



NASA Flight Opportunities

Explore the Opportunities Available with NASA's University SmallSat Technology Partnership Initiative

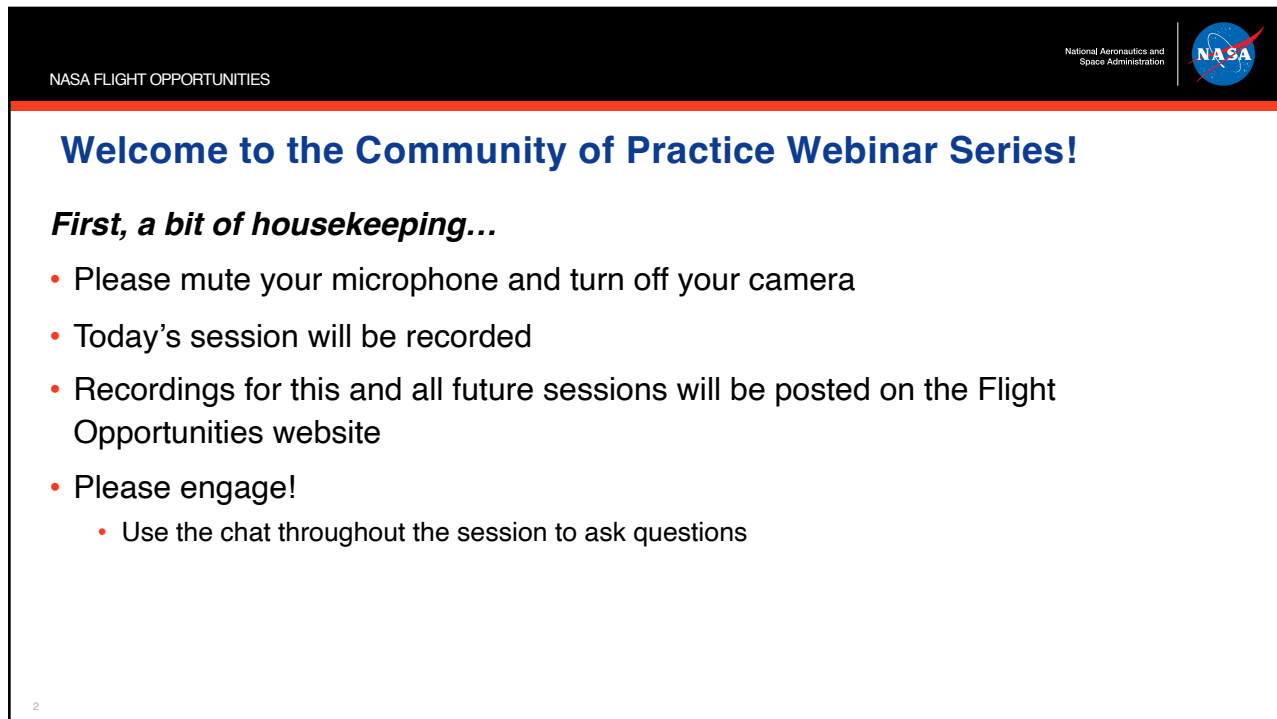
Rudy De Rosee, Program Systems Engineer, NASA's Small Spacecraft Technology Program

Community of Practice Webinar Series – May 4, 2023

Session will start at 10 a.m. PT – Please mute your microphone and turn off your camera

www.nasa.gov

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NASA FLIGHT OPPORTUNITIES

National Aeronautics and Space Administration

Welcome to the Community of Practice Webinar Series!

First, a bit of housekeeping...

- Please mute your microphone and turn off your camera
- Today's session will be recorded
- Recordings for this and all future sessions will be posted on the Flight Opportunities website
- Please engage!
 - Use the chat throughout the session to ask questions

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NASA FLIGHT OPPORTUNITIES

National Aeronautics and Space Administration 

Join us for future Community of Practice webinars!

