



# EXPLORE SPACE TECH

**Enabling and Leveraging Industry to Advance Small Spacecraft Technologies**

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NASA's Small Spacecraft Technology Program

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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.





# Small Spacecraft Technology program 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 to:

- Enable execution of missions at much lower cost than previously possible
- Substantially reduce the time required for development of spacecraft
- Enable new mission architectures for which small spacecraft are uniquely suited for
- Expand the capability of small spacecraft to execute missions at new destinations and in challenging new environments
- Enable 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

# Close Technology Gaps With NASA

## TechPort

Match your solution  
to available funding  
opportunities:

[techport.nasa.gov/  
opportunities](https://techport.nasa.gov/opportunities)



Flight Opportunities and Small Spacecraft Technology utilize a variety of mechanisms to mature innovative solutions from **proof-of-concept, to benchtop, to flight.**

We want to work with **academia, non-profit research institutes, and industry**, as well as **entrepreneurs, small businesses, and students** in order to close our technology gaps.



STMD Tipping  
Point Awards



Announcements  
of Collaboration  
Opportunity

Pathways to flight test for researchers  
with existing support:

Contact the programs directly.



Missions of  
Opportunity



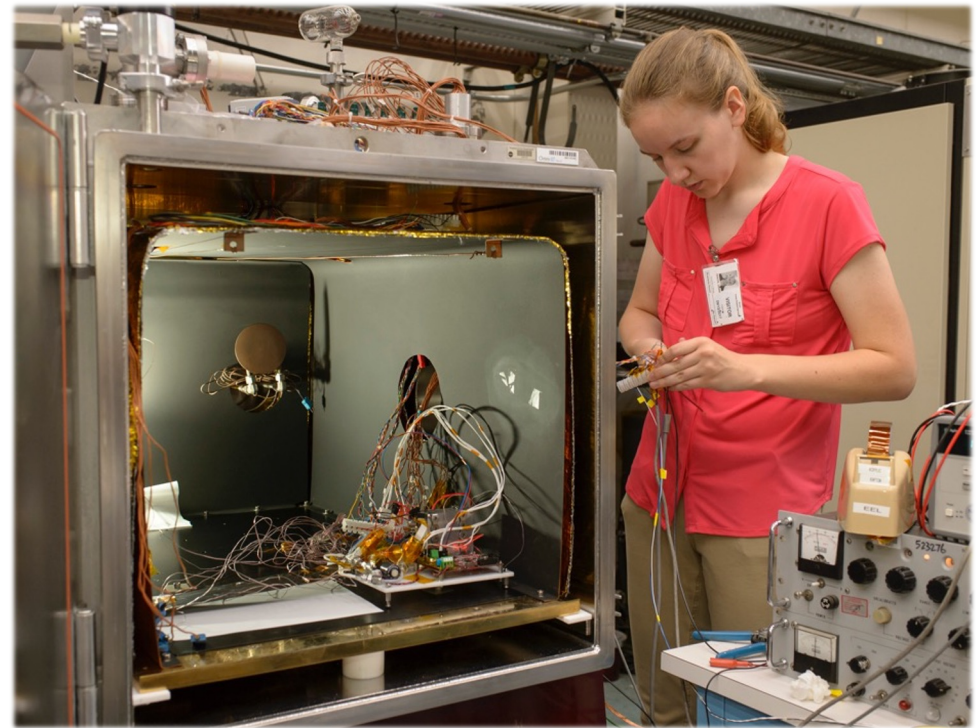
Flights of  
Opportunity



# 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



# SST's University SmallSat Technology Partnerships

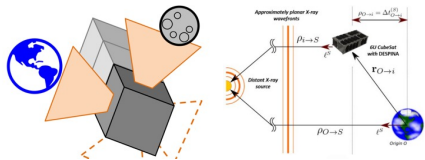


## The SST program sponsors regular University SmallSat Technology Partnerships:

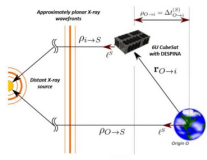
- 2-year PI-led cooperative agreements between a U.S. university team and a NASA center to develop specific technologies for small spacecraft
  - SmallSat defined as spacecraft with a mass of 180 kg or less and capable of being launched into space as an auxiliary or secondary payload (~ESPA-class)
- \$225k/year + 0.5 FTE/year for NASA/JPL partner + \$30k procurement funding for NASA/JPL partner center
  - Cooperative Agreements, duration of two years
  - Year 2 funding contingent on Year 1 progress
- 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
- Competitive solicitations – specific technology topics vary

Image credits - USTP 2023 cohort:

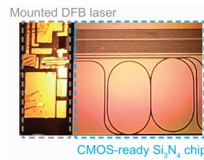
### Earth and GNSS Independent PNT



Georgia Institute of Technology

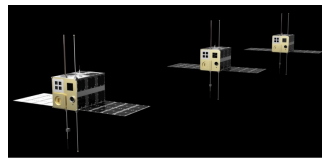


University of Minnesota

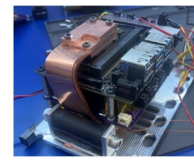


California Institute of Technology

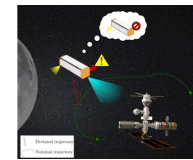
### Edge Computing and Machine Machine-Learning



Utah State University

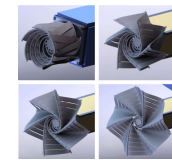


California State Polytechnic University Pomona

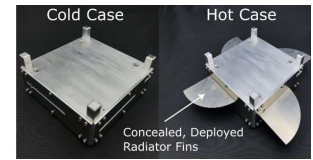


University of Michigan, Ann Arbor

### Thermal Control



Pennsylvania State University



University of Dayton & Brigham Young University

# Flight Test Highlights Of Small Spacecraft Technologies



## Montana State University

Radiation-tolerant computing technology for spacecraft

Advanced through University SmallSat Technology Partnership and Flight Opportunities

