Your place on the team

Strategic Alignment of your Research Interest to SBIR/STTR Subtopics

Mike Vinje
Center Technology Transfer Lead (CTTL)
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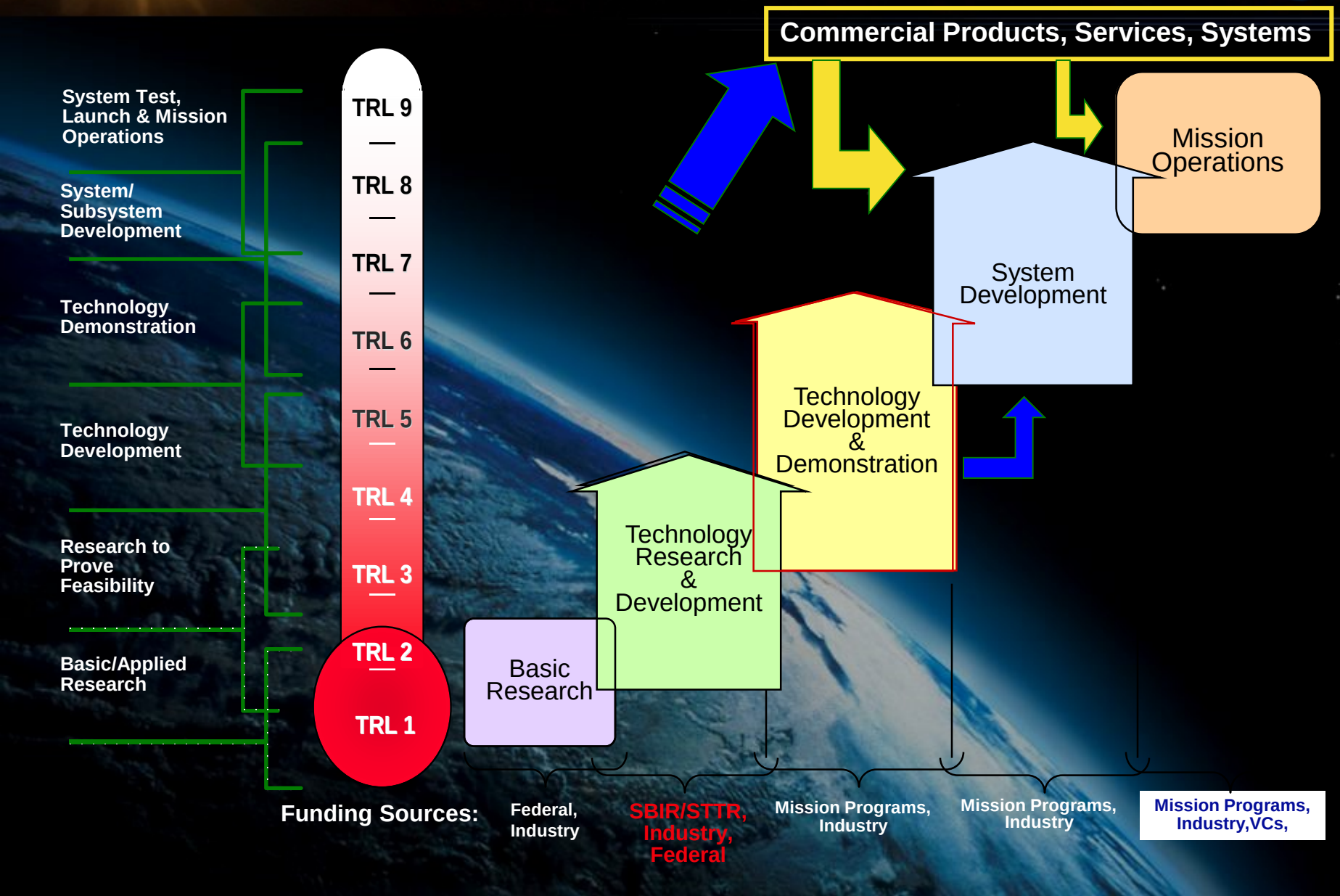
Technology Readiness Levels

Follow-on development, investment and use



How does participation help my Research Interests?

- Seed funding for technology development
- Pathway for commercialization
- Credentials and Government Contracting Experience
- Access to the Federal R&D marketplace
  - Sole source of that technology for Government programs
  - Visibility to prime contractors

Why do small businesses benefit from research partners?