Advancing Technologies for Space Medicine in Suborbital Flight

George Pantalos, Ph.D., University of Louisville
Kathleen Karika, Virgin Galactic

 June 7 at 10 a.m. PDT

Future webinars

- Webinars are held 1st Wednesday of each month at 10 a.m. PT
- Topics will be announced in the Flight Opportunities newsletter and website
- Session recordings will be posted on the Flight Opportunities website
- Let us know session topics you would like to see covered


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EXPLORE SPACE TECH

THROUGH SUBORBITAL FLIGHT


The Flight Opportunities program rapidly demonstrates promising technologies for space exploration, discovery, and the expansion of space commerce through suborbital testing with industry flight providers.



EXPLORE SPACE TECH

WITH SMALL SPACECRAFT







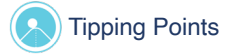


The Small Spacecraft Technology program expands the ability to execute unique missions through rapid development and demonstration of capabilities for small spacecraft applicable to exploration, science, and the commercial space sector.



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MECHANISMS FOR FUNDING FLIGHT TESTS TO AID TECHNOLOGY DEVELOPMENT

Both Flight Opportunities and Small Spacecraft Technology aim to test and advance technologies as quickly as possible. The two programs creatively use a variety of funding mechanisms to mature innovative solutions for the Nation's technology needs.

Challenges	Solicitations	Unsolicited Proposals and Other Mechanisms
 	    	 Missions of Opportunity <ul style="list-style-type: none"> • Space Act Agreements • Grant Extensions • Broad Agency Announcements (BAA) • Unsolicited Proposals • Interagency Agreements • Other mechanisms (Center-led, FFRDC / UARC task, etc.)  Flights of Opportunity <ul style="list-style-type: none"> • In-Space Manufacturing/ ISS Program Office • Intergovernmental support (Department of Defense, USDA) • TechFlights Reflights

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NASA FLIGHT OPPORTUNITIES

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Upcoming Opportunities



NASA TechFlights 2023

- Provides up to **\$1 million** for testing space technologies in relevant environments through flights on U.S. commercial suborbital rockets, rocket-powered lander vehicles, high-altitude balloons, and aircraft following reduced-gravity flight profiles, as well as for payloads hosted on commercial orbital platforms.
- This year, Flight Opportunities will prioritize:
 - Impact of the proposed flight test relative to the amount of funding requested and expected post-flight outcomes.
 - Decreasing the amount of time between award and flight testing, with a goal of accelerating the pace of technology development.

Key Dates

- Live Q&A: May 10, 2023, at 2pm EDT
- Mandatory Preliminary Proposals due: June 7, 2023, at 5pm EDT
- Full proposals (by invitation only) due: October 4, 2023, at 5pm EDT

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COMMERCIAL VEHICLES MAKE FLIGHT OPPORTUNITIES POSSIBLE

- Rocket-Powered Vehicles**

- High-Altitude Balloons**

- Parabolic Flights**

- Vertical Takeoff Vertical Landing (VTVL) Vehicles**

- Orbital Platforms Hosting Payloads**


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NASA FLIGHT OPPORTUNITIES

National Aeronautics and Space Administration 

Today's Presenter



Rudy De Rosee
Programs Systems Engineer
NASA's Small Spacecraft Technology Program

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NASA Flight Opportunities
Community of Practice
May 2023 | Rudy De Rosee
www.nasa.gov

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SPACE TECHNOLOGY MISSION DIRECTORATE
SMALL SPACECRAFT TECHNOLOGY PROGRAM

NASA SST's
*University Smallsat
Technology Partnerships*

Rodolphe "Rudy" De Rosée
Program Systems Engineer
USTP Technical Monitor
NASA STMD Small Spacecraft Technology (SST) program

Flight Opportunities (FO) program Community of Practice
Wednesday 2nd May 2023

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Released!

University Smallsat Technology Partnerships (USTP)
2023 Solicitation

<https://tinyurl.com/NASA-23USTP>

Mandatory Preliminary Proposal due date:	Tuesday 16 th May 2023, 5:00pm E.T.
Full Proposal due date:	Tuesday 18 th July 2023, 5:00pm E.T.

