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 and SUBTOPICS

America's Seed Fund powered by NSF encourages proposals in all areas of science and engineering. An exact fit into one of these topics or subtopics is not required.

For proposals due December 2018

Technology Topic Areas

- Advanced Manufacturing (MN)
- Advanced Materials (MI)
- Biological Technologies (BT)
- Biomedical Technologies (BM)
- Chemical and Advanced Energy Technologies (CT)
- Digital Health (DH)
- Distributed Ledger (OT)
- Educational Technologies and Applications (EA)
- Energy and Power Systems (EW)
- Environmental Technologies (CT)
- Information Technologies (IT)
- Instrumentation and Hardware Systems (MI)
- Internet of Things (I)
- Medical Devices (MD)
- Nanotechnology (MN)
- Other Topics (OT)
- Photonics (PH)
- Quantum Information Technologies (IT)
- Robotics (EW)
- Semiconductors (S)
- Sensors (EW)
- Wireless Technologies (EW)

Advanced Manufacturing (MN)

The Advanced Manufacturing topic aims to support emerging innovations in manufacturing with the potential to rejuvenate the nation's manufacturing sector by improving its efficiency, competitiveness, and sustainability. Proposals should be driven by technological advancements that are environmentally friendly and compatible with human health and that are based on commercially and environmentally sustainable technical innovations aiming to create positive and enduring social impact. NSF accepts proposals in this topic that span the gamut of sectors and materials including, but not limited to, innovative technologies for the processing of a variety of single-component and multi-component materials, biological and bio-inspired materials, flexible electronics, ceramics, polymers, metals, alloys, and novel composites using a variety of advanced manufacturing processes.

M1. Manufacturing Technologies

M2. Bio-Inspired Manufacturing

M3. Additive Manufacturing Components and Systems

M4. Modeling and Simulation

M5. Cybermanufacturing

M6. Personalized Manufacturing / Maker Manufacturing / Maker to Manufacturer

M7. Transportation Technologies

M8. Human-Centric Industrial Technologies

M9. Sustainable Manufacturing Technology

Advanced Materials (MI)

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

MI1. Metals and Ceramics

MI2. Structural and Infrastructural Materials

MI3. Coatings and Surface Modifications

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MI4. Multiferroics and Specialized Functional Materials

MI5. Materials for Sustainability

MI6. Other Materials

Biological Technologies (BT)

The Biological Technologies topic covers a wide range of technology areas to advance engineering and science innovation across the biological spectrum. We are in a biotechnology revolution where advanced biological technologies have disrupted decades-old chemical, agricultural, and medical products and services producing a new bioeconomy. The bioeconomy is on course to make major socioeconomic contributions to the United States and world economies to boost productivity in industrial and agricultural processes, improve human health, and make advances toward environmental sustainability. We seek to support next-generation technologies that will continue to advance disruptive, high-impact, and high-payback innovation in the bioeconomy. Proposed projects should be focused on using or modifying living organisms, systems, or biological processes to develop novel technologies to produce biochemicals, medical products, and agricultural products. They may involve bioengineering to improve function in molecules, cells, and tissues in humans, plants, animals, and microbes. In addition, enabling technologies are encouraged, such as new tools for genomics, proteomics, and drug discovery, the development of instruments for biological applications, computational and bioinformatic tools, and new manufacturing technologies for cells, tissues, organs and biologics.

BT1. Plant Biotechnology

BT2. Biosensors

BT3. Life Science Research Tools

BT4. Bioinstruments

BT5. Synthetic Biology and Metabolic Engineering

BT6. Fermentation Technologies

BT7. Computational Biology and Bioinformatics

BT8. Cell and Biologics Manufacturing

BT9. Drug Discovery Platforms

BT10. Cell and Tissue Engineering

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BT11. Animal Biotechnology

BT12. Food and Food Safety Biotechnology

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 in the United States and globally. Subtopics under Biomedical Technologies include pharmaceutical manufacturing, materials for biomedical application, non-invasive technologies to better understand brain function, medical imaging technologies (covering both better imaging and imaging agents), diagnostic assays and platforms that deal with screening, diagnosis, prognosis and monitoring of diseases, and drug delivery platform. **The BM 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, proof-of-concept studies of early-stage technologies. **Proposals that request support for clinical studies will be deemed non-compliant with the SBIR/STTR solicitations and may be returned without review.**

BM1. Pharmaceutical Manufacturing

BM2. Materials for Biomedical Applications

BM3. Noninvasive Imaging of Brain Function

BM4. Medical Imaging Technologies

BM5. Diagnostic Assays and Platforms

BM6. Drug Delivery

Chemical and Advanced Energy Technologies (CT)

The Chemical and Advanced Energy Technologies topic covers a wide range of technology areas of current and emerging commercial significance pertaining to the broad chemical industry, energy, power generation, and related industrial sectors. Sensing, data and advanced analytics technologies relevant to these fields are also appropriate for Chemical Technologies. 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 high impact commercially and/or from a societal benefit standpoint.

