



Small Spacecraft Systems Virtual Institute (S3VI)

Promoting Innovative Concepts

Building Community through:

Sharing Knowledge

- SmallSat LEARN Forum
- Community of Practice
- Mission Accomplished Webinar Series
- Access to Space Announcements
- S3VI Quarterly Newsletter
- CubeSat 201

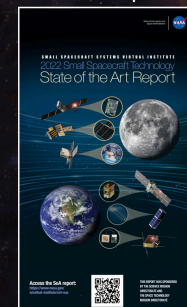
Building Tools

- Small Spacecraft Reliability Initiative Knowledge Base Tool
- Small Spacecraft Information Search
- State of the Art Report
- Space Mission Design Tools Collection
- Anomaly Alert Reporting System

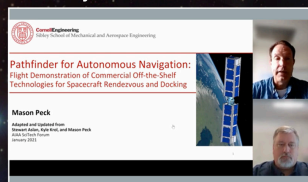
Connecting People and Ideas

- Industry Days Webinar Series
- SmallSat Technology Partnerships – TechExpo
- Cross-Agency Collaboration

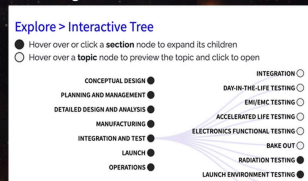
Small Spacecraft Technology
State of the Art Report



Community of Practice Webinar Series



Small Spacecraft Reliability Initiative Knowledge Base



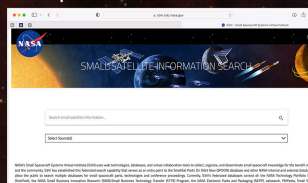
Identifying Emerging
Technology Opportunities

www.nasa.gov/smallsat-institute

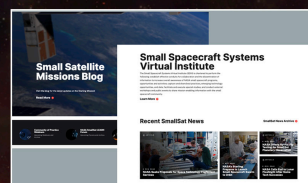


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Small Spacecraft Information Search



