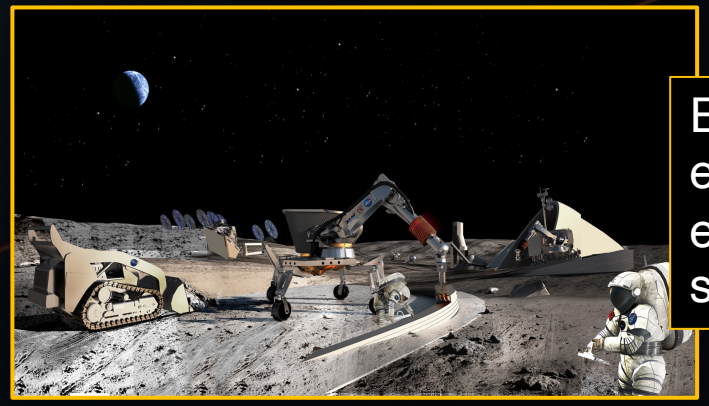
NASA Advisory Council Technology, Innovation & Engineering Committee

Mr. James Reuter | Associate Administrator, Space Technology Mission Directorate | May 16, 2023

Ensuring American Global Leadership in Space Technology

STMD is building upon the Strategic Technology Framework, creating an integrated strategy that shows our investments across technical thrust areas leading to achieving strategic outcomes

Advance U.S. 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 U.S. aerospace technology community

SPACE TECHNOLOGY PORTFOLIO

EARLY STAGE INNOVATION AND PARTNERSHIPS

- Early Stage Innovation
  - Space Tech Research Grants
  - Center Innovation Fund
  - Early Career Initiative
  - Prizes, Challenges & Crowdsourcing
  - NASA Innovation Advanced Concepts
- Technology Transfer

SBIR/STTR PROGRAMS

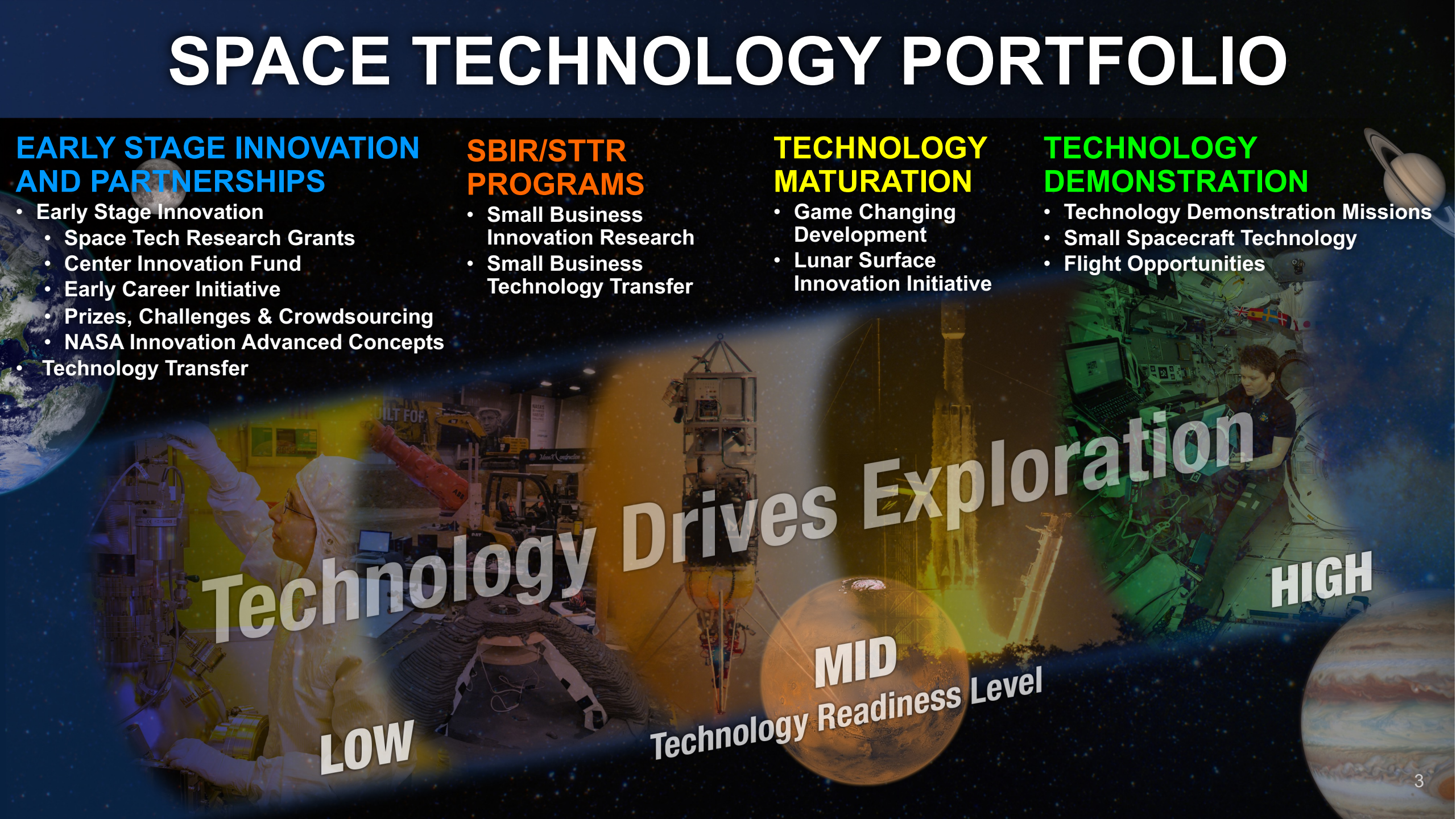
- Small Business Innovation Research
- Small Business Technology Transfer