- Visibility into the latest related research
- Access to research facilities and personnel
- Partnering for technical papers and future proposals
- Results verified by laboratory testing
- Growth within a technology ecosystem

Get started with these two tasks

- Build your team
  - Find several small technology businesses that are in the same research fields as you
  - Jointly discuss the upcoming SBIR/STTR opportunities
  - Submit one or more proposals

- Find the best topics to target
  - Identify all of the best SBIR/STTR opportunities for you
  - Maximize your return on investment (ROI)

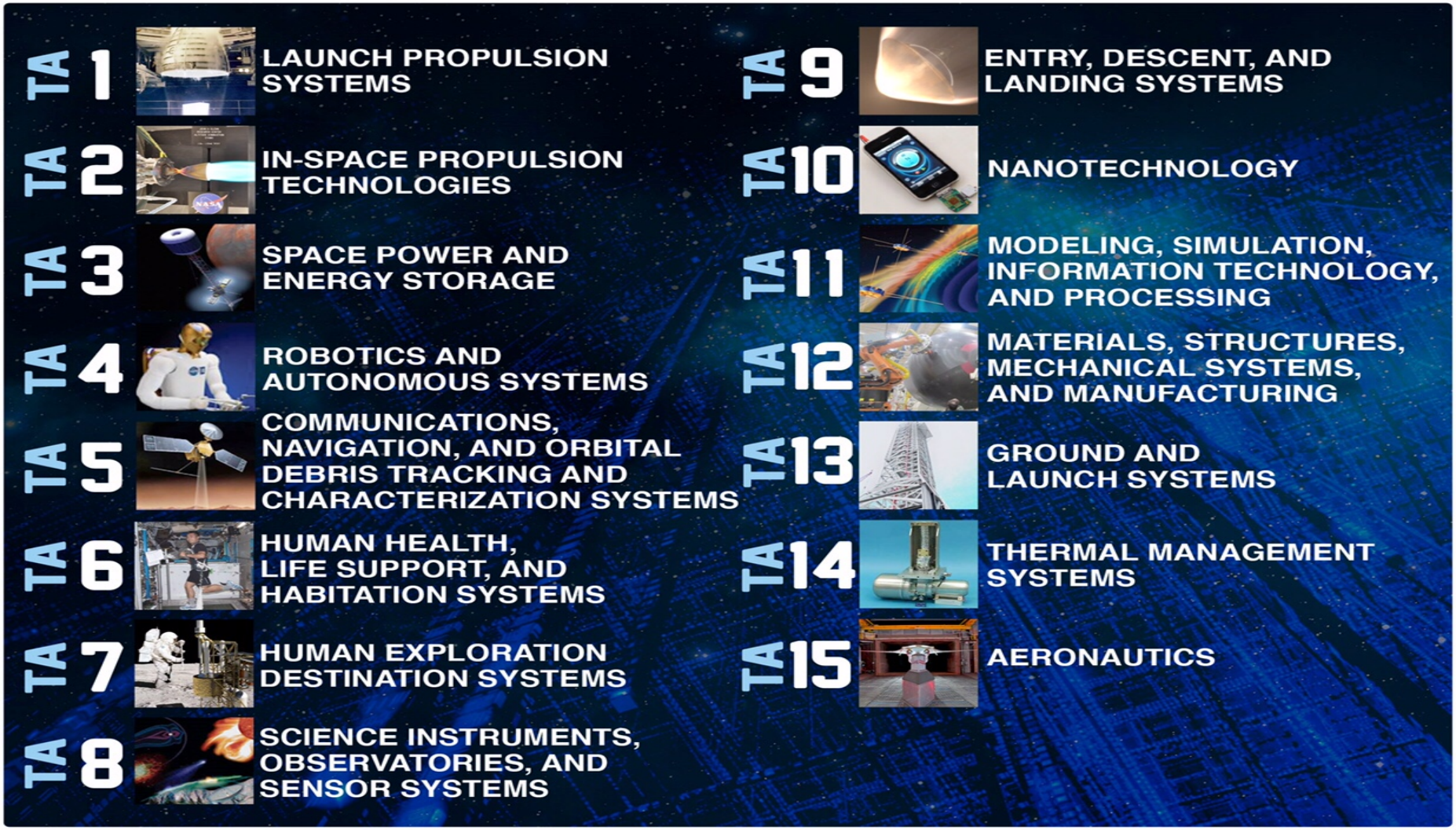
SBIR/STTR is about Problem Solving

- You are being asked to solve the government's problems by developing new technology