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CT1. Advanced Chemical Processes and Products

CT2. Catalytic Products and Processes

CT3. Power Generation and Advanced Infrastructure

CT4. Advanced Hydrocarbons, Petrochemicals and Natural Resources

CT5. Advanced Energy Technologies

CT6. Data Technologies, Sensing and Analytics for Chemicals, and/or Energy

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. **The Digital Health 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, proof-of-concept studies of early-stage technologies. **Proposals that request support for clinical studies will be deemed non-compliant with the SBIR/STTR solicitations and may be returned without review.**

DH1. Business Models for User-Centered Healthcare

DH2. Digital Health Information Infrastructure

DH3. From Data to Decisions

DH4. Interoperability of Health Record Systems, Medical Sensors, Devices and Robotics

DH5. Empowering Individuals and Communities

Distributed Ledger (OT)

The Distributed Ledger (OT) topic area covers a wide range of technology areas of current and emerging commercial significance and impact spanning all areas of distributed ledger 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. It is important that the proposed project involve novel, distinctive approaches and/or disruptive innovations that enable high potential impact and competitive advantage in their field of use. Proposals that address significant pain points and opportunities are solicited; examples include but are not limited to: enhancements to

speed, scalability, efficiency, improved functionalities/capabilities, enhanced security, consensus, immutability, information and identity validation, trusted data/inputs, digital privacy, artificial intelligence (AI) applications, internet of things (IoT) integration, autonomous systems / economies, and improvements to enhance user adoption. Platform technologies and enablers for this field are also welcome. Companies should be sure to address whether there are differentiated technical elements, intellectual property or other competitive barriers that will allow the company, once NSF funded, to defend against potential "fast followers" in this space. The proposal should clearly identify the competitive landscape of what is currently possible, and why the proposed innovation will have high impact commercially and/or from a societal benefit standpoint. Any key points relating to enhancing U.S. leadership in this space should also be highlighted. The subtopic areas below are meant only as incomplete 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: Advanced Protocols: Blockchain, DAGs, and Next Gen Protocols

DL2: Cryptography and Security, Identity and Anonymity Solutions, Trusted Devices

DL3: Smart Contracts, Next-Generation Financial Technologies

DL4: Scalability Solutions, Enhanced Consensus Methods, Organizational Structures

DL5: Human to Technology Interface Innovations, Disruptive Business Model Innovations for Distributed Ledger Technologies

DL6: Distributed Ledger Convergence with Sensing, Big Data, AI, and IoT

DL7: Autonomous Systems and Economies

DL8: Other Technologies and Approaches Potentially Relevant to Distributed Ledger

Educational Technologies and Applications (EA)

NSF welcomes proposals that present creative, ground-breaking, and commercially sustainable innovations in the field of education, where such innovations offer the potential for substantial positive impact on society and the world we live in. The subtopics below provide vital (but incomplete) examples of possible educational applications. Submitted proposals should provide detailed descriptions of how the proposed application will work, provide examples of how users would interact with the application, how learning will be assessed, and how accessible and affordable the application will be. Applicants are encouraged to apply under a subtopic where the strongest case for the project's technical innovation can be made.

EA1. Pre-K and Primary Education

EA2. Middle School and High School Education

EA3. Global, Distance, and Higher Education

EA4. Collaborative and Game-Based Education

EA5. Social and Behavioral Education

EA6. Entrepreneurial, Informal and Maker Education

EA7. Computer Science, Computer Engineering, and Information Technology Education

EA8. Learning Assessments

EA9. Language Applications

EA10. Capacity Building, Education, and Training for the Emerging Fourth Sector Eco-system

EA11. Other Education-Related Topics

Energy and Power Systems (EW)

Proposals are solicited in the areas of electronic systems for portable energy sources for mobile technologies and off-grid type applications, including new energy sources. Proposals in the areas of power management systems for energy scavenging/harvesting and compact energy conversion systems, conversion from renewable resources, interface devices between batteries and super-capacitors as well as smart power demand-response management systems are welcome. 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 its uses are sought. Proposals involving energy storage from the scale of wearable devices to power plant, and energy conversion are encouraged. Proposals that address innovations in new technologies that support smart infrastructures (such as materials, sensors, devices, and control systems) to ensure efficient and sustainable energy transmission, distribution, monitoring, and management for micro grids, integration of diverse energy sources, and self-healing networks are sought. Innovations in the areas of novel voltage conversion, micro-inverters and DC-DC voltage converters, and compact high-voltage, high-power systems are welcome. Proposals covering new energy sources for portable and mobile devices, smart power demand-response management systems, inverters, motors, and generators for higher efficiency, smaller size and power factor corrections are encouraged.