TECHNOLOGY MATURATION

- Game Changing Development
- Lunar Surface Innovation Initiative

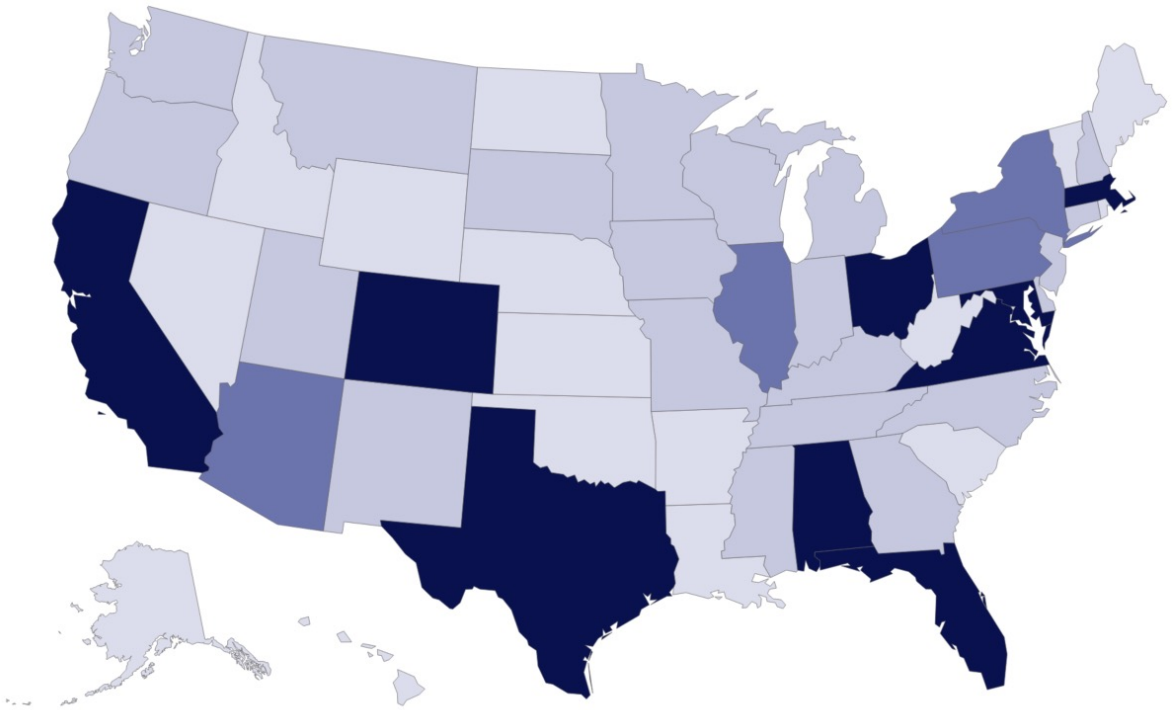
TECHNOLOGY DEMONSTRATION

- Technology Demonstration Missions
- Small Spacecraft Technology
- Flight Opportunities

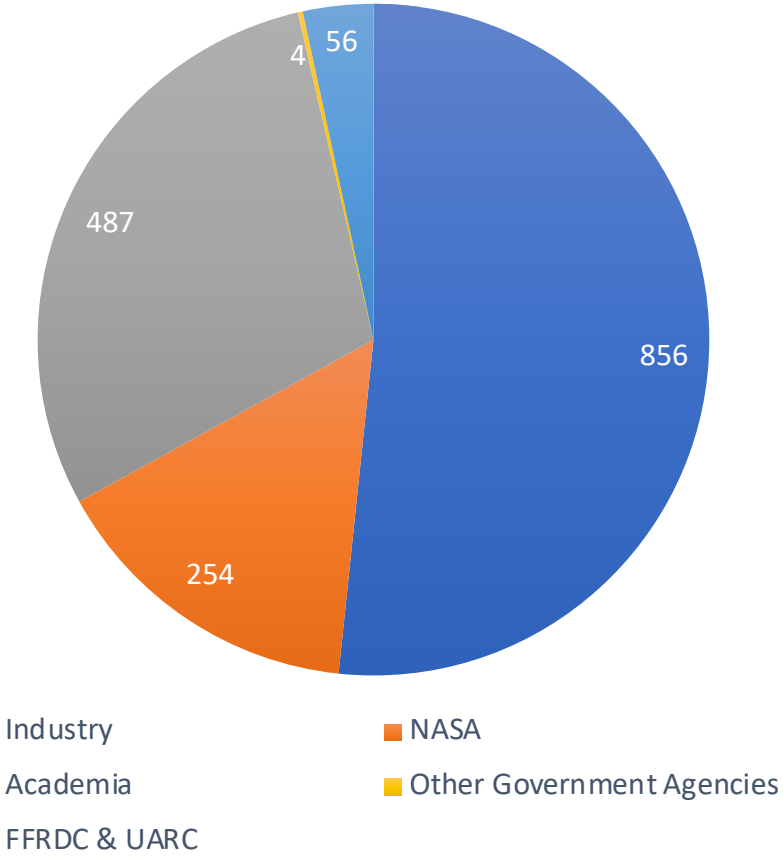


STMD Across the Nation

Space Technology has over 1600 active investments in all 50 states with over 900 unique performing organizations



Number of Investments by Lead Organization Type



Managed by STMD, information on all of NASA's technology investments can be found at techport.nasa.gov