- Learn more about these problems
  - Review the publically available information released by that Agency
  - NASA Strategic Technology Documents:

  http://www.nasa.gov/offices/oct/home/roadmaps/index.html

Space Technology Needs



Policies and Strategies :http://www.nasa.gov/directorates/spacetech/about_us/resources/index.html

Understanding Science Needs

- In Science – “Decadal Surveys” and NASA-developed implementation documents
  - Planetary Science
    - http://solarsystem.nasa.gov/multimedia/download-detail.cfm?DL_ID=742
  - Astronomy and Astrophysics
    - http://science.nasa.gov/astrophysics/special-events/astro2010-astronomy-and-astrophysics-decadal-survey/
    - Heliophysics (Solar and Space Physics)
    - http://www.nap.edu/catalog.php?record_id=13060
    - http://www.nasa.gov/mission_pages/sunearth/news/decadal-2012.html
    - http://science.nasa.gov/media/medialibrary/2010/03/31/Heliophysics_Roadmap_2009_tagged-quads.pdf
  - Earth Science
    - http://science.nasa.gov/earth-science/decadal-surveys/
    - http://esto.nasa.gov/

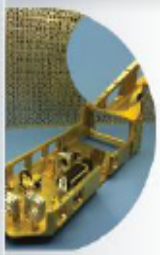
Understanding Human Exploration Needs

- In Human Exploration and Operations Mission Directorate
  - https://www.nasa.gov/sites/default/files/atoms/files/heomd2015goals.pdf
  - http://www.nasa.gov/sites/default/files/files/FY2014_NASA_SP_508c.pdf
- In Aeronautics Research
  - National Aeronautics R&D Plan
    - http://www.whitehouse.gov/sites/default/files/microsites/ostp/aero-rdplan-2010.pdf
  - Various Detailed NASA Aeronautics Research documents
    - http://www.aeronautics.nasa.gov/programs.htm

Space Technology Future Thrust Areas

High Power Solar Electric Propulsion

Deep space human exploration, science missions and commercial applications with investments in advanced solar arrays, high-power Hall thrusters and power processing units.



Space Optical Comm.

Substantially increase the available bandwidth for near Earth space communications currently limited by power and frequency allocation restrictions, and increase the communications throughput for deep space mission.

Advanced life Support & Resource Utilization

Technologies for human exploration mission including Mars atmospheric In-situ resource utilization, near closed loop air revitalization and water recovery, EVA gloves and radiation protection.

Mars Entry Descent and Landing Systems

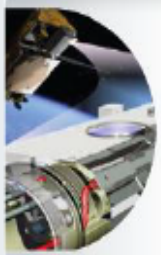
Permits more capable science missions, eventual human missions to mars including, hypersonic and supersonic aerodynamic decelerators, a new generation of compliant TPS materials, retro-propulsion technologies, instrumentation and modeling capabilities.

Space Robotic Systems

Creates future humanoid robotics, autonomy and remote operations technologies to substantially augments the capability of future human space flight missions.

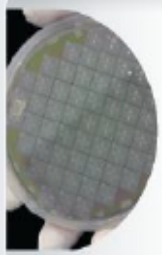
Lightweight Space Structures

Targets substantial increases in launch mass, and allow for large decreases in needed structural mass for spacecraft and in-space structures.



Deep Space Navigation

Allows for more capable science and human exploration missions using advanced atomic clocks, x-ray detectors and fast light optical gyroscopes.



Space Observatory Systems

Allows for significant increases in future science capabilities including, AFTA/WFIRST coronagraph technology to characterize exo-planets by direct observation and advances in the surface materials as well as control systems for large space optics.