S3VI Web Portal



S3VI Newsletter



SmallSat / CubeSat Fleet Chart



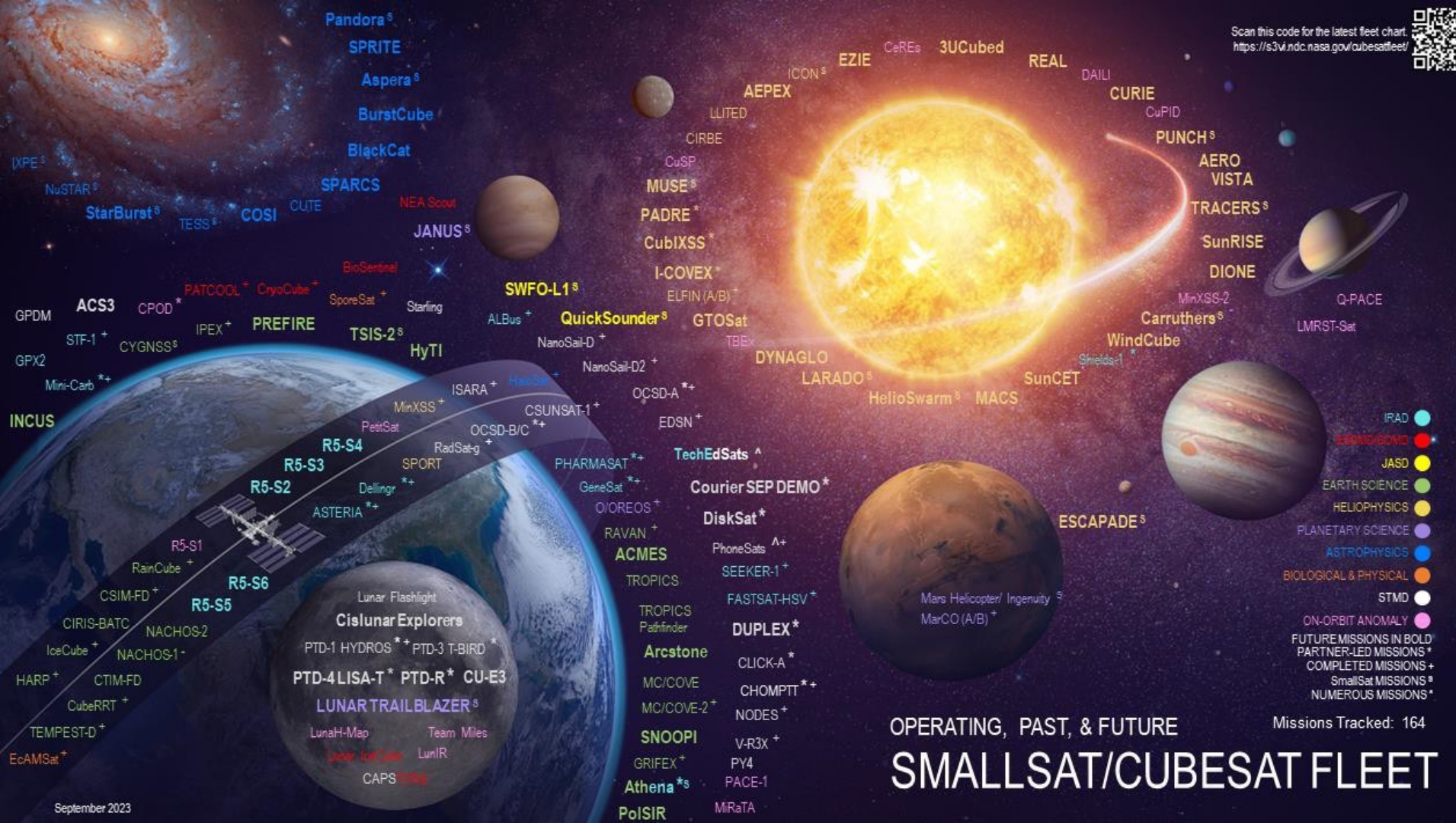
NASA SmallSat LEARN Forum



LaunchPortal: Potential Rideshare Opportunities

Mission Name	Launch Date (NET)	Primary Orbit	Secondary Orbit	Payload (kg)	Integration (deg)	Launches Available
JPSS-2	11/11/22	Polar	600	600	1221.1261	None (U.S. C-Adapted)
MAP	3/1/25	L1			28	CS max v1-0.9
EPHREX	2/26/25	SBO	600	600	6m M/TAN	None (U.S. C-Adapted)
JPSS-3	2025-2027	SBO			13.10	Full SPS for additional opportunities
SENTINEL-6R	2025-11	LEO	1200	1200	66	MS-25A
COSE	2025-09	LEO	500	500	5	T80
REO	2024-05	L1			780	T80
REO	2024-05	L1			780	CS (0.4-6)
MAISE	2027-04	SBO	620	620	97.9	6m M/TAN
VERTAS	2024-2025	Various	600	600	CS-17	T80

Scan this code for the latest fleet chart.
<https://s3vi.ndc.nasa.gov/cubesat/fleet/>



CubeSats and the Small-Satellite Revolution

The power of “containerization”

CubeSats revolutionized the small satellite industry through containerization, just as containerization revolutionized terrestrial shipping

- Containerization simplifies the interface and protects the host, enabling inexpensive rideshare
- In 20 years, well over 1000 CubeSats have been launched worldwide
- CubeSats have flown on at least 20 different launch vehicle types

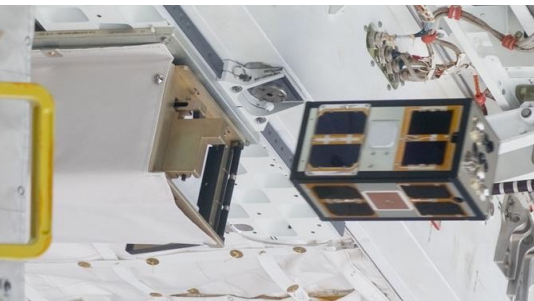
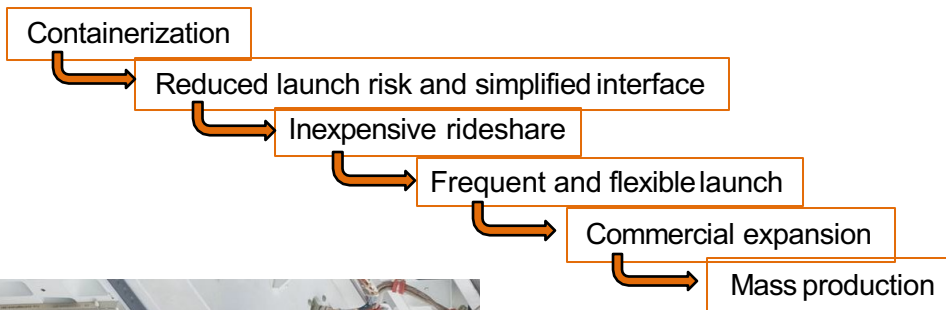
CubeSats are rigidly constrained by the volume of the container