TechPort

STMD FY 2024 PBR Summary ($M)	FY 2022 Actual	FY 2023 Enacted	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028
	1,100.0	1,200.0	1,391.6	1,419.4	1,447.8	1,476.8	1,506.3
SBIR and STTR	**227.0**	**231.7**	**299.9**	**305.9**	**312.0**	**318.2**	**324.6**
Early Stage Innovation and Partnerships	**126.3**	**129.0**	**138.1**	**140.9**	**143.7**	**146.6**	**149.5**
Agency Technology and Innovation	**7.4**	**8.4**	**-**	**-**	**-**	**-**	**-**
Technology Transfer	**19.5**	**21.5**	**22.5**	**23.0**	**23.4**	**23.9**	**24.4**
Early Stage Innovation	**99.4**	**99.1**	**115.6**	**118.0**	**120.3**	**122.7**	**125.1**
Early Stage Innovation and Commerce	1.1	2.9	7.0	7.2	7.4	7.6	7.7
Early Career Initiative (ECI) and Center Innovations Fund (CIF)	23.6	24.4	28.3	28.9	29.4	30.0	30.6
Prizes, Challenges and Crowdsourcing	11.3	11.1	12.0	12.2	12.5	12.7	13.0
NASA Innovative Advanced Concepts (NIAC)	8.1	7.2	9.5	9.7	9.9	10.1	10.3
Space Technology Research Grants (STRG)	55.5	53.5	58.8	59.9	61.1	62.2	63.5
Technology Maturation / Game Changing Development (GCD)	**257.7**	**323.9**	**402.3**	**410.3**	**418.5**	**426.9**	**435.4**
Space Transportation	19.5	17.6	36.7	32.0	30.0	30.0	30.0
Entry, Descent and Landing	30.4	37.8	37.1	21.7	17.9	14.2	14.0
Sustainable Exploration	104.8	131.6	154.8	188.2	197.8	197.7	197.7
Transformative Missions and Discoveries	76.0	62.4	67.7	56.7	55.0	62.0	64.0
Industry & Commerce Innovative Opportunity, Space Tech Management and Integration	121.6	74.4	106.1	111.7	117.8	123.1	129.7
Technology Demonstration	**489.0**	**515.4**	**551.3**	**562.3**	**573.6**	**585.1**	**596.8**
Flight Opportunities and Small Spacecraft Technology	**67.0**	**67.1**	**84.0**	**85.7**	**87.4**	**89.2**	**91.0**
Technology Demonstration Missions (TDM)	**422.0**	**448.3**	**467.3**	**476.6**	**486.2**	**495.9**	**505.8**
On-Orbit Servicing and Manufacturing Demonstration-1 (OSAM-1)	227.0	227.0	227.0	174.5	123.0	28.7	-
Solar Electric Propulsion (SEP)	24.2	18.5	10.8	13.7	7.7	6.4	5.5
Cryogenic Fluid Management (CFM)	60.1	75.0	90.9	99.0	99.0	99.0	99.0
Fission Surface Power	16.9	16.0	84.5	135.8	205.1	309.0	315.4
Space Nuclear Propulsion	49.9	91.3	35.0	35.0	35.0	35.0	35.0
On-Orbit Servicing and Manufacturing Demonstration-2 (OSAM-2)	10.4	2.9	3.3	-	-	-	-
MOXIE, LOFTID, DSOC, LCRD, TDM Selected ACO/TP, TDM Management &	33.5	17.6	15.9	18.6	16.5	16.9	50.9

STMD FY 2023 Appropriations

STMD Appropriations ($M)	FY 2023 PBR	FY 2023 Enacted	Delta from PBR, includes NTP direction
On-Orbit Servicing and Manufacturing Demonstration-1 (OSAM-1)	227.0	227.0	-
Nuclear Thermal Propulsion*	110.0	110.0	
*NTP Flight**	*110.0*	*90.0*	*+80.0M*
Reactor Development	*10.0*	*45.0*	*+80.0M*
Fuel Materials Development		*45.0*	
*NTP Foundational and Non-nuclear Systems Development**	*100.0+*	*20.0*	*-*
SBIR/STTR Statutory Requirements	285.0	285.0**	
All other directions (NEP, Regional Economics, Innovative Nanomaterials, In-Space Additive Manufacturing Capabilities, Lunar Surface power, and Orbital Debris Remediation)	190.0	Up to 202.0	
Remaining STMD Programmatic Content	626.0	376.0	
Total	1,437.9	1,200.0	-318.0M (from PBR, with NTP direction

*Includes CFM

**To be calculated and validated consistent with the Consolidated Appropriations Act, 2023 (H.R. 2617) and the NASA FY 2023 Initial IOP submission.