CSLI, ISS, and CLPS infusions



## V-R3x, Stanford, and NASA Ames

Advanced swarm communications tech

Orbital flight test in Jan 2021

High-altitude balloon test in March 2021

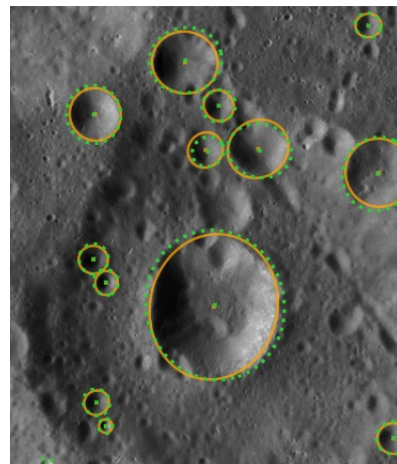


## San Diego State University

University SmallSat Technology Partnership

Commercial 5G technologies to provide LunaNet relay nodes with high gain, high data rate, multi-point communications without physical pointing mechanisms

Upcoming high-altitude balloon flight test via Flight Opportunities



## University of Texas at Austin

Ongoing University SmallSat Technology Partnership

Surface feature-based navigation and timing for cislunar spacecraft using machine learning algorithms

NASA SPLICE and CSLI awards for tech demos

# Commercial Vehicles Make Flight Opportunities Possible



## Rocket-Powered Vehicles



Credits: NASA



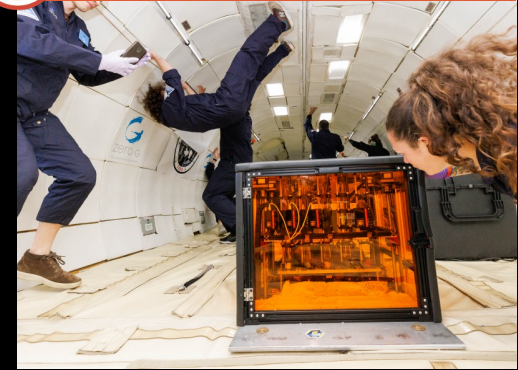
## High-Altitude Balloons



Credits: World View Enterprises



## Parabolic Flights



Credits: University of California, Berkeley



## Vertical Takeoff Vertical Landing (VTVL) Vehicles



Credits: Lauren Hughes/NASA



## Orbital Platforms Hosting Payloads



Credits: Firefly (formerly Spaceflight, Inc.)

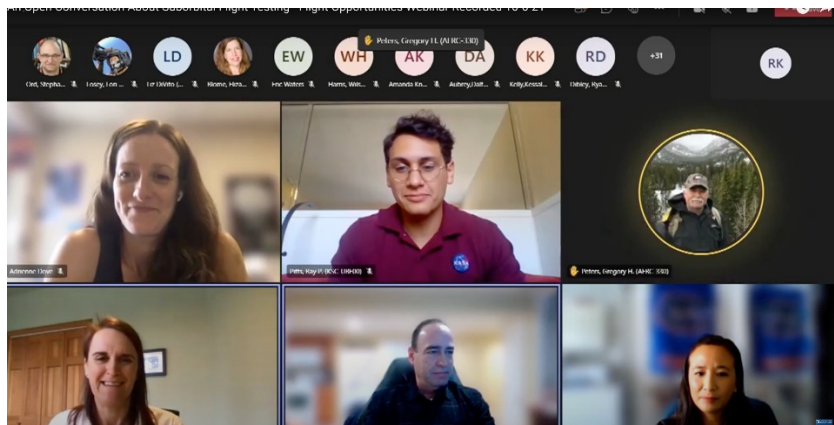


# Supporting the Flight Test Community

## Community of Practice Webinars

Designed to distill and share most important lessons learned by suborbital researchers.

First Wednesday of each month 10 am PT



October 6, 2021 Community of Practice - An Open Conversation About Suborbital Flight Testing

## Flight Opportunities Newsletter

[www.nasa.gov/flightopportunities](http://www.nasa.gov/flightopportunities)



# Lessons Learned Library

**An ongoing collection of best practices and suggestions to help researchers optimize their flight test outcomes**

Designed to support researchers as they move through each part of the flight testing process:

- Getting involved with the program
- Preparing proposals
- Step-by-step suggestions for getting ready to fly
- Best practices for payload design
- Top tips for each type of flight platform

Practical tips are linked to helpful clips from the program's monthly Community of Practice webinar.

Search...

NASA

News & Events ▾ Multimedia

Lessons Learned Library

Home About News Work with Us ▾ Resources ▾ Tech Portfolio ▾ Images

# Lessons Learned Library

QUICK TIPS

Contact flight providers - either those that have flown with Flight Opportunities in the past or other vendors that meet the requirements - early in the process to strengthen your proposal.

Over the years, Flight Opportunities participants have identified dozens of suggestions to help researchers be more successful in their flight testing. The Lessons Learned Library presents these suggestions - many of which were shared in the program's Community of Practice webinars. (Access more information about these webinars under the Resources menu above.)

Check back often, as Flight Opportunities is always adding to this library.

## STAY ENGAGED:

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

[NASA.GOV/FLIGHTOPPORTUNITIES](https://www.nasa.gov/flightopportunities)

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

Reach out:

[ARC-SST@mail.nasa.gov](mailto:ARC-SST@mail.nasa.gov)

[NASA-FlightOpportunities@mail.nasa.gov](mailto:NASA-FlightOpportunities@mail.nasa.gov)