- Limits on power and aperture, even with complex deployables

Containerization of
terrestrial shipping

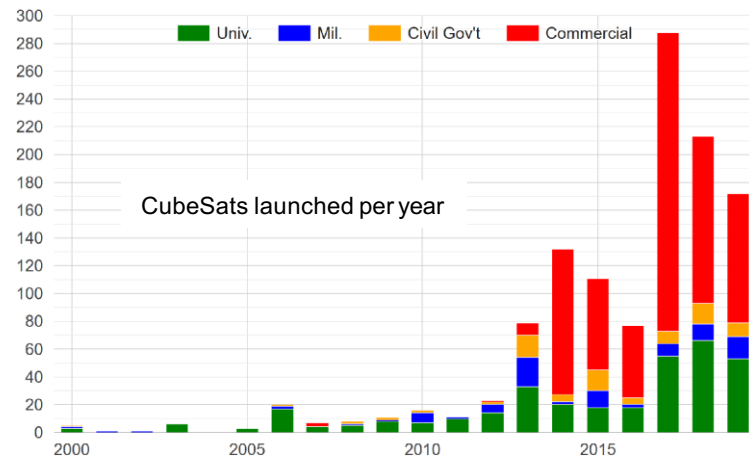


Images courtesy U.S. DOT



PSSCT-2 leaving dispenser on STS-135

Image courtesy NASA



Data from M. Sw artwout

How to get the benefits of containerization without the limitations of CubeSats?

Slide Courtesy of The Aerospace Corporation

Small Spacecraft Technology Program

SPACE TECHNOLOGY MISSION DIRECTORATE

Expanding NASA's ability to execute unique missions through rapid development and demonstration of capabilities for small spacecraft applicable to exploration, science and the commercial space sector.



Starling
Technologies for Distributed
Small Spacecraft Missions

PTD-3
Pathfinder Technology Demonstrator-3
TeraByte InfraRed Delivery (TBIRD)

PTD-R
Pathfinder Technology
Demonstrator-R Monolithic
UV/SWIR/VIS Camera

DUPLEX
Dual Propulsion Experiment
(DUPLEX) CubeSat

GPDM
Green Propulsion
Dual Mode

CLICK
CubeSat Laser
Infrared Crosslink

PY4
Four-CubeSat Swarm of
PyCubed-Based Spacecraft

PTD-4
Pathfinder Technology Demonstrator-4
Lightweight Integrated Solar Array
and anTenna (LISA-T)

DiskSat
Two-Dimensional; High-Power,
High-Aperture, Maneuverable Spacecraft

R5
Rapid Technology Maturation

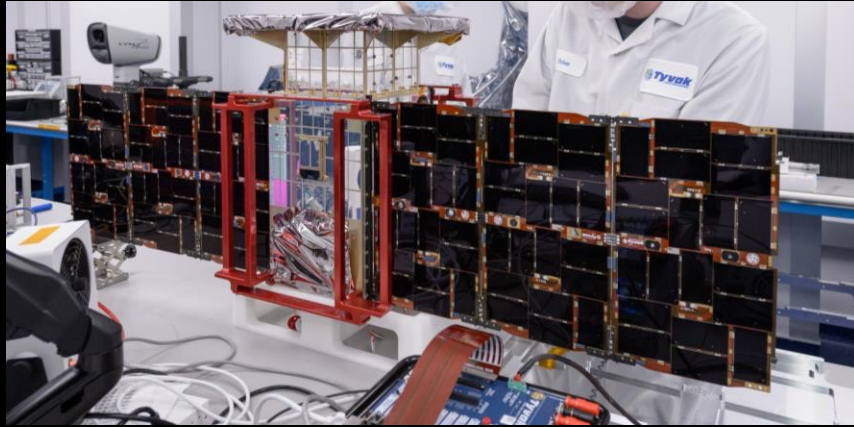
Courier
Solar Electric Propulsion Module