SBIR & STTR Topic Areas

Small Business Innovation Research (SBIR)

Aeronautics Research Mission Directorate (ARMD)

- Topic A1 Aviation Safety
- Topic A2 Unmanned Aircraft Systems
- Topic A3 Air Vehicle Technology
- Topic A4 Ground and Flight Test Techniques and Measurement

Human Exploration and Operations Mission Directorate (HEOMD)

- Topic H1 In-Situ Resource Utilization
- Topic H2 Space Transportation
- Topic H3 Life Support and Habitation Systems
- Topic H4 Extra-Vehicular Activity Technology
- Topic H5 Lightweight Spacecraft Materials and Structures
- Topic H6 Autonomous & Robotic Systems
- Topic H7 Entry, Descent, and Landing Technologies
- Topic H8 High Efficiency Space Power Systems
- Topic H9 Space Communications and Navigation (SCaN)
- Topic H10 Ground Processing & ISS Utilization
- Topic H11 Radiation Protection
- Topic H12 Human Research and Health Maintenance
- Topic H13 Non-Destructive Evaluation

Science Operations (SMD)

- Topic S1 Sensors, Detectors and Instruments
- Topic S2 Advanced Telescope Systems
- Topic S3 Spacecraft and Platform Subsystems
- Topic S4 Robotic Exploration Technologies
- Topic S5 Information Technologies

Space Technology (STMD)

- Topic Z1 Space Technology for Cross-Cutting Applications Topic
- Topic Z2 Cross Cutting Advanced Manufacturing Processes for Large Scale Bulk Metallic Glass Systems for Aerospace Applications

Small Business Technology Transfer (STTR)

- Topic T1 Launch Propulsion Systems
- Topic T2 In-Space Propulsion Technologies
- Topic T3 Space Power and Energy Storage
- Topic T4 Robotics, Tele-Robotics and Autonomous Systems
- Topic T5 Communication and Navigation
- Topic T6 Human Health, Life Support and Habitation Systems
- Topic T7 Human Exploration Destination Systems
- Topic T8 Science Instruments, Observatories and Sensor Systems
- Topic T9 Entry, Descent and Landing Systems
- Topic T10 Nanotechnology
- Topic T11 Modeling, Simulation, Information Technology and Processing
- Topic T12 Materials, Structures, Mechanical Systems and Manufacturing
- Topic T13 Ground and Launch Systems Processing
- Topic T14 Thermal Management Systems
- Topic T15 Aeronautics

Alignment of Research to SBIR/STTR Funding

Remember…Government is a whole new language

- SBIR/STTR Subtopics do not directly align with fields of research
  - Subtopics often pose the research problem without dictating the relevant sciences involved
  - This allows proposers to suggest nontraditional approaches
- Subtopics are written from the perspective of the Government user
  - May utilize terminology that differs from your field to describe similar needs

Previous Year's Solicitation

- Search for "NASA SBIR", click on solicitation tab at top
- http://sbir.gsfc.nasa.gov/solicit-detail/56329

National Aeronautics and Space Administration

SMALL BUSINESS INNOVATION RESEARCH (SBIR) & SMALL BUSINESS TECHNOLOGY TRANSFER (STTR)

Fiscal Year 2016 General Solicitation

Opening Date: November 12, 2015
Closing Date: February 1, 2016

Appendix C: SBIR/STTR and the Space Technology Roadmaps

Research and technology topics/subtopics for the SBIR Program are 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.

