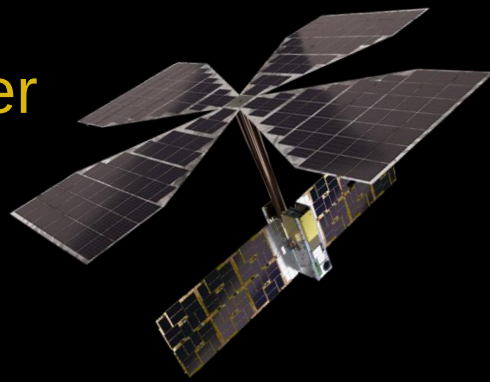
National Aeronautics and
Space Administration

NASA SMALL SPACECRAFT TECHNOLOGY PROGRAM

Roger C. Hunter
Program Manager

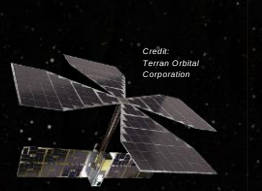


NASA Town Hall ✦ August 5, 2024
Small Satellite Conference

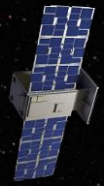
Small Spacecraft Technology Program

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.


Credit: Terran Orbital Corporation

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



CAPSTONE
Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment

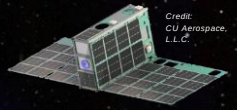
Starling
Technologies for Distributed Small Spacecraft Missions


Credit: Terran Orbital Corporation

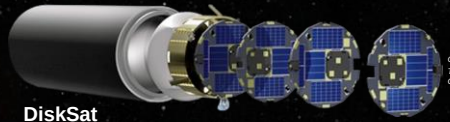
PTD-3
Pathfinder Technology Demonstrator-3 TeraByte InfraRed Delivery (TBIRD)


Credit: Terran Orbital Corporation

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


Credit: CU Aerospace, L.L.C.

DUPLEX
Dual Propulsion Experiment (DUPLEX) CubeSat


Credit: The Aerospace Corporation

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


Credit: ExoTerra Resource, L.L.C.

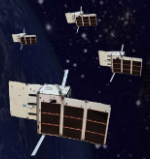
Courier
Solar Electric Propulsion Module

GPDM
Green Propulsion Dual Mode

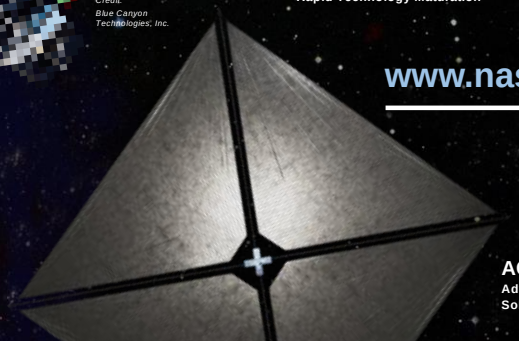
CLICK
CubeSat Laser Infrared CrosslinK


Credit: Blue Canyon Technologies, Inc.

