

Appendix D: SBIR/STTR and the Space Technology Roadmaps

Funded at 2.5% of NASA's R&D budget, the Small Business Innovation Research (SBIR) Program was established by Congress in 1982 to provide increased opportunities for small businesses to participate in R&D, to increase employment, and to improve U.S. competitiveness. The program's specific objectives are to stimulate U.S. technological innovation, use small businesses to meet federal research and development needs, increase private-sector commercialization of innovations derived from federal R&D, and foster and encourage participation by socially disadvantaged businesses. Legislation enacted in 2000 extended and strengthened the SBIR program and increased its emphasis on pursuing commercial applications of SBIR project results.

Funded at 0.3% of NASA's R&D budget, the Small Business Technology Transfer (STTR) Program awards contracts to small business concerns for cooperative research and development with a non-profit research institution, such as a university. The goal of the Congress in establishing the STTR program is to facilitate the transfer of technology developed by an RI through the entrepreneurship of a small business.

The following statistics shows the extent of the effort associated with these two programs each year:

- Approximately 2,500 proposals per year from 1,000 small businesses throughout the Nation.
 - About 62,000 pages of technical, proprietary data.
 - 1/3 of the phase 1 contracts are with firms "new" to NASA.
- Approximately 500 new contracts per year.
 - 1/2 of NASA new contracts with for profit firms.
 - Up to 650 active contracts managed at any time.
- About 1,800 NASA employees participate in evaluation and oversight processes.

In the past few years, research and technology topics for the SBIR program were identified annually by Mission Directorates and Center Programs. The Directorates identify high priority research and technology needs for respective programs and projects. Research and technology topics for the STTR Program are aligned with needs associated with the research interest and core competencies across NASA Centers. Both programs support a broad range of technologies defined by a list of topics and subtopics that vary in content within each annual solicitation.

The following table relates these SBIR/STTR topics and subtopics to the Technology Area Breakdown Structure (TABS) in the Space Technology Roadmaps (STR). The table is organized by Technology Area (first column), with the related SBIR/STTR topics (third column) and subtopics (fourth column) listed as well. For completeness, the Aeronautics area is included for completeness, though this was beyond the scope of the STR.

TA	STR Technology Area (TA) Level 1 Description	FY 11 SBIR/STTR Topic	FY11 SBIR/STTR Sub-topic Description	FY 11 SBIR / STTR Sub-topic
TA01	Launch Propulsion Systems	Propulsion	Low Cost Heavy Lift Propulsion	X2.01
TA01	Launch Propulsion Systems	Space Transportation	Nano/Small Sat Launch Vehicle Technology	O2.01
TA01	Launch Propulsion Systems	Space Transportation	Propulsion Technologies	O2.02
TA02	In-Space Propulsion Technologies	Spacecraft and Platform Subsystems	Propulsion Systems	S3.04

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TA02	In-Space Propulsion Technologies	Propulsion	High Thrust In Space Propulsion	X2.02
TA02	In-Space Propulsion Technologies	Propulsion	Electric Propulsion Systems	X2.03
TA03	Space Power and Energy Storage	Spacecraft and Platform Subsystems	Power Generation and Conversion (for Science Spacecraft)	S3.03
TA03	Space Power and Energy Storage	Spacecraft and Platform Subsystems	Power Electronics and Management and Energy Storage (for Science Spacecraft)	S3.05
TA03	Space Power and Energy Storage	High-Efficiency Space Power Systems	Fuel Cells and Electrolyzers for Space Applications	X8.01
TA03	Space Power and Energy Storage	High-Efficiency Space Power Systems	Advanced Space-Rated Batteries	X8.02
TA03	Space Power and Energy Storage	High-Efficiency Space Power Systems	Space Nuclear Power Systems	X8.03
TA03	Space Power and Energy Storage	High-Efficiency Space Power Systems	Advanced Photovoltaic Systems	X8.04
TA04	Robotics, Telerobotics and Autonomous Systems	Robotic Exploration Technologies	Sample Collection, Processing, and Handling	S5.02
TA04	Robotics, Telerobotics and Autonomous Systems	Robotic Exploration Technologies	Surface and Subsurface Robotic Exploration	S5.03
TA04	Robotics, Telerobotics and Autonomous Systems	Robotic Exploration Technologies	Spacecraft Technology for Sample Return Missions	S5.04
TA04	Robotics, Telerobotics and Autonomous Systems	Autonomous Systems and Avionics	Spacecraft Autonomy and Space Mission Automation	X6.01
TA04	Robotics, Telerobotics and Autonomous Systems	Autonomous Systems and Avionics	Intelligent System Health Management for Flexible Exploration	X6.03
TA04	Robotics, Telerobotics and Autonomous Systems	Human-Robotic Systems	Human Robotic Systems - Human Robot Interfaces	X7.01
TA04	Robotics, Telerobotics and Autonomous Systems	Human-Robotic Systems	Human-Robotic Systems - Mobility Subsystems	X7.02
TA04	Robotics, Telerobotics and Autonomous Systems	Processing and Operations	Remotely Operated Mobile Sensing Technologies for inside ISS	O3.01