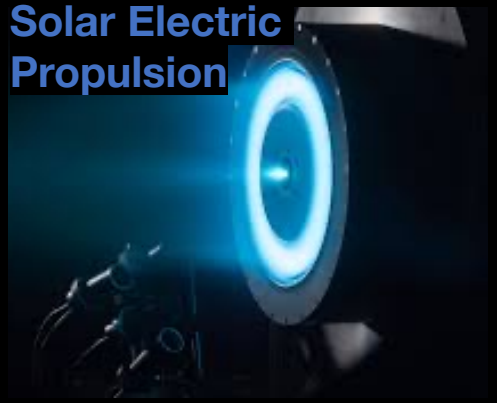
Tech Highlights

Bernard Kutter LOFTID

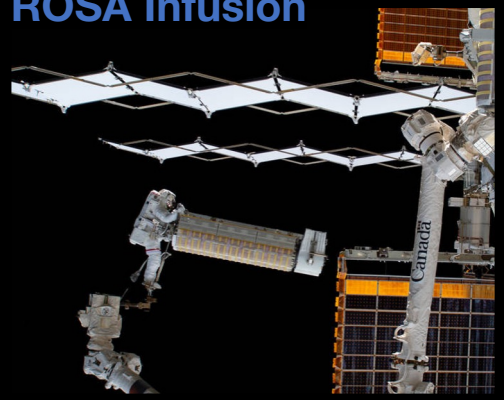
CAPSTONE

TeraByte Infrared Delivery (TBIRD)

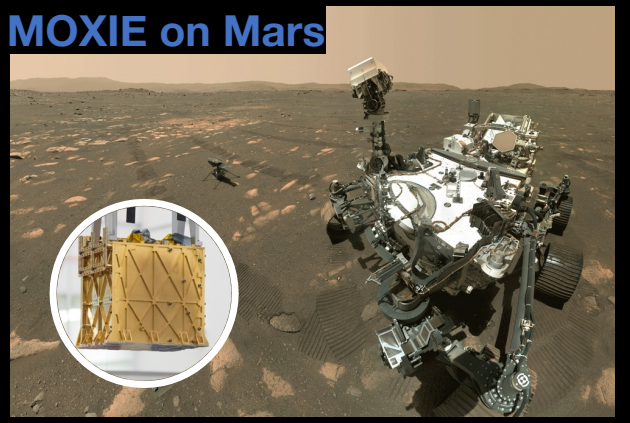
Solar Electric Propulsion



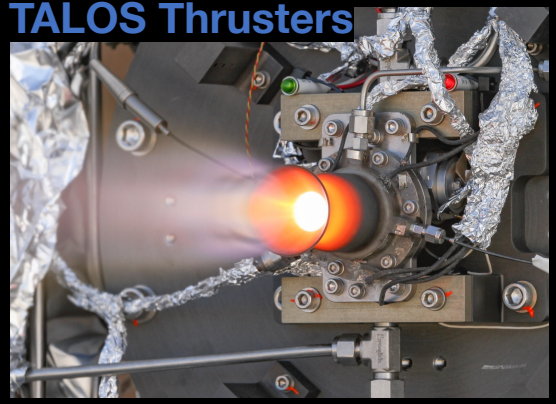
ROSA Infusion



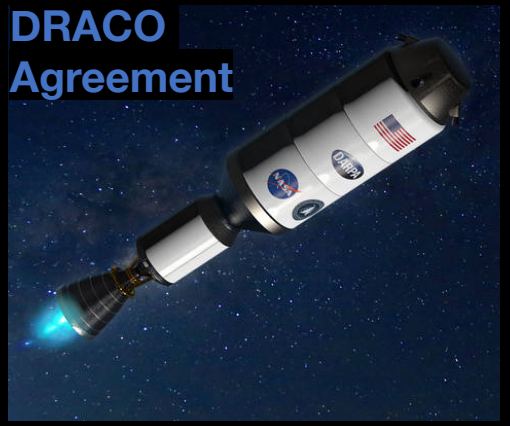
MOXIE on Mars



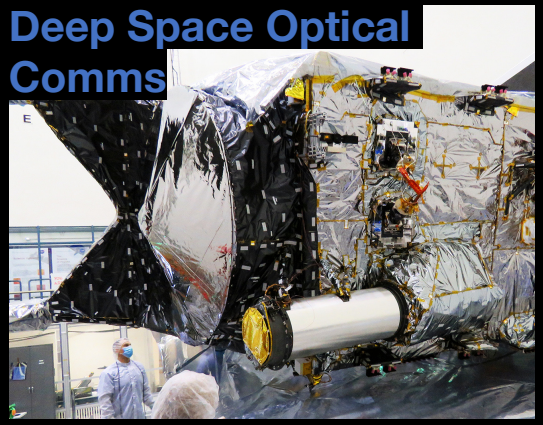
TALOS Thrusters



DRACO Agreement

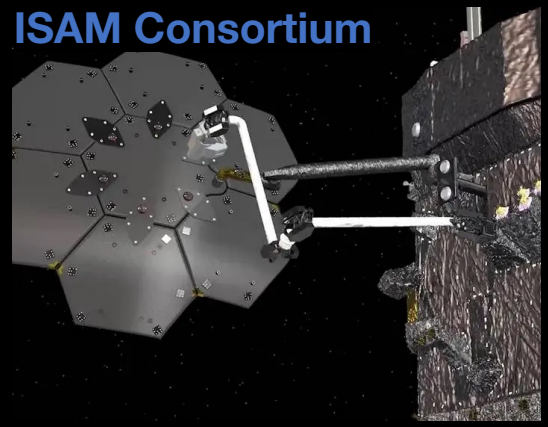


Deep Space Optical Comms



Cryogenic Fluid Management Demos

ISAM Consortium



LOFTID: Initial Post-Flight Results

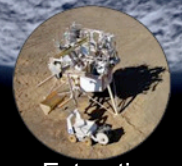
- Initial results indicate LOFTID performed as predicted
- Inflatable structure looks pristine
- Damage to TPS on nose-cap from splashdown
- Aeroshell sensor suite data recovered from internal and ejectable data recorders
- First time recording backshell during entry in video and infrared
- Issue with initial data relay during entry; project is extracting data from secondary source

LOFTID demonstration was successful!

