Lead Outcome #1

Advance US space technology innovation and competitiveness in a global context

August 2023

STMD Strategic Framework

THRUSTS		OUTCOMES	CAPABILITIES
Lead **Ensuring American global leadership in space technology** • Advance US space technology innovation and competitiveness in a global context • Encourage technology driven economic growth with an emphasis on the expanding space economy • Inspire and develop a diverse and powerful US aerospace technology community	 **Go** **Rapid, Safe, & Efficient Space Transportation**	• Develop nuclear technologies enabling fast in-space transits. • Develop cryogenic storage, transport, and fluid management technologies for surface and in-space applications. • Develop advanced propulsion technologies that enable future science/exploration missions.	• Nuclear Systems • Cryogenic Fluid Management • Advanced Propulsion
	 **Land** **Expanded Access to Diverse Surface Destinations**	• Enable Lunar/Mars global access with ~20t payloads to support human missions. • Enable science missions entering/transiting planetary atmospheres and landing on planetary bodies. • Develop technologies to land payloads within 50 meters accuracy and avoid landing hazards.	• Entry, Descent, Landing, & Precision Landing

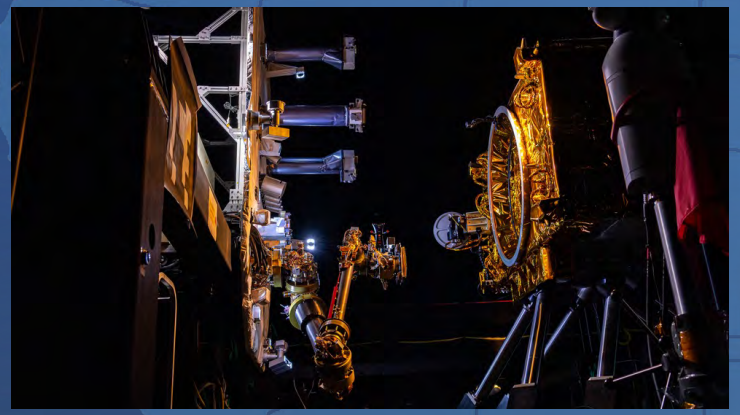
	 **Live**
	Sustainable Living and Working Farther from Earth
		• Develop exploration technologies and enable a vibrant space economy with supporting utilities and commodities
		  • Sustainable power sources and other surface utilities to enable continuous lunar and Mars surface operations.
		  • Scalable ISRU production/utilization capabilities including sustainable commodities on the lunar & Mars surface.
		  • Technologies that enable surviving the extreme lunar and Mars environments.
		  • Autonomous excavation, construction & outfitting capabilities targeting landing pads/structures/habitable buildings utilizing in situ resources.
		• Enable long duration human exploration missions with Advanced Habitation System technologies.
			• Advanced Power
			• In-Situ Resource Utilization
			• Advanced Thermal
			• Advanced Materials, Structures, & Construction
			• Advanced Habitation Systems

	 **Explore** **Transformative Missions and Discoveries**	• Develop next generation high performance computing, communications, and navigation. • Develop advanced robotics and spacecraft autonomy technologies to enable and augment science/exploration missions. • Develop technologies supporting emerging space industries including: Satellite Servicing & Assembly, In Space/Surface Manufacturing, and Small Spacecraft technologies. • Develop vehicle platform technologies supporting new discoveries. • Develop technologies for science instrumentation supporting new discoveries. • Develop transformative technologies that enable future NASA or commercial missions and discoveries	• Advanced Avionics Systems • Advanced Communications & Navigation • Advanced Robotics • Autonomous Systems • Satellite Servicing & Assembly • Advanced Manufacturing • Small Spacecraft • Rendezvous, Proximity Operations & Capture • Sensor & Instrumentation

Lead

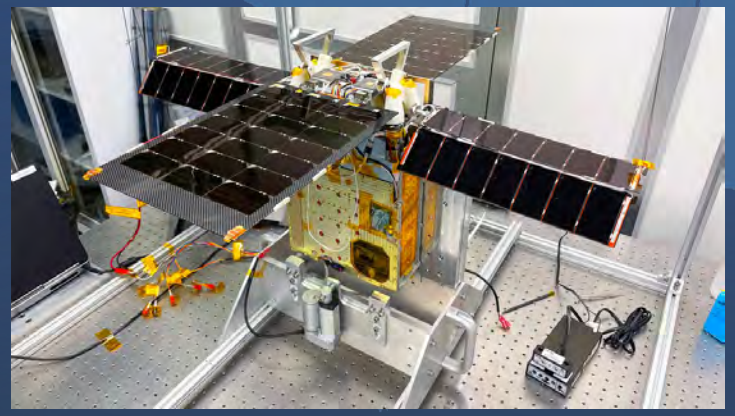
Ensuring American global leadership in space technology