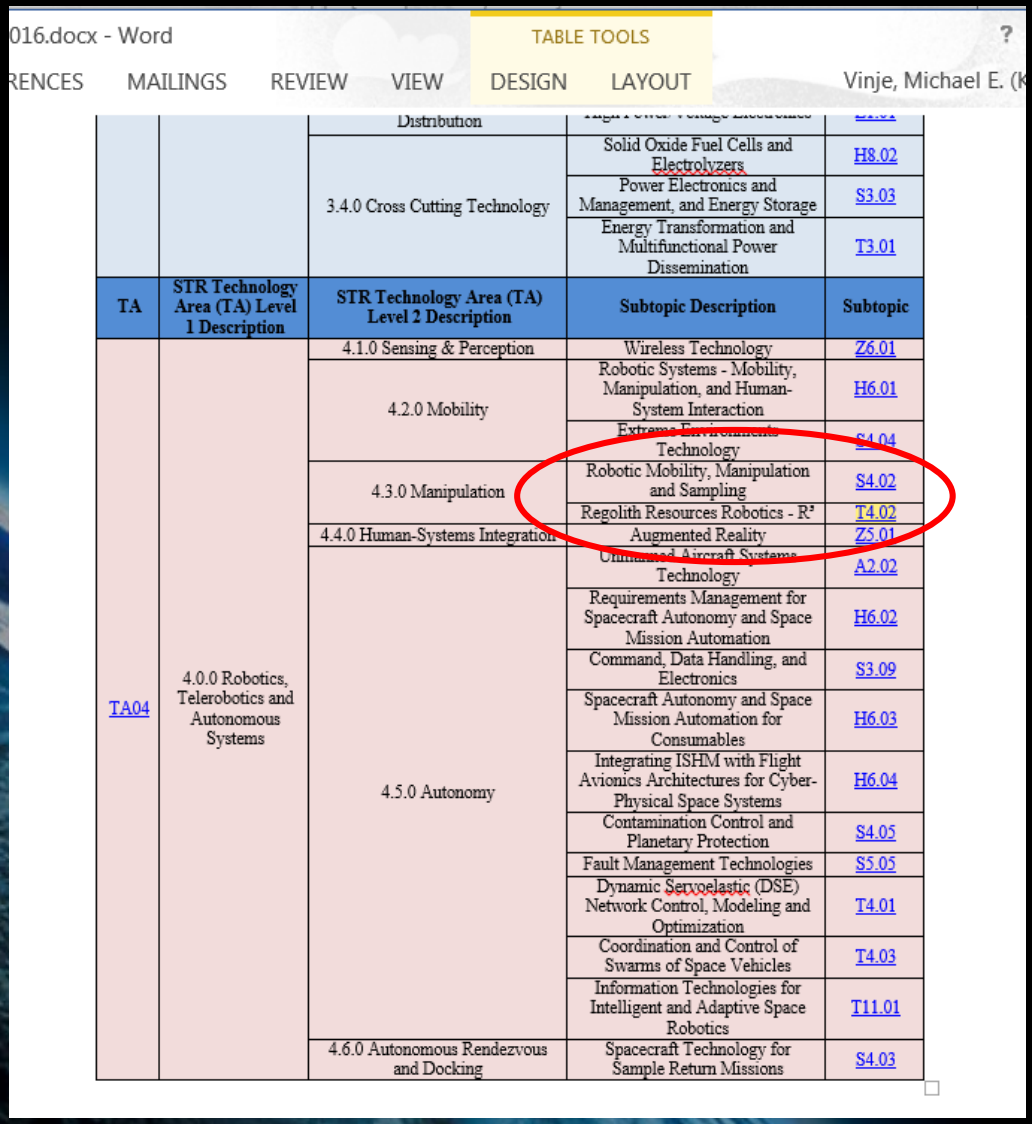
The following table relates these SBIR/STTR topics and subtopics to the Technology Area Breakdown Structure (TABS) in the Space Technology Roadmaps (STR). The table is organized by the OCT Technology Area level one (first column) and level 2 (third column), with the related SBIR Select subtopic description (fourth column) and subtopics ID (fifth column) listed as well. The Aeronautics area is included for completeness, though this is beyond the scope of the STR.

TA	STR Technology Area (TA) Level 1 Description	STR Technology Area (TA) Level 2 Description	Subtopic Description	Subtopic
TA01	1.0.0 Launch Propulsion Systems	1.2.0 Liquid Rocket Propulsion Systems	Detailed Multiphysics Propulsion Modeling & Simulation Through Coordinated Massively Parallel Frameworks	T1.02
		1.3.0 Air Breathing Propulsion Systems	Propulsion Efficiency - Turbomachinery Technology for Reduced Fuel Burn	A1.07
		1.5.0 Unconventional/Other Propulsion Systems	Terrestrial and Planetary Balloons	S3.06
			Affordable Nano/Micro Launch Propulsion Stages	T1.01
TA	**STR Technology Area (TA) Level 1 Description**	**STR Technology Area (TA) Level 2 Description**	**Subtopic Description**	**Subtopic**
TA02	2.0.0 In-Space Propulsion Technologies	2.1.0 Chemical Propulsion	Low Emissions/Clean Power - Combustion Technology/Emissions Measurement Techniques	A1.03
			LOX/Methane In-Space Propulsion	H2.01
			Cryogenic Fluid Management for In-Space Transportation	H2.04
		2.2.0 Non-Chemical Propulsion	Nuclear Thermal Propulsion (NTP)	H2.02
			High Power Electric Propulsion	H2.03
			Propulsion Systems for Robotic Science Missions	S3.02
TA	**STR Technology Area (TA) Level 1 Description**	**STR Technology Area (TA) Level 2 Description**	**Subtopic Description**	**Subtopic**
TA03	3.0.0 Space Power and Energy Storage	3.1.0 Power Generation	Thermal Energy Conversion	H8.01
			Advanced Photovoltaic Systems	H8.03
			Power Generation and Conversion	S3.01
			Self-Powered, Ultra-Miniature	