NASA SST University SmallSat Technology Partnerships

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Agenda

- 1) Overview of the University Smallsat Technology Partnerships mechanism
- 2) How to apply
- 3) Discussion of Success Stories and Questions

NASA SST University SmallSat Technology Partnerships

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Agenda


- 1) Overview of the University Smallsat Technology Partnerships mechanism
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NASA SST University SmallSat Technology Partnerships

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NASA SST Overview



NASA's Small Spacecraft Technology (SST) program expands the United States' ability to execute unique missions through rapid development and demonstration of capabilities for small spacecraft applicable to exploration, science and the commercial space sector.

Performed through targeted development and frequent in-space testing:

- Enabling execution of missions at much lower cost than previously possible
- Substantially reducing the time required for development of spacecraft
- Enabling new mission architectures that small spacecraft are uniquely suited for
- Expand the capability of small spacecraft to execute missions at new destinations and in challenging new environments
- Enabling the augmentation of existing assets and future missions with supporting small spacecraft

NASA SST's CAPSTONE mission
12U form factor Small Spacecraft

Credit: NASA/Rocket Lab/Advanced Space/Tyvak Nano-Satellite Systems

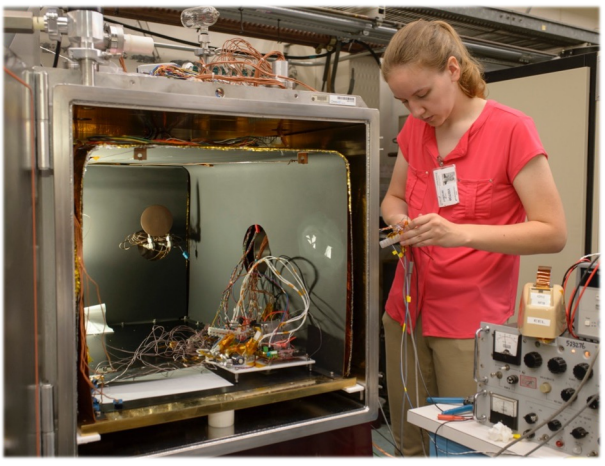
NASA SST University SmallSat Technology Partnerships

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Rationale – University Smallsat Technology Partnerships

- Advance novel technologies for SmallSats useful to NASA and industry
- Leverage unique talents and fresh perspectives from the university community
- Share NASA experience and expertise in relevant university projects
- Engage NASA personnel in rapid, agile and cost-conscious small spacecraft approaches that characterize university teams
- Foster a new generation of innovators for NASA and the nation



- NASA benefits from rapid, innovative academic processes yielding new technologies
- Universities gain experience and recognition through hands-on NASA collaborations

NASA SST University SmallSat Technology Partnerships

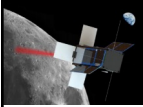
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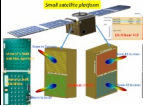
SST's University Smallsat Technology Partnerships

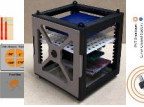
The SST program sponsors regular University Smallsat Technology Partnerships:


- 2-year PI-led cooperative agreements between a U.S. university team and a NASA center to develop specific technologies for small spacecraft
- \$225k/year + 0.5 FTE/year for NASA/JPL partner + \$30k procurement funding for NASA/JPL partner center
 - Cooperative Agreements for maximum duration of two years
 - Year 2 funding contingent on Year 1 progress
- Competitive solicitations – specific technology topics vary
- Starting Technology Readiness Level (TRL) 3-5
 - Advancement of at least +2 TRL levels is expected by end of period of performance
 - Advancement to at least system-level TRL 6 is desired by end of period of performance
- Smallsat defined as spacecraft with a mass of 180 kg or less and capable of being launched into space as an auxiliary or secondary payload (~ESPA-class)


Image credits - USTP 2020 cohort:

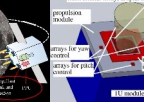

 Arizona State University

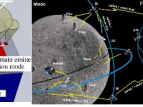

 San Diego State University

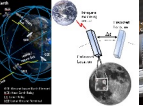

 California State University, Los Angeles



 University of Colorado, Boulder


 University of Illinois, Urbana-Champaign


 University of California, Irvine


 University of California, Los Angeles


 University of Texas, Austin


 Utah State University

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Funded Extensions

The SST program may approve requests within a limited time period of the USTP effort for a funded extension to cover specific activities in support of a technology demonstration flight through:

- NASA Flight Opportunities (FO) program**
 - E.g. Parabolic flights, High-altitude balloons, Suborbital rocket, Hosted-Orbital
 - Requires selection by FO program
 - See FO annual Tech Flights solicitation
- NASA CubeSat Launch Initiative (CSLI)**
 - Orbital freeflyer technology demonstration
 - Requires selection by CSLI
 - See annual CSLI solicitation
- Other as-yet unspecified opportunity**
 - Contingent upon respecting all applicable U.S. laws
 - Contingent upon respecting SST guidelines

The diagram illustrates the progression of flight opportunities from ground-based activities to orbital missions. It is divided into three main categories: **GROUND** (including Labs, Universities, etc.), **SUBORBITAL FLIGHTS** (including Parabolic Aircraft, High-Altitude Balloons, and Rocket-Powered Vehicles), and **ORBITAL MISSIONS** (including International Space Station and Satellites). The Moon is also shown as a destination for orbital missions.

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Past Technology Topic Areas

STP Cohort	2013	2015	2016	2018	2020
Technology Topic Areas	Communications	Avionics / Command & Data Handling Subsystem	Enhanced Power Generation and Storage	Instruments for SmallSats including Multiple SmallSats	Lunar Communications and Navigation Network
	GN&C	Communication Subsystem	Cross-linking Communications Systems	Technologies That Enable Large Swarms of Small Spacecraft	Smallsat Propulsion for Lunar Missions
	Propulsion	Ground Data Systems	Relative Navigation for Multiple Small Spacecraft	Technologies That Enable Deep Space Small Spacecraft Missions	Advanced Electrical Power and Thermal Management
	Power	Guidance Navigation & Control / Attitude Determination & Control Subsystem	Instruments and Sensors for Small Spacecraft Science Missions		<i>Solicitation encourages grant extensions for suborbital, orbital flight demo</i>
	Science Instrument Capabilities	Payloads			
	Advanced Manufacturing	Power Subsystem			
		Propulsion Subsystem			
	Structures and Mechanisms				
	Subsystem-Oriented Manufacturing Instruments	System-Oriented LEO Instruments	Mission-Oriented Deep Space, Multi-Spacecraft Instruments		Pivot to Lunar Missions Exploration Infrastructure

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2023 Technology Topic Areas




Technology Topic Areas:

- Earth- and Global Navigation Satellite System-Independent Position Navigation and Timing for Small Spacecraft
- Edge Computing and Machine-Learning Architectures, Software, Platforms, and Devices for Small Spacecraft
- High Specific Power Systems and Thermal Control for Small Spacecraft

To be addressed at either Target Operational Domains:

- A: Enabling Cislunar and Deep Space Exploration with Small Spacecraft
- B: Improving the Performance and Resiliency of Future Civil and Commercial Small Spacecraft in Earth Orbit

- Solicitation encourages Cooperative Agreement funded extensions for suborbital and orbital flight demonstrations
- 8 awards anticipated in 2023 across all three Technology Topic Areas





OPERATING, PAST, & FUTURE
SMALLSAT/CUBESAT FLEET

NASA SST University SmallSat Technology Partnerships

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USTP Partnership Successes to Date

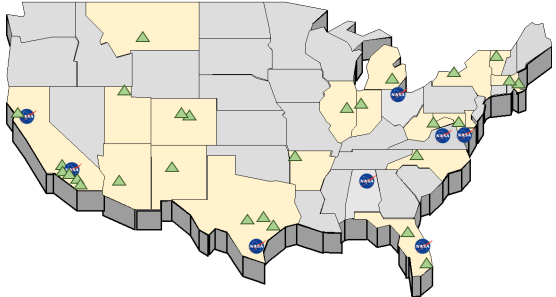
Investments:

- Over \$26,468,000 awarded
- 46 partnerships in 5 class years
- 28 universities in 19 states
- 8 of 10 NASA centers partnered

Results:

- 22 flight demonstrations performed/planned
- 1 Intersatellite Network Planning/ Routing tool software open-sourced
- Numerous New Technology Reports / Patents
- 30+ conference presentations
- 50+ papers published
- 100+ students involved
- Many technology readiness levels (TRL) raised

▲ 28 Universities in 19 States
● 8 NASA Centers



2013:	\$6,500,000	17 awards;	13 Y2 option
2015:	\$3,590,150	8 awards;	8 Y2 option
2016:	\$4,676,693	8 awards;	8 Y2 option
2018:	\$5,802,500	8 awards;	8 Y2 option
2020:	\$5,900,000	9 awards;	9 Y2 option

NASA SSTP SmallSat Technology Partnerships

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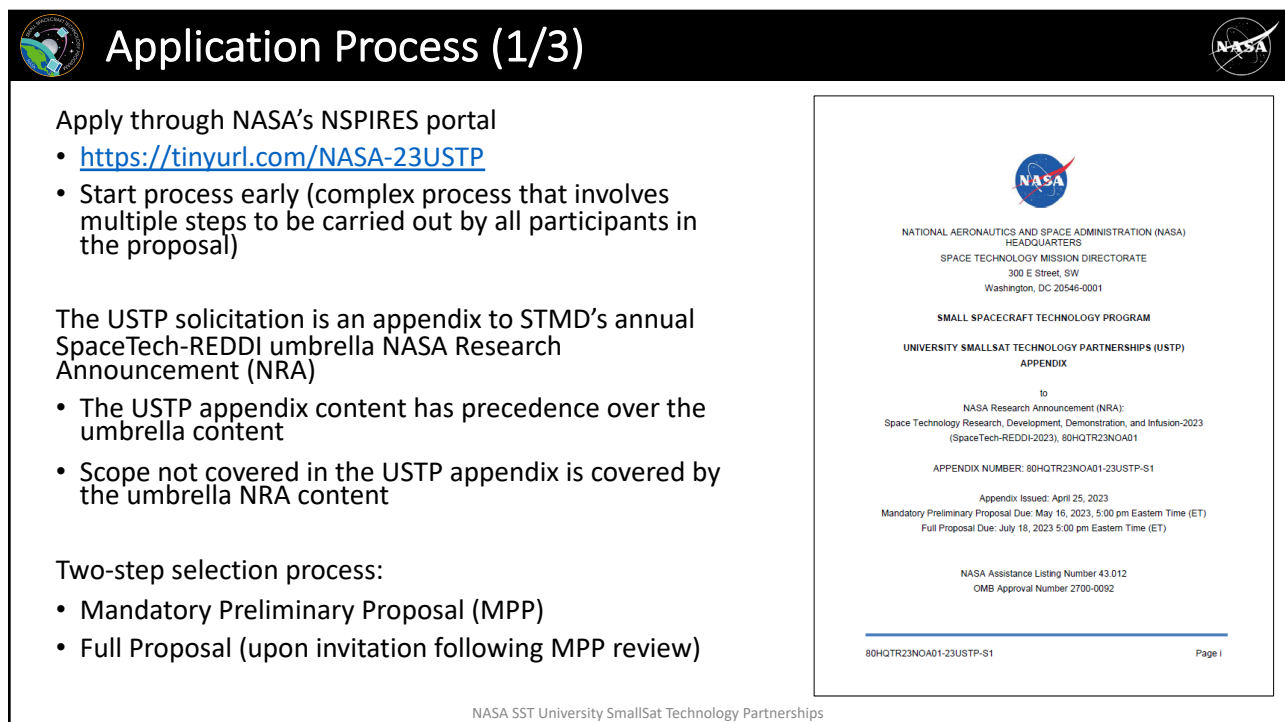


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NASA SST University SmallSat Technology Partnerships

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Application Process (1/3)