R5
Rapid Technology Maturation



PY4
Four-CubeSat Swarm of PyCubed-Based SpaceCraft



ACS3
Advanced Composite Solar Sail System

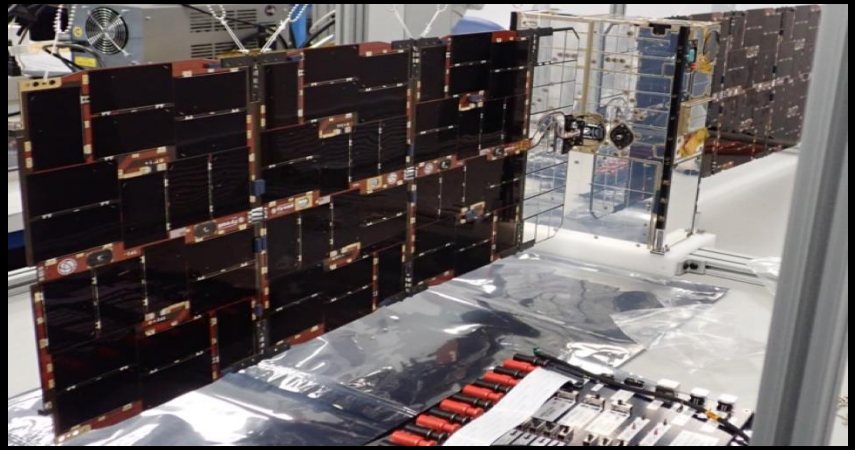
www.nasa.gov/smallspacecraft

www.nasa.gov

2024-2026 Launch Schedule

Technology Demonstrations	Launch Timeframe
PY4: *Four CubeSat Swarm of PYCubed-Based Spacecraft*	Launched March 4, 2024
ACS3: *Advanced Composite Solar Sail System*	Launched April 23, 2024
R5 (S2 and S4): *Rapid Technology Maturation*	Launched July 3, 2024
PTD-4: *Pathfinder Technology Demonstrator-4: Payload: LISA-T High-Power Deployable Solar Array Antenna*	NET August 2024
PTD-R: *Monolithic UV/SWIR/VIS Camera*	NET August 2024
R5 (S3 and S5): *Rapid Technology Maturation*	NET October 2024
DUPLEX: *Dual Propulsion Experiment*	NET April 2025
GPDM*: Green Propulsion Dual Mode*	Q3 2025
Courier: *Solar Electric Propulsion Module*	Q1 2026
CLICK B/C: *CubeSat Laser Infrared CrosslinK*	Q2 2026
DiskSat: *2D, High-Power, High-Aperture Maneuverable Spacecraft*	NET April 2026

On-Orbit U-Class Technology Demonstration Missions



Pathfinder Technology Demonstrator (PTD-3)
Launched: May 25, 2022

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

Image Credits: Terran Orbital Corporation

CAPSTONE
Launched: June 28, 2022

Demonstrate how to enter and function in a NRHO around the Moon and demonstrate spacecraft-to-spacecraft navigation.
Successful completion of objectives including crosslink and one-way ranging with DSN

Image Credits: NASA

On-Orbit U-Class Technology Demonstration Missions

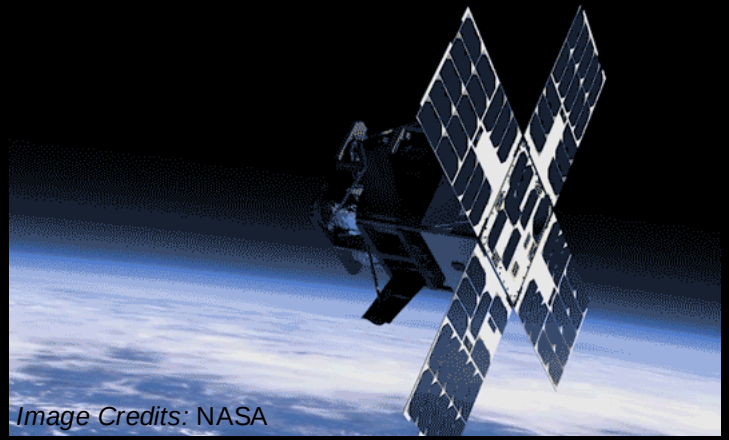


Image Credits: NASA

Advanced Composite Solar Sail System (ACS3)
Launched: April 23, 2024

Demonstrate deployment of the composite boom solar sail in low-Earth orbit. The unfurled solar sail will measure approximately 84 m^2