Lunar Surface Technology Demonstration Strategy

Power, ISRU, Autonomy, Robotics, Excavation, Construction

Early lunar surface demonstrations will increase technology readiness for key infrastructure capabilities with opportunities for collaboration with OGAs, industry, academia, and international partners



Oxygen Extraction Ground Demo

IM-2 Demo (on CLPS IDIQ)

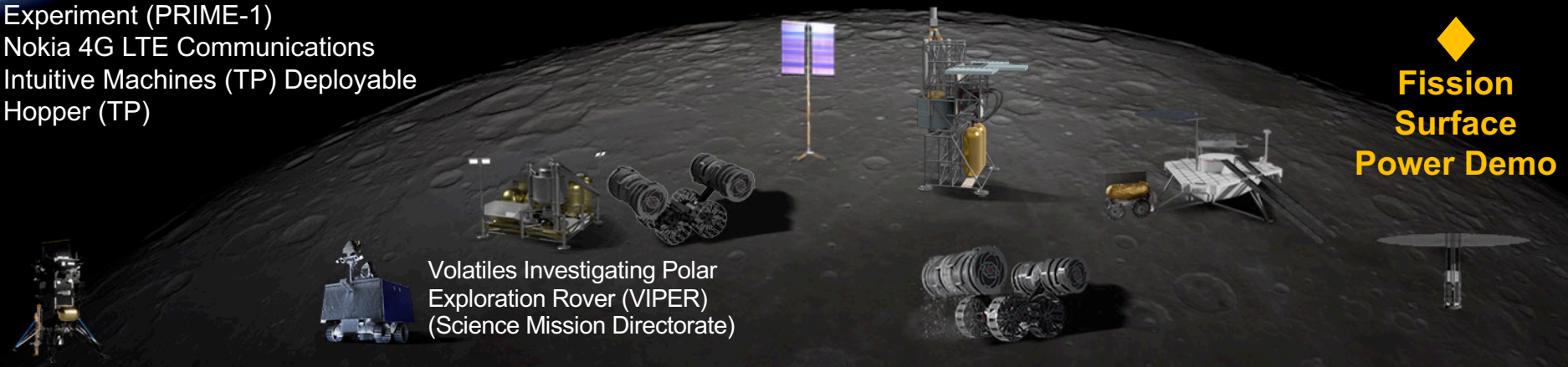
- Polar Resources Ice Mining Experiment (PRIME-1)
- Nokia 4G LTE Communications
- Intuitive Machines (TP) Deployable Hopper (TP)

CT-1 Space Tech CLPS Demo

CT-2 Space Tech CLPS Demo

CT Candidate Technologies (in formulation):

- ISRU Subscale Demo
- Power (e.g. Vertical Solar Array, Power Beaming, Fuel Cells)
- Dust Mitigation
- Autonomy & Robotics (e.g. Mobility, Navigation, etc.)
- Excavation
- Construction



Volatiles Investigating Polar Exploration Rover (VIPER) (Science Mission Directorate)