Apply through NASA's NSPIRES portal

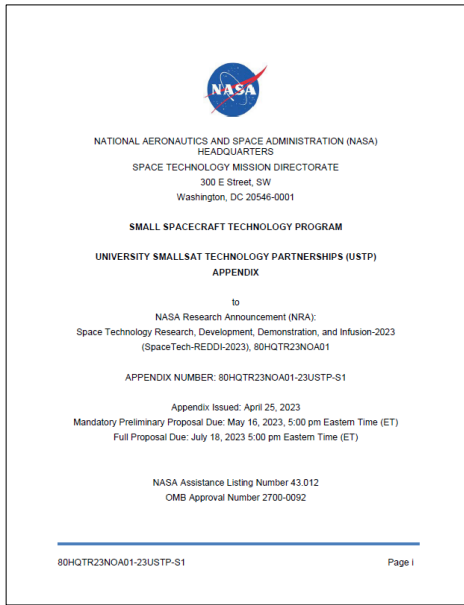
- <https://tinyurl.com/NASA-23USTP>
- Start process early (complex process that involves multiple steps to be carried out by all participants in the proposal)

The USTP solicitation is an appendix to STMD's annual SpaceTech-REDDI umbrella NASA Research Announcement (NRA)

- The USTP appendix content has precedence over the umbrella content
- Scope not covered in the USTP appendix is covered by the umbrella NRA content

Two-step selection process:

- Mandatory Preliminary Proposal (MPP)
- Full Proposal (upon invitation following MPP review)



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)
HEADQUARTERS
SPACE TECHNOLOGY MISSION DIRECTORATE
300 E Street, SW
Washington, DC 20546-0001

SMALL SPACECRAFT TECHNOLOGY PROGRAM
UNIVERSITY SMALLSAT TECHNOLOGY PARTNERSHIPS (USTP)
APPENDIX

to
NASA Research Announcement (NRA):
Space Technology Research, Development, Demonstration, and Infusion-2023
(SpaceTech-REDDI-2023), 80HQTR23NOA01

APPENDIX NUMBER: 80HQTR23NOA01-23USTP-S1

Appendix Issued: April 25, 2023
Mandatory Preliminary Proposal Due: May 16, 2023, 5:00 pm Eastern Time (ET)
Full Proposal Due: July 16, 2023 5:00 pm Eastern Time (ET)

NASA Assistance Listing Number 43.012
OMB Approval Number 2700-0092

80HQTR23NOA01-23USTP-S1 Page 1

NASA SST University SmallSat Technology Partnerships

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Application Process (2/3)

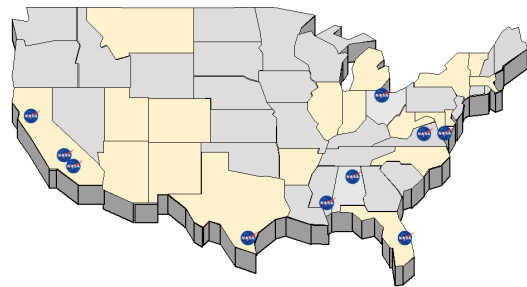


Eligibility is limited to U.S. college and university teams, including faculty, undergraduate and/or graduate students. The Principal Investigator (PI) submitting a proposal and leading a university team shall be affiliated with a U.S. college or university (including community colleges), accredited in and having a campus located in the U.S

Goals of this solicitation include collaboration with university teams that have experience in small spacecraft development **and the extension of support to colleges and universities that have little or no previous involvement in this field**. Colleges and universities with experience in small spacecraft development are encouraged to team with other college and universities to address these dual goals.