TA04	Robotics, Telerobotics and Autonomous Systems	Spacecraft and Platform Subsystems	Unmanned Aircraft and Sounding Rocket Technologies	S3.08
TA05	Communication and Navigation	Space Communications	Antenna Technology	O1.01
TA05	Communication and Navigation	Space Communications	Reconfigurable/Reprogrammable Communication Systems	O1.02
TA05	Communication and Navigation	Space Communications	Game Changing Technologies	O1.03
TA05	Communication and Navigation	Space Communications	Long Range Optical Telecommunications	O1.04
TA05	Communication and Navigation	Space Communications	Long Range Space RF Telecommunications	O1.05
TA05	Communication and Navigation	Space Communications	CoNNeCT Experiments	O1.06
TA05	Communication and Navigation	Navigation	Metric Tracking of Launch Vehicles	O4.01
TA05	Communication and Navigation	Navigation	PNT (Positioning, Navigation, and Timing) Sensors and Components	O4.02
TA05	Communication and Navigation	Spacecraft and Platform Subsystems	Guidance, Navigation and Control	S3.06
TA06	Human Health, Life Support and Habitation Systems	Radiation Protection	Radiation Shielding Materials Systems	X11.01
TA06	Human Health, Life Support and Habitation Systems	Radiation Protection	Integrated Advanced Alert/Warning Systems for Solar Proton Events	X11.02
TA06	Human Health, Life Support and Habitation Systems	Exploration Crew Health capabilities	Crew Exercise Systems	X12.01
TA06	Human Health, Life Support and Habitation Systems	Exploration Crew Health Capabilities	Portable Load Sensing Systems	X12.02
TA06	Human Health, Life Support and Habitation Systems	Exploration Medical Capability	Smart Phone Driven Blood-Based Diagnostics	X13.01
TA06	Human Health, Life Support and Habitation Systems	Exploration Medical Capability	Non-Wet Prep Electrodes	X13.02
TA06	Human Health, Life Support and Habitation Systems	Behavioral health and Performance	Virtual Reality and World Technologies for Team Training Approaches	X14.01

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TA06	Human Health, Life Support and Habitation Systems	Space Human Factors and Food Systems	A New Technique for Automated Analyses of Raw Operational Videos	X15.01
TA06	Human Health, Life Support and Habitation Systems	Space Human factors and Food Systems	Advanced Food Technologies	X15.02
TA06	Human Health, Life Support and Habitation Systems	Space Radiation	Radiation measurement Technologies	X16.01
TA06	Human Health, Life Support and Habitation Systems	Inflight Biological Sample Preservation and Analysis	Alternative Methods for Ambient Preservation of Human Biological Samples During Extended Spaceflight and Planetary Operations	X17.01
TA06	Human Health, Life Support and Habitation Systems	Life Support and Habitation Systems	Enabling Technologies for Biological Life Support	X3.01
TA06	Human Health, Life Support and Habitation Systems	Life Support and Habitation Systems	Crew Accommodations and Waste Processing for Long Duration Missions	X3.02
TA06	Human Health, Life Support and Habitation Systems	Life Support and Habitation Systems	Environmental Monitoring and Fire Protection for Spacecraft Autonomy	X3.03
TA06	Human Health, Life Support and Habitation Systems	Life Support and Habitation Systems	Spacecraft Cabin Ventilation and Thermal Control	X3.04
TA07	Human Exploration Destination-Systems	Processing and Operations	ISS Utilization	O3.02
TA07	Human Exploration Destination-Systems	Processing and Operations	ISS Demonstration & Development of Improved Exploration Technologies	O3.03
TA07	Human Exploration Destination-Systems	In Situ Resource Utilization	In-Situ Resource Characterization, Extraction, Transfer, and Processing	X1.01
TA07	Human Exploration Destination-Systems	Extra Vehicular Activity Technologies	Space Suit Pressure Garment and Airlock Technologies	X4.01
TA07	Human Exploration Destination-Systems	Extra Vehicular Activity Technologies	Space Suit Life Support Systems	X4.02
TA07	Human Exploration Destination-Systems	Extra Vehicular Activity Technologies	Space Suit Radio, Sensors, Displays, Cameras, and Audio	X4.03