Fission Surface Power Demo

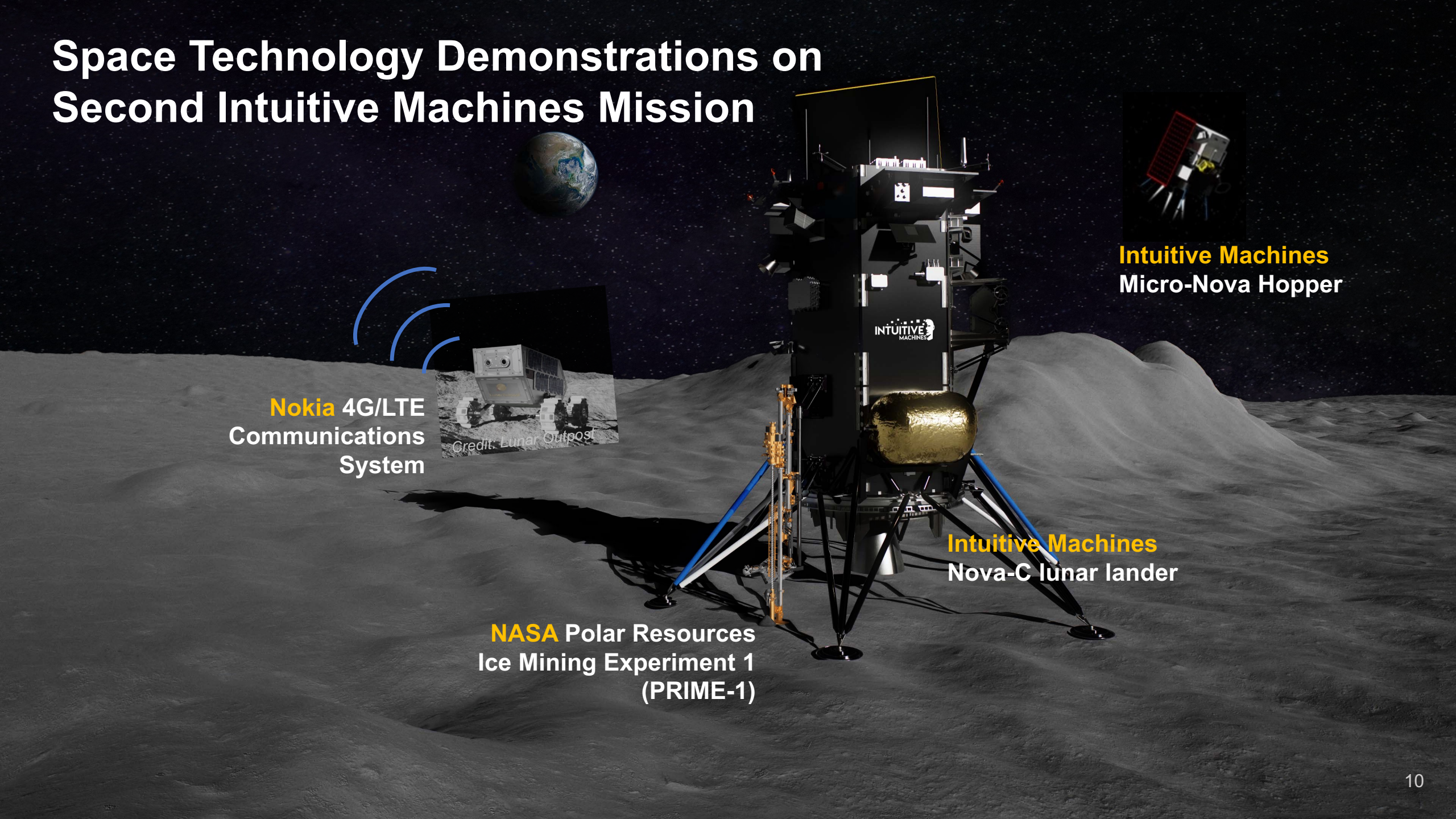
ISRU Pilot Plant

Space Tech Lunar Surface Demo

2023 **2033**

TP = Tipping Point

Space Technology Demonstrations on Second Intuitive Machines Mission



Nokia 4G/LTE Communications System

Intuitive Machines Micro-Nova Hopper

Intuitive Machines Nova-C lunar lander

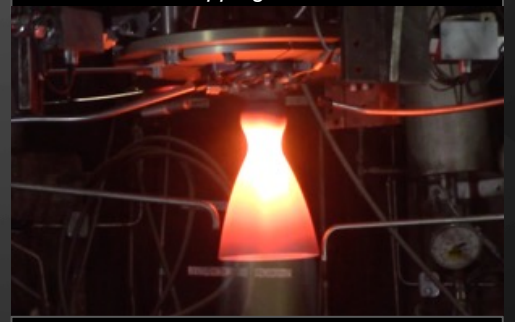
NASA Polar Resources Ice Mining Experiment 1 (PRIME-1)

Other Near-Term Lunar Technology Demos

Early lunar surface demonstrations with Commercial Lunar Payload Services (CLPS) are opportunities to mature the capabilities required for NASA and industry

Astrobotic Peregrine-1 Mission

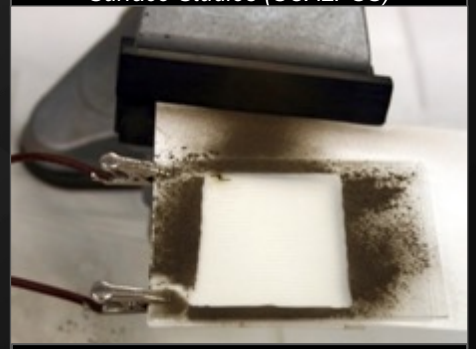
Astrobotic Terrain Relative Navigation – Tipping Point



Thruster for Advancement of Low Temperature Operations in Space (TALOS) – Tipping Point

CLPS 19D Mission (Firefly)

Stereo Camera for Lunar Plume Surface Studies (SCALPSS)



Electrodynamic Dust Shield (EDS)

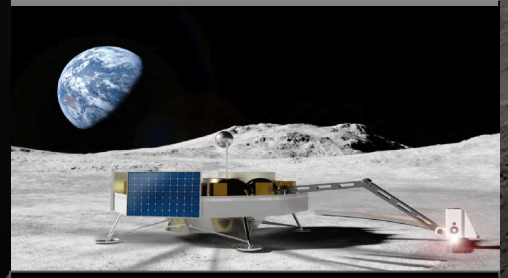
CLPS CP11 Mission (Intuitive Machines)

Cooperative Autonomous Distributed Robotic Explorers (CADRE)

TBD Mission

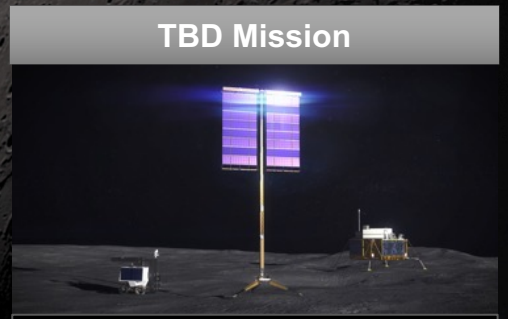
Cold Operable Lunar Deployable Arm (COLDArm)

TBD Mission



Moon-to-Mars Planetary Autonomous Construction Technology (MMPACT)

TBD Mission



Vertical Solar Array Technologies (VSAT)