Partnering between the university team and a NASA center or Jet Propulsion Laboratory (JPL) is **required**

- NASA team member must be either a civil servant or a member of the technical staff from JPL
- **NASA partner can be TBD for the MPP**
- NASA partner shall be identified for the Full Proposal
- See solicitation for NASA Center POCs



NASA SST University SmallSat Technology Partnerships

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Application Process (3/3)

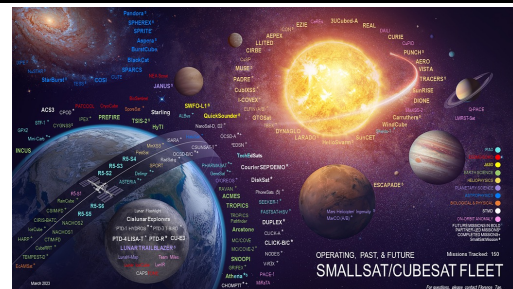


Address one Technology Topic Area only

- Identify the primary Target Operational Domain for that Technology Topic Area
- Identify if technology also applies to other Target Operational Domain and under what circumstances it does
- Technology proposed should be an improvement over the state-of-the-art

Key dates:

- Appendix Issued: April 25, 2023
- MPP Due: May 16, 2023, 5:00 pm ET
- MPP Downselect Date: June 9, 2023 (TARGET)
- Full Proposals Due: July 18, 2023, 5:00 pm ET
- Selections Announcement: August 11, 2023 (TARGET)
- Awards Issued: September 11, 2023 (TARGET)



University SmallSat
 Technology Partnerships

NASA SST University SmallSat Technology Partnerships

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Mandatory Preliminary Proposals Content

Section #	MPP Section	Maximum Length
1	Title Page and Proposal Summary	2 pages
2	Introduction	3 pages for the combined Sections 2 - 5
3	Relevance and Impact	
4	Technical Approach	
5	Qualifications and Capabilities	
---	Summary Chart (separate document uploaded on NSPIRES, see Section 4.1.6)	1 page
Maximum Size of combined documents: <u>Not to Exceed 20 MB</u>		

Evaluation Criteria:

Criterion 1 – Relevance and Impact (Weight 50%)

Criterion 2 – Technical Approach (Weight 50%)

NASA SST University SmallSat Technology Partnerships

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Full Proposals Content

Section #	Full Proposal Section	Maximum Length
1	Title Page and Proposal Summary	2 pages
2	Table of Contents	1 page
3	Relevance and Impact	4 pages
4	Technical and Management Approach	4 pages
5	Schedule Summary	1 page
6	Budget Summary (Table)	1 page
7	Budget Justification	As needed, no page limit
8	References & Citations	As needed, no page limit
9	Letters of Commitment and Statements of Support	As needed, no page limit
---	Summary Chart (separate document uploaded on NSPIRES, see Section 4.2.10)	1 page
Maximum Size of combined documents: <u>Not to Exceed 20 MB</u>		

Evaluation Criteria:

Criterion 1 – Relevance and Impact (Weight 45%)

Criterion 2 – Technical and Management Approach (Weight 45%)

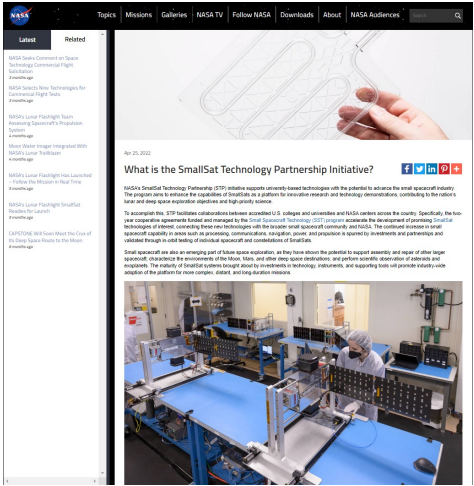
Criterion 3 – Cost (Weight 10%)

NASA SST University SmallSat Technology Partnerships

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Questions and Further Information

- Questions pertaining to the solicitation should be submitted via email to the NASA Point of Contact, Christopher Baker, SST and FO Program Executive no later than later than May 4, 2023 (5:00 pm Eastern)
 - HQ-STMD-SST-Partnerships@nasaprs.com
- Solicitation should include all necessary information for application
 - FAQ will be posted on NSPIRES page after Thursday May 4
- See Section 9 of solicitation for additional resources
 - <https://www.nasa.gov/smallspacecraft>
 - <https://www.nasa.gov/flightopportunities>
 - https://www.nasa.gov/directorates/heo/home/CubeSats_initiative
 - and more...
- See USTP website and related material
 - https://www.nasa.gov/directorates/spacotech/small_spacecraft/smallsat-technology-partnership-initiative
 - <https://www.nasa.gov/smallsat-institute/2022-techexpo-agenda>
 - <https://www.nasa.gov/smallsat-institute/2021-techexpo-agenda>