Example: Search for Robotics

Researcher is interested in subtopics that involve mobile robotics

- Robotics, Telerobotics and Autonomous Systems is Within Technology Area 4 (TA4)
- Under 4.3.0 Manipulation is Robotic Mobility, Manipulation, and Sensing
- STTR Subtopic T4.02: Regolith Resource Robotics – R4 (next page)



		Distribution		
		3.4.0 Cross Cutting Technology	Solid Oxide Fuel Cells and Electrolyzers	H8.02
			Power Electronics and Management, and Energy Storage	S3.03
			Energy Transformation and Multifunctional Power Dissemination	T3.01
TA	**STR Technology Area (TA) Level 1 Description**	**STR Technology Area (TA) Level 2 Description**	**Subtopic Description**	**Subtopic**
TA04	4.0.0 Robotics, Telerobotics and Autonomous Systems	4.1.0 Sensing & Perception	Wireless Technology	Z6.01
		4.2.0 Mobility	Robotic Systems - Mobility, Manipulation, and Human-System Interaction	H6.01
			Extreme Environments Technology	S4.04
		4.3.0 Manipulation	Robotic Mobility, Manipulation and Sampling	S4.02
			Regolith Resources Robotics - R²	T4.02
		4.4.0 Human-Systems Integration	Augmented Reality	Z5.01
		4.5.0 Autonomy	Unmanned Aircraft Systems Technology	A2.02
			Requirements Management for Spacecraft Autonomy and Space Mission Automation	H6.02
			Command, Data Handling, and Electronics	S3.09
			Spacecraft Autonomy and Space Mission Automation for Consumables	H6.03
			Integrating ISHM with Flight Avionics Architectures for Cyber-Physical Space Systems	H6.04
			Contamination Control and Planetary Protection	S4.05
			Fault Management Technologies	S5.05
			Dynamic Servoelastic (DSE) Network Control, Modeling and Optimization	T4.01
			Coordination and Control of Swarms of Space Vehicles	T4.03
			Information Technologies for Intelligent and Adaptive Space Robotics	T11.01
		4.6.0 Autonomous Rendezvous and Docking	Spacecraft Technology for Sample Return Missions	S4.03

T4.02 Regolith Resource Robotics

T4.02 Regolith Resources Robotics - R^3

Lead Center: KSC

Participating Center(s): ARC, LaRC

- The use of robotics for In-Situ Resource Utilization (ISRU) in outer space on various planetary bodies is essential since it uses large quantities of regolith that must be acquired and processed. In some cases this will happen while the crew is not there yet, or it will take place at a remote destination where the crew cannot spend much time due to radiation exposure limits (Asteroids, Mar's Moons & NEO's). Communications latencies of greater than 40 minutes at Asteroids mandate autonomous robotics applications. Proposals are sought which provide solutions for the following space resource related technology area:

Asteroid Resource Prospecting and Characterization

- The first step towards using resources derived from small bodies in space, such as water, volatiles, metals and organic compounds is to visit the Near Earth Object (NEO) target body and prospect it with sample acquisition devices and subsequently do characterization of these samples. Proposals are sought for innovative resource prospecting mission concepts and associated technology demonstrations such as autonomous small marsupial free flier prospector spacecraft that can sample an asteroid, comet or Mars moon and transport the sample back to a locally orbiting spacecraft with an associated suite of characterization instruments for analysis.

T4.02 Regolith Resource Robotics (cont'd)