TA08	Science Instruments, Observatories and Sensor Systems	Sensors, Detectors and Instruments	Lidar and Laser System Components	S1.01
TA08	Science Instruments, Observatories and Sensor Systems	Sensors, Detectors and Instruments	Active Microwave Technologies	S1.02
TA08	Science Instruments, Observatories and Sensor Systems	Sensors, Detectors and Instruments	Passive Microwave Technologies	S1.03
TA08	Science Instruments, Observatories and Sensor Systems	Sensors, Detectors and Instruments	Sensor and Detector Technology for Visible, IR, Far IR and Submillimeter	S1.04
TA08	Science Instruments, Observatories and Sensor Systems	Sensors, Detectors and Instruments	Detector Technologies for UV, X-Ray, Gamma-Ray and Cosmic-Ray Instruments	S1.05
TA08	Science Instruments, Observatories and Sensor Systems	Sensors, Detectors and Instruments	Particles and Field Sensors and Instrument Enabling Technologies	S1.06
TA08	Science Instruments, Observatories and Sensor Systems	Sensors, Detectors and Instruments	Cryogenic Systems for Sensors and Detectors	S1.07
TA08	Science Instruments, Observatories and Sensor Systems	Sensors, Detectors and Instruments	In Situ Airborne, Surface, and Submersible Instruments for Earth Science	S1.08
TA08	Science Instruments, Observatories and Sensor Systems	Sensors, Detectors and Instruments	In Situ Sensors and Sensor Systems for Planetary Science	S1.09
TA08	Science Instruments, Observatories and Sensor Systems	Sensors, Detectors and Instruments	Atomic Interferometry	S1.10
TA08	Science Instruments, Observatories and Sensor Systems	Sensors, Detectors and Instruments	Planetary Orbital Sensors and Sensor Systems (POSSS)	S1.11
TA08	Science Instruments, Observatories and Sensor Systems	Advanced Telescope Systems	Precision Spacecraft Formations for Telescope Systems	S2.01
TA08	Science Instruments, Observatories and Sensor Systems	Advanced Telescope Systems	Proximity Glare Suppression for Astronomical Coronagraphy	S2.02
TA08	Science Instruments, Observatories and Sensor Systems	Advanced Telescope Systems	Advanced Optical Component Systems	S2.04
TA08	Science Instruments, Observatories and Sensor Systems	Robotic Exploration Technologies	Extreme Environments Technology	S5.05
TA08	Science Instruments, Observatories and Sensor Systems	Robotic Exploration Technologies	Planetary Protection	S5.06

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TA08	Science Instruments, Observatories and Sensor Systems	Spacecraft and Platform Subsystems	Terrestrial and Planetary Balloons	S3.07
TA08	Science Instruments, Observatories and Sensor Systems	Low-Cost Small Spacecraft and Technologies	Unique Mission Architectures Using Small Spacecraft	S4.01
TA09	Entry, Descent and Landing Systems	Robotic Exploration Technologies	Planetary Entry, Descent and Landing Technology	S5.01
TA09	Entry, Descent and Landing Systems	Planetary Entry, Descent and Landing (EDL) Technology	Advanced Integrated Hypersonic Entry Systems	X9.02
TA10	Nanotechnology	N/A	N/A	N/A
TA10	Nanotechnology	N/A	N/A	N/A
TA11	Modeling, Simulation, Information Technology and Processing	Navigation	Flight Dynamics Software and Technologies	O4.03
TA11	Modeling, Simulation, Information Technology and Processing	Spacecraft and Platform Subsystems	Command, Data Handling, and Electronics (for Science Spacecraft)	S3.01
TA11	Modeling, Simulation, Information Technology and Processing	Information Technologies	Technologies for Large-Scale Numerical Simulation	S6.01
TA11	Modeling, Simulation, Information Technology and Processing	Information Technologies	Earth Science Applied Research and Decision Support	S6.02
TA11	Modeling, Simulation, Information Technology and Processing	Information Technologies	Algorithms and Tools for Science Data Processing, Discovery and Analysis, in State-of-the-Art Data Environments	S6.03
TA11	Modeling, Simulation, Information Technology and Processing	Information Technologies	Integrated Mission Modeling for Opto-mechanical Systems	S6.04
TA11	Modeling, Simulation, Information Technology and Processing	Information Technologies	Fault Management Technologies	S6.05
TA11	Modeling, Simulation, Information Technology and Processing	Autonomous Systems and Avionics	Radiation Hardened/Tolerant and Low Temperature Electronics and Processors	X6.02
TA12	Materials, Structures, Mechanical Systems and Manufacturing	Space Transportation	Advanced Tank Technology Development	O2.04