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- 1) Overview of the University Smallsat Technology Partnerships mechanism
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NASA SST University SmallSat Technology Partnerships

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Example Success Stories



- Utah State University's Active Thermal Architectures (ATA) technology will be flying aboard NASA's Earth Science Technology Office's Active Cooling for Multispectral Earth Sensors (ACMES) mission
- Stanford's STP-supported autonomous and distributed navigation technologies are slated for three different upcoming CubeSat swarm missions, starting with NASA's Starling multi-CubeSat technology demonstration scheduled for launch in 2023
- See: <https://www.nasa.gov/image-feature/nasa-supported-university-research-slatted-for-upcoming-cubesat-missions>

Discussion:

- NASA CHOMPTT mission and related technologies – Anh Nguyen
- MIT HiSPEED/STEP-1 technology and mission – Gustav Petterson



NASA CHOMPTT
Mission

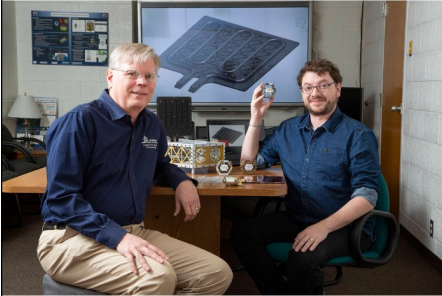


MIT HiSPEED/STEP-1
Mission

NASA SST University SmallSat Technology Partnerships

NASA Ames
Apr 27, 2022

NASA-Supported University Research Slatted for Upcoming CubeSat Missions



Expanding the capabilities of small spacecraft as critical enablers for research and technology demonstrations, the agency's SmallSat Technology Partnerships (STP) initiative is funding university research with the potential to advance the small spacecraft industry and support lunar and deep space missions. Under cooperative agreements managed by NASA's SmallSat Technology (SST) program, Utah State University in Logan and Stanford University in California will test research payloads on several CubeSat missions planned for launch as early as 2022.

"We are driving innovative small spacecraft research that shows promise for widespread adoption by industry, as well as the advancement of space exploration and science goals," said Roger Hunter, SST program manager at NASA's Ames Research Center in California's Silicon Valley. "This is a key to our program's mission."

Keeping Instruments Cool
Building on earlier support from STP, Utah State University will soon test their active thermal architectures (ATA) technology in space to address the challenge of heat buildup in spacecraft. The team aims to improve the use of CubeSats for carrying scientific instruments into orbit for tasks like measuring the heat that cools in Earth's upper atmosphere. Unfortunately, those instruments tend to overheat.

"Currently, we can only run scientific instruments in space very briefly before they get really hot, and we have to turn them off and cool them down before trying again," said Charles Swenson, principal investigator for ATA and professor of electrical and computer engineering at Utah State University.

To address the issue, the team tested a thermal control technology based on a microchannel pumped fluid loop that transports coolant from one part of a spacecraft to another. Using 3D-printed flow channels, microtubes, and 2-gigawatt refrigeration units, the STP CubeSat is 2 centimeters x 10 centimeters x 10 centimeters (approximately 2 inch x 4 inch x 4 inch) space inside a small CubeSat. Like a radiator fluid pump in car engines, the device cools and ultimately heats by pumping fluid through a resistor.

Justin Kruger, a Bachelor's P.E. student, oversees the Autonomous Navigation Systems (ANS) development and testing efforts. He is also the lead developer of the image processing and target tracking software.
Source: [Stanford University](#)

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[NASA.GOV/SMALLSPACECRAFT](https://www.nasa.gov/smallspacecraft)

Visit our websites for more information and resources, including our newsletter and monthly Community of Practice webinars.

Reach out:
NASA-FlightOpportunities@mail.nasa.gov




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