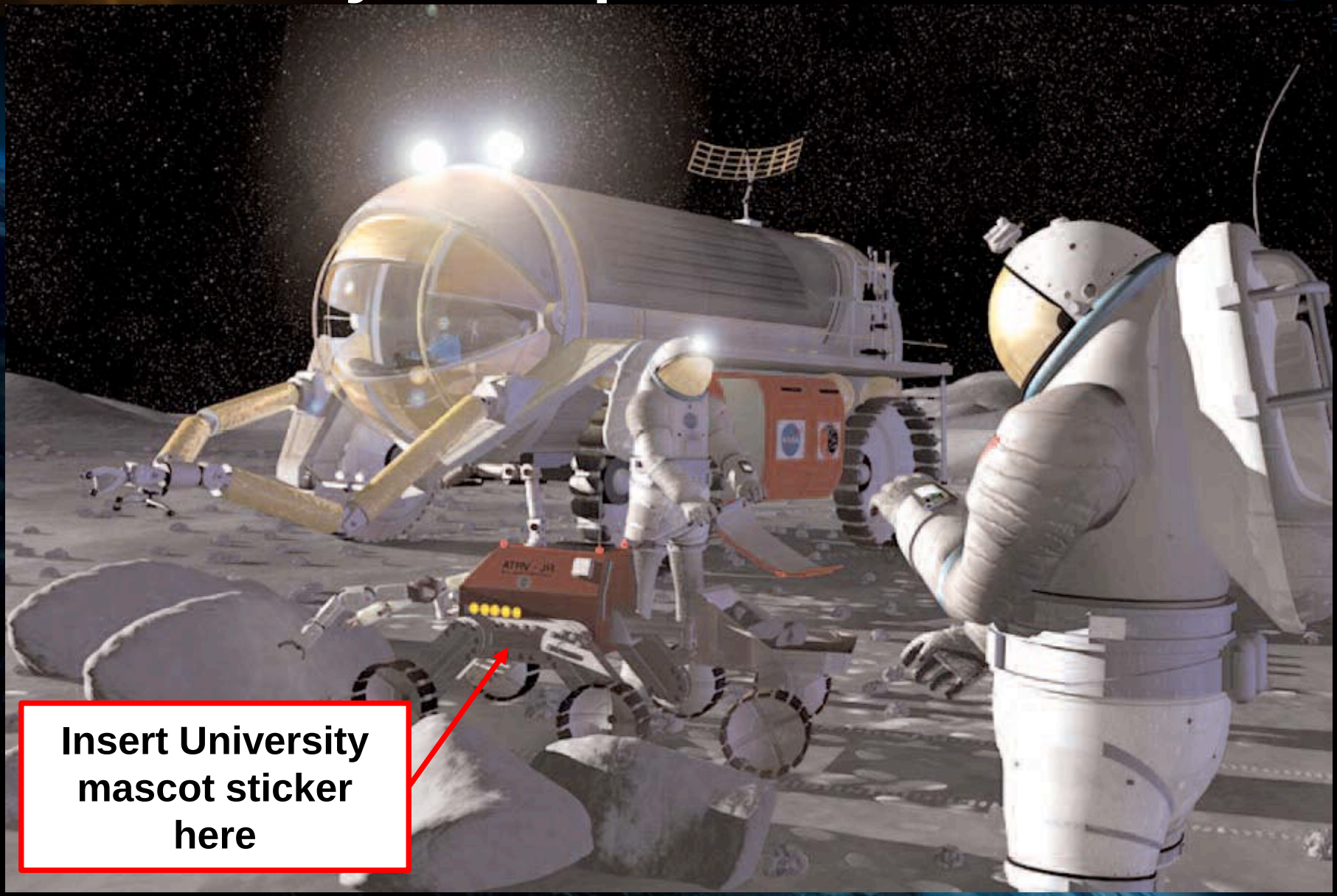
- Proposals are sought for innovative resource prospecting mission concepts, technology development, and demonstrations.

- Technologies include sample acquisition methods and devices, regolith anchoring methods, autonomous conops, sub-surface access, excavation, specialized sensors, dust lofting mitigation, perception in dusty environments, mobility methods, surveying, remote sample characterization, geodetic mapping, replenishing and transferring robotic commodities such as propellants, electric power, data transfer, pneumatics and robust interfaces for commodity transfer.

- Future prospecting missions include:

- Water/Ice on Mars, Mars moons or Earth's Moon.
- Micro-gravity Near Earth Object (NEO) operations to prospect/sample surface resources.
- Lava tubes/shadowed crater cold traps on planetary surfaces to characterize volatiles accumulation.

Ready to be part of the team?



Resources

Learn about your customer and their problems

- Regardless of who your customer is, do the research to understand what information they have made available
- Learn their “language” and how they refer to technologies within your research areas

NASA Technology Roadmaps

http://www.nasa.gov/offices/oct/home/roadmaps/index.html

http://techport.nasa.gov

- Recently opened to the public
- Comprehensive resource for locating information about NASA-funded technology development activities
- 1,200 active technology development programs
- Thousands of historical records
- Equipped with extensive search capabilities

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