EW8. Energy Harvesting and Storage

EW9. Infrastructure and Smart Grids

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Environmental Technologies (CT)

Environmental Technologies cover a range of innovations that bring promise of high commercial impact and/or societal benefit for the environment. The topic covers a wide range of technology areas of current and emerging commercial significance pertaining to the technologies and materials that improve environmental and or environmental health outcomes. Sensing, data and advanced analytics technologies relevant to these fields are also appropriate for Environmental Technologies. If the proposed technology or approach solves a problem without a current solution or underserved area, this should be highlighted.

CT7. Water Treatment

CT8. Agricultural and Food Technologies

CT9. Environmental Health, Green Chemistry

CT10. Resource Efficiency, Renewable Resources

CT11. Technologies for Extreme Environments

CT12. Environmental Security and Defense

CT13. Data Technologies, Sensing and Analytics for the Environment

Information Technologies (IT)

This topic encourages the submission of proposals that present ground-breaking innovations in the generation, analysis, use, transmission or protection of information, where such innovations offer the potential for substantial commercial returns and a positive impact on society and the world in which we live. The subtopics below provide specific examples of technologies and applications, although given the enormous range and diversity in the field of IT these examples are inevitably incomplete.

Note that Software (the IT13 subtopic) focuses on information technology innovations that are embodied in software and provide important new or enhanced capabilities that will usually be generalized, rather than directed to a specific use case. Examples of such capabilities include (but are not limited to): enhanced computational speed or efficiency; new or improved functionality; improved or extended performance; increased ease of use and accessibility. The range of possible innovations under that subtopic is too broad to attempt to describe here. Past examples of significant software innovations cover a wide range of technical approaches and resulting new capabilities, and they include (but are obviously not limited to): object-oriented programming; the GUI; HTTP; HTML; TCP/IP; SQL; internet search engine(s); the spreadsheet; word processing; MapReduce; virtualization.

IT1. Artificial Intelligence, Machine Learning, and Natural Language Processing

IT2. Image and Video

IT4. Cybersecurity, Authentication, and Privacy

IT5. Cybersecurity for the Internet of Things
Note: This subtopic is focused on cybersecurity innovations pertaining to IoT. Hardware innovations related to IoT should be submitted to the Internet of Things (I) topic.

IT6. Networking Technology
Note: This subtopic includes IT-based innovations pertaining to IoT networking technology. Hardware innovations related to IoT should be submitted to the Internet of Things (I) topic.

IT7. Mobile Computing and Internet of Things
Note: This subtopic includes IT-based innovations pertaining to IoT devices. Hardware innovations related to IoT should be submitted to the Internet of Things (I) topic.

IT8. Cloud Computing and High-Performance Computing

IT9. Cloud-based IT Services

IT10. Big Data and Advanced Analytics

IT11. Human-Computer Interaction, Virtual Reality, and Augmented Reality

IT12. Social Media and Collaborative Networking

IT13. Software

Instrumentation and Hardware Systems (MI)

The Instrumentation and Hardware Systems (MI) 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. Types of instruments that will be considered include systems and tools designed for the purposes of detection, manipulation, characterization, measurement, processing, control, and/or monitoring. A wide variety of applications areas will be considered as part of this topic.

MI7. Instrumentation or Hardware Systems for Characterization and Imaging

MI8. Instrumentation or Hardware Systems for Detection, Actuation, Control, and Manipulation

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MI9. Other Instrumentation or Hardware Systems

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, information, communication, and actuation technologies. Today, most of what we consider as IoT is a variety of largely stand-alone devices and isolated systems, such as wearable fitness monitors, home thermostats and lighting, remote video streaming, smartphones, and smart watches. Emerging IoT implementations will use smaller and more energy- efficient embedded sensor technologies, enhanced communications, advanced data analytics, and more sophisticated actuators to collect and aggregate information and enable intelligent systems that understand context, track and manage complex interactions, and anticipate requirements.

IoT is expected to become ubiquitous, with implementations in the smart home for management of energy use, control of appliances, monitoring of food and other consumables; consumer applications such as health and fitness monitoring, condition diagnosis; manufacturing and industrial settings for supply chain management, robotic manufacturing, quality control, health and safety compliance; utility grids and other critical infrastructure for grid optimization, automated fault diagnosis, automated cyber security monitoring and response; and automotive/transportation for optimization for driving conditions, assessing driver alertness, collision/accident avoidance, and managing vehicle health.