Outcome 1: Advance US space technology innovation and competitiveness in a global context



Address National Aerospace Challenges

Enable Rapid and Efficient Technology Development



Take Risks

Capture and Disseminate Knowledge

Objective 1: Address National Aerospace Challenges

Mitigate community-wide technology challenges through the development and infusion of knowledge and technologies at the component and system level

Rationale

- ✓ Emphasis on finding the technical difficulties keeping US space economy from moving forward in a given discipline area by focusing on and solving challenges. PTs and SCLs are currently working to find these kinds of problems through engagement with NASA and the US Space Economy and by aligning with Agency level strategies such as the Moon to Mars Blueprint objectives.
  - ✓ In addition to the gaps identified in the technical envisioned future priorities for GO, LAND, LIVE and EXPLORE, challenges can include focus areas like orbital debris and climate change technology development.
- ✓ Monitoring progress on how well challenges are addressed across numerous investments is a complex task. STMD Capability Reviews will show the progression of how investments are closing gaps, highlight the next area of investment needed, and promote communication between programs.
- ✓ STMD should also emphasize investing in the push technologies that will solve the challenges of tomorrow, not just those that are tied to known architectures.

Proposed Metrics and Activities

- Conduct Capability Area reviews for each Capability Area in GO, LAND, LIVE and EXPLORE.
  - Measure extent to which STMD retires gaps in the STAR Strategic Framework.
  - Measure gap closure rate, first for component level, and then for system level gaps.
- Support Agency strategy with appropriate solicitations and activities.
- Measure alignment of investments to Blueprint Objectives, Strategic Framework, etc. while leaving room for push investments.

Objective 2: Enable Rapid and Efficient Technology Development

Improve efficiency and remove programmatic barriers to enable the rapid development and transition of new aerospace capabilities

Rationale

- ✓ The overarching need is to solicit, propose, evaluate, award, and transition, etc. technology and talent development opportunities as quickly and efficiently as possible. Technology should be ready at the right time to be used by NASA missions and industry.
- ✓ This objective covers many barriers:
  - ✓ Improved methodologies for solicitations
  - ✓ Increased success in program transitions by including next step planning into early formulation

Proposed Metrics and Activities

- Identify transition and infusion need dates for priority technologies and establish transition agreements
- Establish Roadmaps in coordination with other Mission Directorates for priority technologies
- Study the time it takes to close gaps
- Track timeliness from solicitation release to authority to proceed to identify opportunities for streamlining.
- Publish impact stories quarterly to showcase impact of transitions between early stage programs and higher technology maturation programs.
- Track infusions and transitions of STMD investments to other Mission Directorates and outside of NASA

Objective 3: Take Risks

Implement a risk portfolio that provides transformational and revolutionary progress in applied research and technology development while also meeting NASA and Space Economy needs

Rationale

- ✓ STMD's Mission (Rapidly develop, demonstrate, and transfer revolutionary, high-payoff space technologies driven by diverse ideas) calls us to "push" the envelope on cutting edge technologies (revolutionary, high-payoff) while also being responsible to make available needed technologies ("pull") to advance both human exploration and science architectures.
- ✓ To maintain US peer competitiveness and national posture, NASA and STMD will need to take risks. In this context, risks referenced are technical risks, but those also relate to financial and schedule risks.

Proposed Metrics and Activities

- Striking the right balance between low TRL seed investments and higher TRL development is a challenge for any R&D organization. STMD currently has a budget goal of 10% for Early-Stage Innovation and Partnerships Program (excluding SBIR and Tech Transfer) investments. The current investment is 8-9% of total STMD budget.

Objective 4: Capture and Disseminate Knowledge

Pursue a culture of generating and capturing knowledge as well as knowledge management (including documenting, organizing, analyzing, and sharing) to inform and guide national aerospace development goals and capabilities

Rationale

- ✓ STMD has a duty to capture the knowledge generated through the development of technologies and talent and disperse this knowledge for the good of the space community
- ✓ Many efforts are already in place and being expanded upon including sharing of data and closeout information in TechPort and collection of lessons learned. The TechPort Ecosystem provides data management infrastructure to document, organize, analyze, and share investments within STMD and beyond.

Proposed Metrics and Activities

- Public usage of TechPort and its effectiveness in meeting the needs of users.
- Conduct annual Programmatic Lessons Learned sessions to help each Program to learn from each other.
- Tracking of patent and license information for STMD investments in Techport to show conversion of investment to commercialization (*related to LEAD outcome 2)
- Achieve at least 1 knowledge transition for a minimum of 75% of research grants.