ACS3
Advanced Composite
Solar Sail System

www.nasa.gov/smallspacecraft

www.nasa.gov

On-Orbit U-Class Technology Demonstration Missions



CAPSTONE

Launched: June 28, 2022

Status: Ongoing

Demonstrate ability to enter and maintain a near rectilinear halo orbit around the Moon.
Demonstrate one & two way ranging and autonomous spacecraft navigation

Image Credits: NASA



Pathfinder Technology Demonstrator (PTD-3)

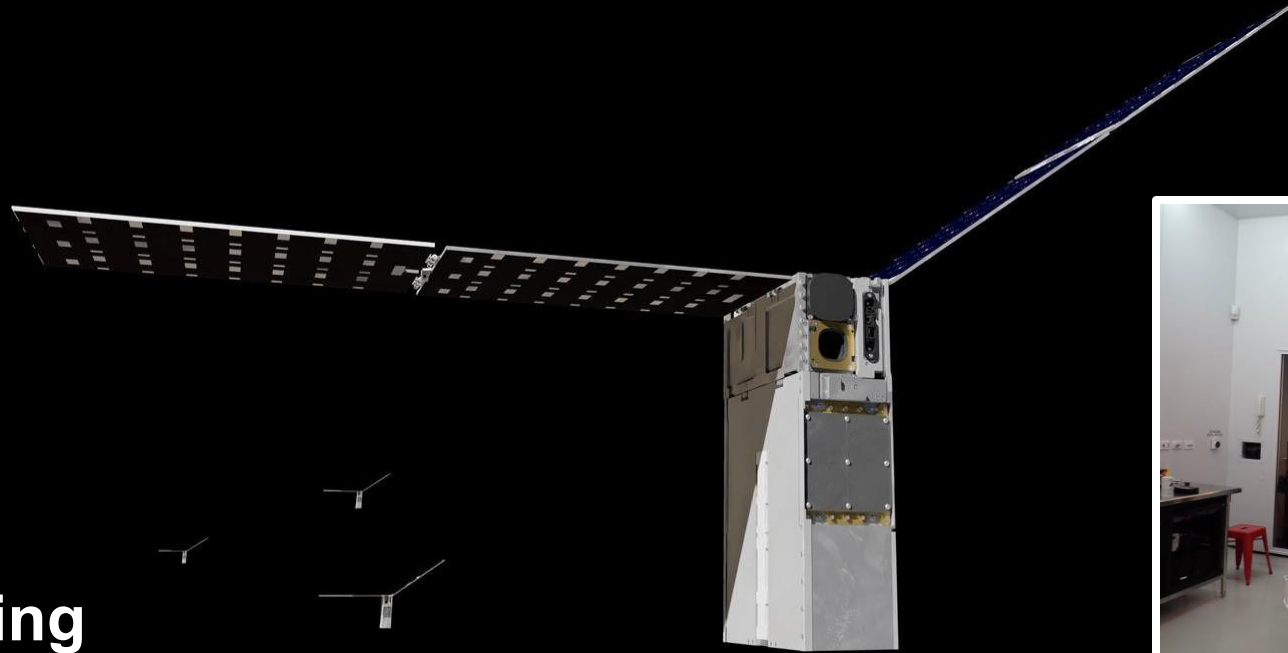
Launched: May 25, 2022

Status: Ongoing

Demonstrate TeraByte InfraRed Delivery (TBIRD) technology for high-bandwidth laser communications. Demonstrated 200 gigabit per second data downlink rate on April 28.

