational awareness and improved artificial intelligence. Innovations in voice, obstacle and image recognition, emotional response and hand-eye coordination are encouraged. We encourage proposals describing projects that borrow features from other animal nervous systems and include biologists, neuroscientists and psychologists on their team to exploit new knowledge in the study of the brain and behavior.

NSF also seeks proposals that address next-generation automation; the flexible and rapid reconfiguration of assembly lines allowing mass customization; the use of advanced control, scheduling, modularization, and decentralization with agile, mobile robotic systems that can enable the cost-effective manufacture of small lot-size products; and on-demand parts manufacturing.

Proposals to support the physical and educational needs of individuals with disabilities (e.g., vision, hearing, cognitive, motor related) are sought. Robotic applications in healthcare, smart drones and drone networks are appropriate. Medical devices focused on providing new capabilities to doctors including surgery; robotic exoskeletons to enhance human strength; personal robots with an emphasis on human-centered end use and interaction, personal caregiving and increased autonomy; future of work; flying taxis; reverse engineering the human brain; robot sense, motion, thought, and emotion; human-robot art; and robots of augmentation are welcome.

R1. Human Assistive Technologies and Bio-related Robotics

R2. Human-Machine Interfaces and Control/Architecture

R3. Robotic Applications

R4. Robotics in Agile Manufacturing, and Co-Robots

R5. Underground or Underwater Robotics for Low-Visibility, Poor-Connectivity or Hidden Topography

R6. Other Robotics Technologies

Semiconductors (S)

The Semiconductors topic addresses the research and development of new designs, materials, devices and manufacturing systems that have the potential for impactful change in the semiconductor and microelectronics industry.

S1. Electronic Devices

S2. Electronic Materials

S3. Integrated Circuit Design

S4. Microelectronics Packaging and Systems Integration

S5. Novel Semiconductor-based Sensors

S6. Processing and Metrology Technology

S7. Sustainable Semiconductor Manufacturing

S8. Wide Bandgap Power Devices and Materials

S9. Other Semiconductor Technologies

Space (SP)

The Space topic seeks revolutionary technologies to be deployed outside Earth's atmosphere to enhance the commercial use of space. Technologies could include innovations that provide cheaper, safer, and more frequent products and solutions for commercial space customers. This topic particularly seeks to support growth-oriented small businesses who have not previously received significant SBIR/STTR funding and are seeking to contribute to economic growth by developing innovative technologies to support the overall emerging space economy.

Proposals should address real capability gaps or enabling technologies for the space industry, anchored with a solid understanding of the challenges of working in space including launch, mass and volume restrictions, the radiation and thermal environment, communications and latency, power, and energy. NSF encourages proposals with revolutionary satellite and vehicle hardware or systems innovations involving propulsion systems, navigation systems, energy collection and power generation systems unique to space environments, and in-space manufacturing systems and services. Proposals focused on Earth imaging and sensing; planetary (other than Earth) physical surveying, mapping, and prospecting services; extraction and processes of water and volatiles (not on Earth); search for extraterrestrial intelligence; space tourism; space weather; interplanetary habitats; and analytic algorithms based on data collected extensively from space-based systems, either alone or in combination with terrestrial systems, are also encouraged.

SP1. Extra-terrestrial Resource Extraction

SP2. Geological and Geoclimatic Science Data Technologies

SP3. Ground Launch Sites and Satellite Operations Technologies

SP4. In-space Manufacturing Technologies

SP5. Navigation and Positioning Technologies

SP6. On-Orbit Technologies

SP7. Remote Sensing Technologies

SP8. Spacecraft Development and Manufacturing

SP9. Space Technologies and Systems

SP10. Space Transportation and Access

SP11. Telecommunications Technologies

SP12. Other Space-related Technologies

Wireless Technologies (W)

The Wireless topic involves next-generation wireless communication technologies requiring systems with high data rates, low costs and that support a wide variety of applications and services while maintaining full mobility, minimum latency, and long battery life. Devices and subsystems that increase data throughput rates via cell density; increased spectrum; multiple input, multiple output (MIMO); and new "antenna" concepts are encouraged. NSF welcomes proposals involving modulation and demodulation techniques for signal generation and reception through spectral efficiency, noise immunity, jamming immunity, and power efficiency; radio frequency (RF) pollution: devices and circuits; processing algorithms/3D spatial control; and high efficiency devices such as micro-TWT (traveling-wave tube), smart dust and inductive couplers. NSF seeks proposals in the areas of spectrum-related research and development activities that improve the efficiency by which the radio spectrum is used, and the ability of all members of the public to access spectrum-related services. Mobile and automotive radar, smart solar panels, on-panel DC-AC converters, openRAN (Radio Access Networks)-related devices and applications and self-testing and self-networking devices are also of interest.

W1. Communication and Networking Technologies

W2. Networked Sensors and Sensing

W3. Wireless Devices and Components

W4. Wireless Systems

W5. Other Wireless Technologies