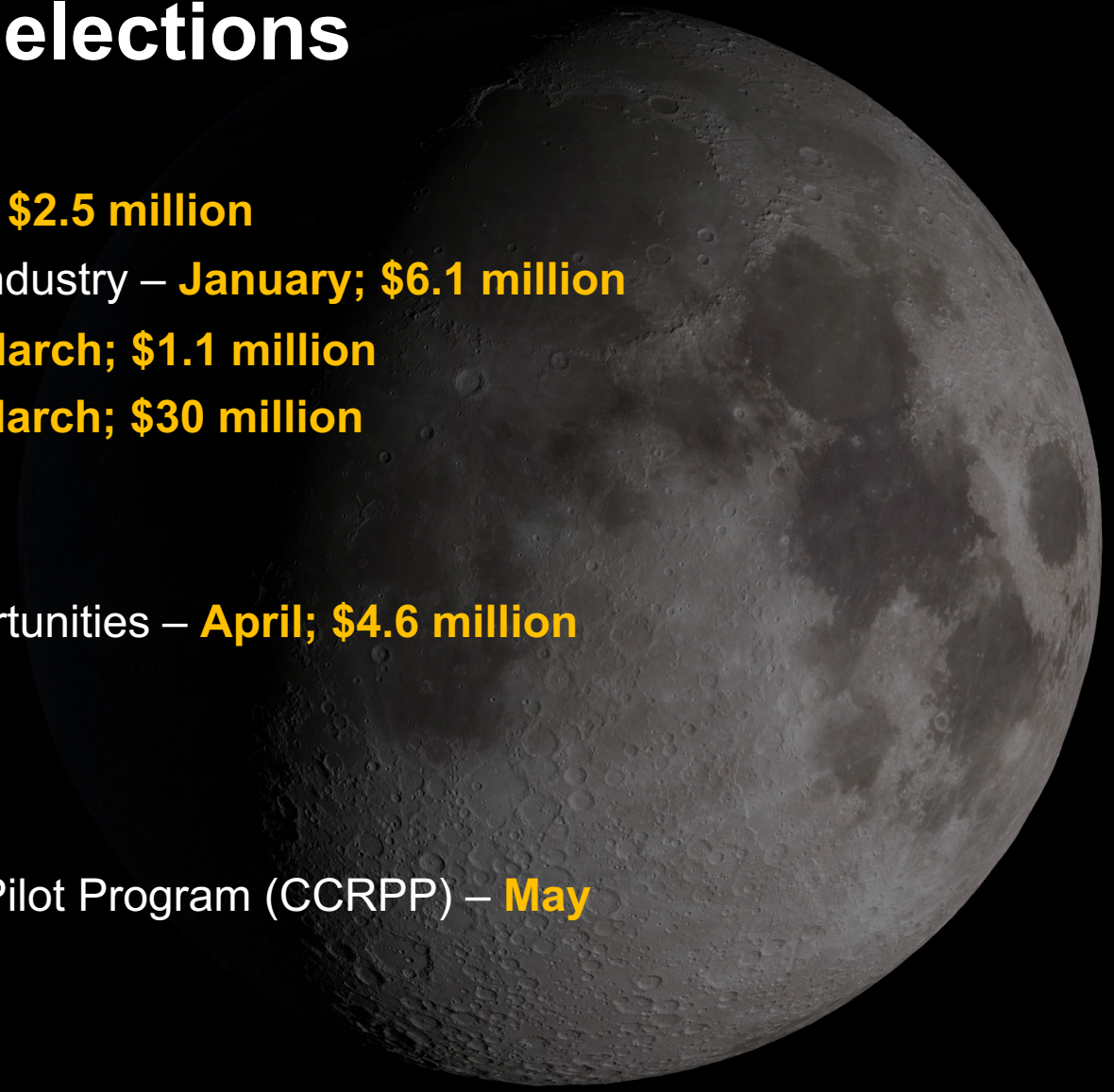
TBD Mission

Planetary and Lunar Environment Thermal Toolbox Elements (PALETTE)

TBD Mission

Space Science Test and Evaluation Facility (SSTEF-1) – Tipping Point

Recent & Upcoming STMD Selections



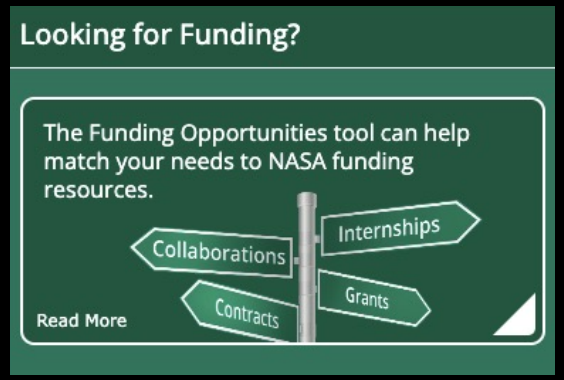
- NIAC Phase I awards to 14 researchers – **January; $2.5 million**
- TechFlights for 9 technologies from academia and industry – **January; $6.1 million**
- BIG Idea Challenge grants to 7 university teams – **March; $1.1 million**
- Two new Space Technology Research Institutes – **March; $30 million**
- SBIR Phase II – **April; $95 million**
- NIAC Phase II awards – **April; $3.6 million**
- NASA Space Technology Graduate Research Opportunities – **April; $4.6 million**
- Announcement of Collaboration Opportunity – **April**
- Tipping Point – **May**
- Deep Space Food Challenge Phase II – **May**
- SBIR/STTR Civilian Commercialization Readiness Pilot Program (CCRPP) – **May**
- SBIR/STTR Phase I – **May/June**

Estimate award values and dates

Announcement of Collaboration Opportunity (ACO)

- Since 2015 STMD has supported more than 75 ACO projects
  - Access to NASA facilities and technical expertise
- Selected 16 proposals from 12 companies in April 2023
  - Range of capabilities
  - Project durations 12-24 months
  - Estimated total value of agency resources $14.5 million
  - **https://go.nasa.gov/3oL7vzO**
- Future ACO planned to be open continuously
  - Single step approach
  - ~$20M per year, pending appropriations

https://techport.nasa.gov/opportunities



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Funding Opportunities

Interested in developing technology with NASA?