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. Proposals are encouraged that address key challenges across the full range of IoT applications

IoT1. IoT Sensors and Actuators

IoT2. IoT Energy and Power Systems

IoT3. IoT Communications

IoT4. IoT Integrated Systems

Medical Devices (MD)

The Medical Devices 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 in the United States as well as globally. The medical devices topic is not aimed at supporting or conducting clinical trials, clinical efficacy or safety studies, the development of

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, proof-of-concept studies of early-stage technologies. Proposals that request support for clinical studies will be deemed non-compliant with the SBIR/STTR solicitations and may be returned without review.

MD1. Medical Devices

Nanotechnology (MN)

The Nanotechnology topic addresses the creation and manipulation of functional materials, devices, and systems with novel properties and functions 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. Proposals focusing on global technological challenges through development of innovative nanotechnologies are especially encouraged. Examples of such challenges include (but are not limited to) desalination of seawater to solve the emerging water crisis, solar energy collection, storage, and conversion for contributing to energy solutions for the future, solid-state refrigeration for reducing global greenhouse emissions and conversion of atmospheric $CO2$ to useful products.

N1. Nanomaterials

N2. Nanomanufacturing

N3. Other topics in nanotechnology

Other Topics (OT)

The Other Topics area is intended to be a home to any proposed project which does not seem to fit into one of the other technology topic areas, but still seems to meet the NSF SBIR/STTR goals of supporting research and development of innovative, risky, unproven technology, with commercial viability and the potential to benefit society.

OT1. Other Topics

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.

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PH1. Lighting and Displays

PH2. Communications, Information, and Data Storage

PH3. Energy

PH4. Advanced Metrology and Sensors

PH5. Advanced Optical Components and Systems

Quantum Information Technologies (IT)

The Quantum 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 in order to provide faster, more efficient or more secure information processing and communications. Quantum proposals could include innovations at the component, sub-system and 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 intended application. Applications will in general fall into one of the four broad areas of quantum sensing, quantum communications, quantum simulation and quantum computing.

IT3. Quantum Information Technologies

Robotics (EW)

Proposals addressing robot intelligence and experiential learning, particularly those in the areas of high-performance processors/hardware to provide situational awareness, and improved artificial intelligence, are welcome. Innovations in voice, obstacle and image recognition, emotional response, and eye-hand coordination are encouraged. Proposals describing projects that borrow features from other animal nervous systems and include biologists, neuroscientists, and/or psychologists on their team to exploit new knowledge in the study of the brain and behavior are encouraged. 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 are sought. 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 that provide

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; and robots of augmentation are welcome.

EW2. Human-Machine Interfaces and Control/Architecture

EW3. Robotic Applications

EW4. Robotics in Agile Manufacturing, and Co-Robots

EW5. Human Assistive Technologies and Bio-related Robotics

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 industry.

S1. Electronic Materials

S2. Electronic Devices

S3. Processing and Metrology Technology

S4. Integrated Circuit Design

S5. Micro-electronics Packaging, Thermal Management, and Systems Integration

Sensors (EW)

Recent technological advancements in materials science and bioengineered systems have made inexpensive, powerful, and ubiquitous sensing a reality. Examples range from truly smart airframes and self-evaluating buildings and infrastructure for natural hazard mitigation to large-scale weather forecasting, self-organizing energy systems, and smart devices that self-assemble into networks leading to the first electronic nervous system that connects the internet back to the physical world. Proposals are sought in new sensing modalities; self-powered and energy efficient sensors; sensors for extreme environments; sensor fabrication techniques such as 3D printing and self-assembly; sensor signal read out, conditioning, and processing; and biodegradable sensors. For sensor systems and algorithms, tomographic processing, 3D array, autonomous sensing, sensor fusion, extreme environment materials sensing, and remote sensing parametric inversion are of interest.

EW1. Sensors

Wireless Technologies (EW)

Proposals that involve next-generation wireless communication technologies requiring systems with high data rates, low cost, and that support a wide variety of applications and services, while maintaining full mobility, minimum latency, and long battery life are sought. Devices and subsystems that increase data throughput rates via cell density, increased spectrum, multiple input, multiple output (MIMO), massive MIMO, and new "antenna" concepts. 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: device and circuit; processing algorithms - 3D spatial control; high efficiency devices such as micro-TWT, smart dust, and inductive couplers are appropriate. 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 are sought. Mobile and automotive radar, smart solar panels, on-panel DC-AC converters, and self-testing and self-networking devices are also of interest.

EW6. Wireless Systems

EW7. Wireless Devices and Components