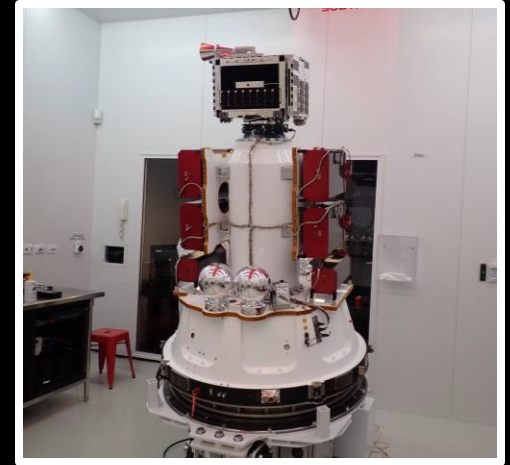
Animation Credits: NASA

On-Orbit U-Class Technology Demonstration Missions

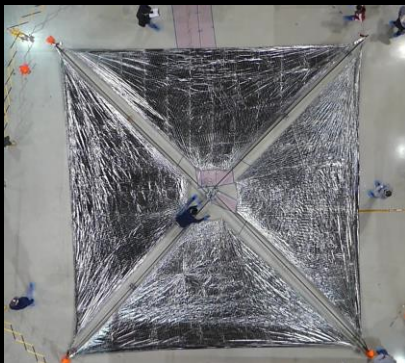


Starling

Starling's four 6U CubeSats launched on July 17, 2023 from Rocket Lab Launch Complex 1 in Mahia, New Zealand. Starling will test swarm maneuver planning and execution, communications networking, relative navigation, and autonomous coordination between spacecraft. Image Credits: NASA. Inset Image Credits: Rocket Lab



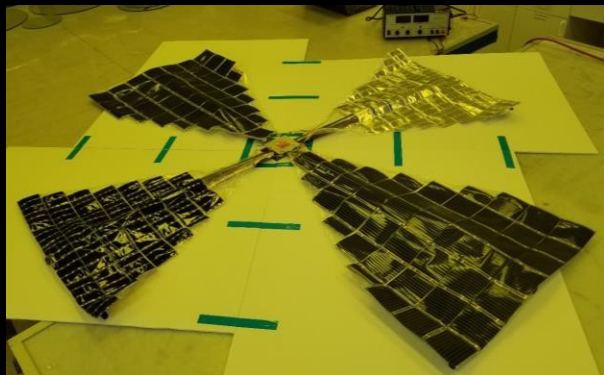
Upcoming U-Class Technology Demonstration Missions – 2024



**Advanced Composite Solar
Sail System (ACS3)**
Launch Timeframe:
First Half of 2024

Demonstrate deployment
of the composite boom
solar sail in low-Earth orbit.
The unfurled solar sail will
measure approximately 84 m²

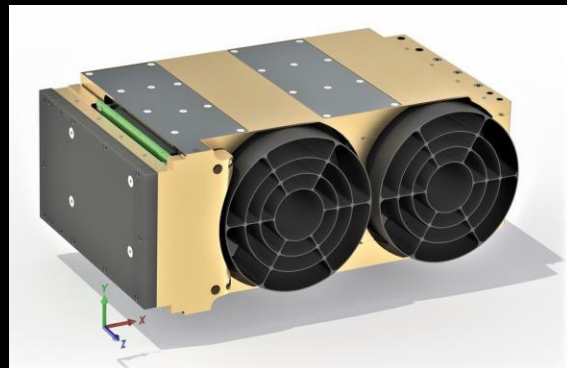
Image Credits: NASA



**Pathfinder Technology
Demonstrator (PTD-4)**
Launch Timeframe:
NET June 2024

Demonstrate Lightweight
Integrated Solar Array and
anTenna (LISA-T) – A high-
power deployable solar array
antenna.

Image Credits: NASA



**Pathfinder Technology
Demonstrator (PTD-R)**
Launch Timeframe:
NET June 2024

Demonstrate a new type of
UV and SWIR Telescope that
may be used in a wide range
of applications.

*Image Credits: Lawrence Livermore
National Laboratory*

University SmallSat Technology Partnership Successes to Date



Investments:

- Over \$30,000,000 awarded
- 54 partnerships in 6 cohort years
- 36 universities in 22 states (+6 supporting collaborators in 6 states)
- 8 of 10 NASA centers partnered

Results:

- 24 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

National Aeronautics and Space Administration

▲ 36 Universities in 22 States



8 NASA Centers (including JPL FFRDC)



6 Supporting University Collaborators in 6 States