Tell us about the types of opportunities you are looking for. Please note, this page is for informational purposes only, and solicitation dates are subject to change. This information does not constitute a solicitation. To respond to a funding opportunity listed, please access and respond according to the provided solicitation link. NASA does not collect or store any of the information provided by users of this page.

Your roles or organization:

- [ ] General Public / Innovator
- [ ] Small Business
- [ ] Large Business
- [ ] Non-Profit or Research Institution
- [ ] International
- [ ] NASA
- [ ] Undergraduate Student
- [x] Graduate Student
- [ ] High School Student
- [ ] Other Academic Researcher
- [ ] Minority-Serving Institution

Funding Needed

$0 - $15,000,000

Technology Maturity

TRL 1 - 9

These opportunities might be a good fit for you:

Clear all filters

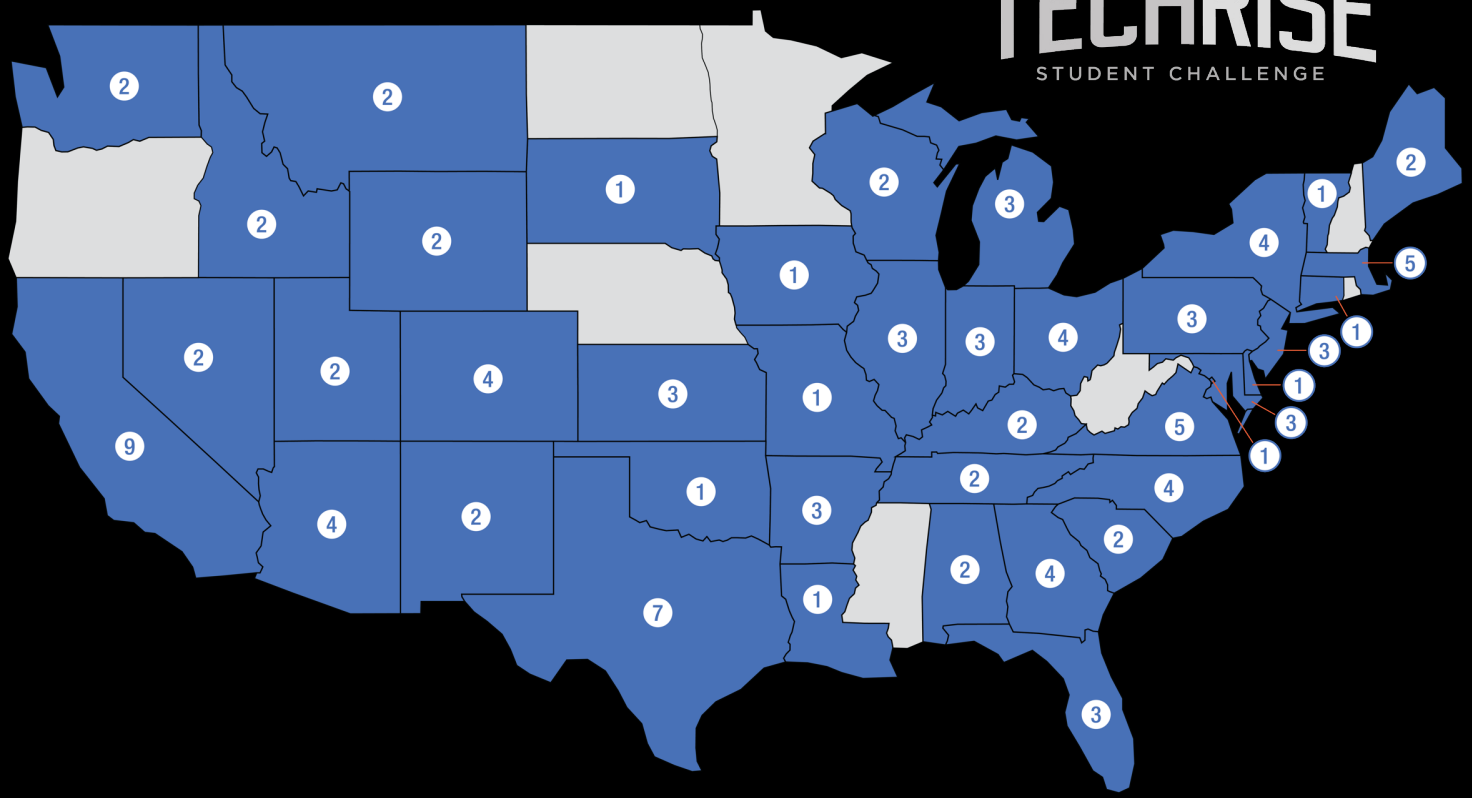
19 results found

Funding Opportunity	Average Project Funding	Average Duration (Months)	Frequency	Next Opportunity	Mission Directorate	Topic-Specific or Open
BIG Idea Challenge	$180,000	9	Annual	2024/01	STMD	Topic
Centennial Challenges	$500,000	36	Ongoing	Ongoing	STMD	Topic

TechRise Winners by State and Territory

Credits: Saint Mary's Middle School

Credits: Escuela Secundaria de la Universidad de Puerto Rico



Winners from 44 states and territories, representing 106 schools and approximately 1,100 students

Map shows cumulative state and territory winners across two TechRise challenges

STMD BY THE NUMBERS FY 22

>3300 proposals evaluated

~750 proposals selected

>1650 active technology projects

>900 academic collaborations with >175 unique organizations

>1300 industry collaborations with >700 unique companies

>150 planned flight demonstrations

>175 patent licenses to companies

>1000 transitions since 2011