TA12	Materials, Structures, Mechanical Systems and Manufacturing	Advanced Telescope Systems	Precision Deployable Optical Structures and Metrology	S2.03
TA12	Materials, Structures, Mechanical Systems and Manufacturing	Advanced Telescope Systems	Optics Manufacturing and Metrology for Telescope Optical Surfaces	S2.05
TA12	Materials, Structures, Mechanical Systems and Manufacturing	Lightweight Spacecraft Materials and Structures	Expandable Structures	X5.01
TA12	Materials, Structures, Mechanical Systems and Manufacturing	Lightweight Spacecraft Materials and Structures	Advanced Fabrication and Manufacturing of Metallic and Polymer Matrix Composite Materials for Lightweight Structures	X5.02
TA12	Materials, Structures, Mechanical Systems and Manufacturing	Lightweight Spacecraft Materials and Structures	Spaceflight Structural Sensor Systems and NDE	X5.03
TA13	Ground and Launch Systems Processing	Space Transportation	Propulsion Technologies	O2.02
TA13	Ground and Launch Systems Processing	Space Transportation	21st Century Spaceport Ground Systems Technologies	O2.03
TA13	Ground and Launch Systems Processing	Processing and Operations	Vehicle Integration and Ground Processing	O3.04
TA13	Ground and Launch Systems Processing	Processing and Operations	Advanced Motion Imaging	O3.05
TA13	Ground and Launch Systems Processing	Processing and Operations	Environmental Control Systems & Technologies for NR & Cubesats	O3.06
TA13	Ground and Launch Systems Processing	Space Transportation	Advanced Propulsion Testing Technologies	O2.05
TA14	Thermal Management Systems	Spacecraft and Platform Subsystems	Thermal Control Systems (for Science Spacecraft)	S3.02
TA14	Thermal Management Systems	Cryogenic Propellant Storage and Transfer	Cryogenic Fluid Management Technologies	X10.01
TA14	Thermal Management Systems	Entry, Descent and Landing (EDL) Technology	Ablative Thermal Protection Systems	X9.01
		Aviation Safety	Aviation External Hazard Sensor Technologies	A1.01
		Aviation Safety	Inflight Icing Hazard Mitigation Technology	A1.02
		Aviation Safety	Durable Propulsion Components	A1.03
		Aviation Safety	Airframe Design and Sustainment	A1.04
		Aviation Safety	Sensing and Diagnostic Capabilities for Degradation in Aircraft Materials and Structures	A1.05

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		Aviation Safety	Propulsion Health State Assessment and Management	A1.06
		Aviation Safety	Avionics Health State Assessment and Management	A1.07
		Aviation Safety	Crew Systems Technologies for Improved Aviation Safety	A1.08
		Aviation Safety	Integrated Vehicle Dynamics Modeling Methods for LOC Conditions	A1.09
		Aviation Safety	Advanced Dynamic Testing Capability for Abnormal Flight Conditions	A1.10
		Aviation Safety	Transport Aircraft Simulator Motion Fidelity For Abnormal Flight Conditions	A1.11
		Aviation Safety	Propulsion System Performance Prediction for Integrated Flight and Propulsion Control	A1.12
		Aviation Safety	Advanced Upset Protection System	A1.13
		Aviation Safety	Detection, Identification, and Mitigation of Sensor Failures	A1.14
		Aviation Safety	Unmanned Vehicle Design for Loss-of-Control Flight Research	A1.15
		Aviation Safety	Validation Methods for Safety-Critical Systems Operating under LOC Conditions	A1.16
		Aviation Safety	Data Mining and Knowledge Discovery	A1.17
		Aviation Safety	Prognostics and Decision Making	A1.18
		Aviation Safety	Technologies for Improved Design and Analysis of Safety-Critical Dynamic Systems	A1.19
		Aviation Safety	Verification and Validation of Flight-Critical Systems	A1.20
		Fundamental Aeronautics	Materials and Structures for Future Aircraft	A2.01
		Fundamental Aeronautics	Combustion for Aerospace Vehicles	A2.02
		Fundamental Aeronautics	Aero-Acoustics	A2.03
		Fundamental Aeronautics	Aeroelasticity	A2.04
		Fundamental Aeronautics	Aerodynamics	A2.05
		Fundamental Aeronautics	Aerothermodynamics	A2.06
		Fundamental Aeronautics	Flight and Propulsion Control and Dynamics	A2.07
		Fundamental Aeronautics	Aircraft Systems Analysis, Design and Optimization	A2.08
		Fundamental Aeronautics	Rotorcraft	A2.09

		Fundamental Aeronautics	Propulsion Systems	A2.10
		Airspace Systems	Concepts and Technology Development (CTD)	A3.01
		Airspace Systems	Systems Analysis Integration Evaluation (SAIE)	A3.02
		Aeronautics Test Technologies	Ground Test Techniques and Measurement Technology	A4.01
		Aeronautics Test Technologies	Flight Test Techniques and Measurement Technology	A4.02
		Integrated System Research Project (ISRP)	UAS Integration in the NAS	A5.01