Addresses Shortfall ID# 700 Solar Sails for Propellant-less Propulsion

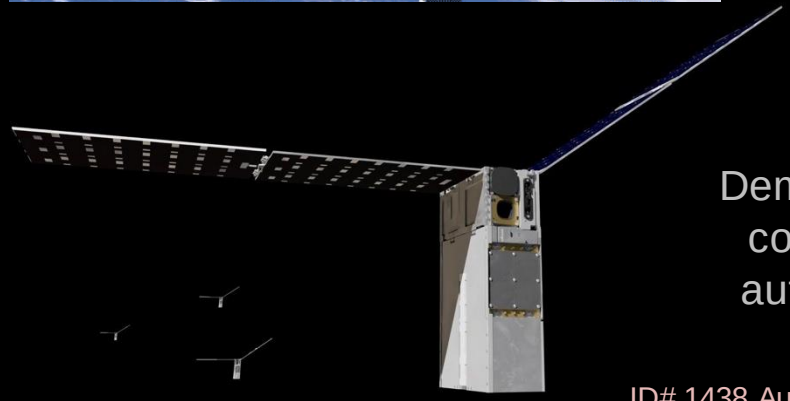


Image Credits: NASA

Starling
Autonomous Swarm Technology
Launched: July 17, 2023

Demonstrate swarm maneuver planning and execution, communications networking, relative navigation, and autonomous coordination between four 6U CubeSats

Addresses Shortfalls: ID# 1477 Debris Mitigation Technologies;
ID# 1438 Autonomy, Edge Computation, and Interoperable Networking for Small Spacecraft

Starling 1.5 Goals and Objectives

Goals

- Demonstrate a model of space traffic management (STM) between two cooperative swarms/constellations with onboard conjunction assessment (CA) and collision avoidance (COLA) capabilities.
- Develop autonomous maneuvering methods and tools that could be operationalized for NASA flight missions

Project Objectives

- Demonstrate onboard conjunction assessment (CA) for Starling's planned maneuvers
- Demonstrate continuous CA checking of passive and active/maneuvering objects
- Demonstrate a ground-based space situational awareness (SSA) / space traffic management (STM) hub that facilitates on-orbit autonomous CA/COLA
- Demonstrate collision avoidance (COLA) maneuver of Starling spacecraft in response to an onboard CA detection

6

Starling 1.5 launched as Starling 1.0. Starling 1.5 operations have commenced.

On-Orbit U-Class Technology Demonstration Missions


Image Credits: NASA


Image Credits: NASA

Realizing Rapid, Reduced-cost high-Risk Research (R5)
S2 & S4 – Launched July 3, 2024
S3 & S5 – NET October 2024

Build and operate rapid, low-cost, highly-capable spacecraft platforms to demonstrate payloads of interest and technology relevant to human spaceflight .

Addresses Shortfall ID # 1586 Enhanced Access to Orbital and Suborbital Space for Flight Demonstration and Test

---

PY4
Launched: March 4, 2024

Demonstrate low size, weight, power, and cost (SWaP-C) spacecraft-to-spacecraft ranging, on-orbit relative navigation, and coordinated simultaneous multi-point radiation measurements

Addresses Shortfall ID # 1433 Position, Navigation, and Timing for Small Spacecraft

Upcoming U-Class Technology Demonstration Missions – 2024

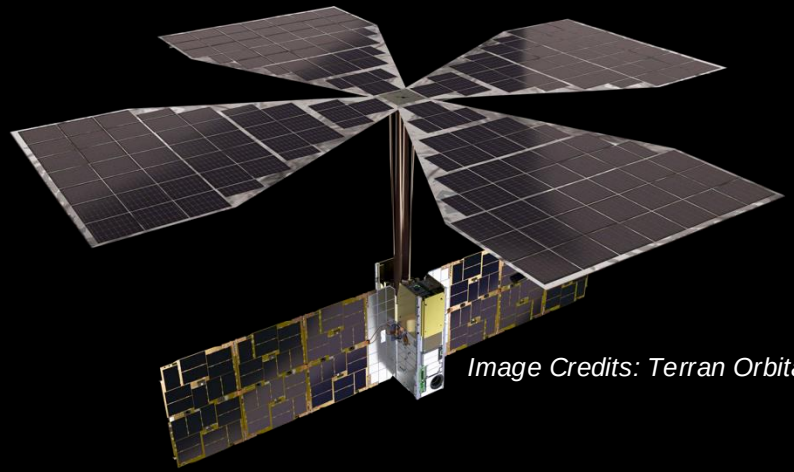


Image Credits: Terran Orbital

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

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

Addresses Shortfall ID# 1434 Communications Technology and Capabilities for Small Spacecraft; 1436 Efficient and Safe Higher Power Systems for Small Spacecraft

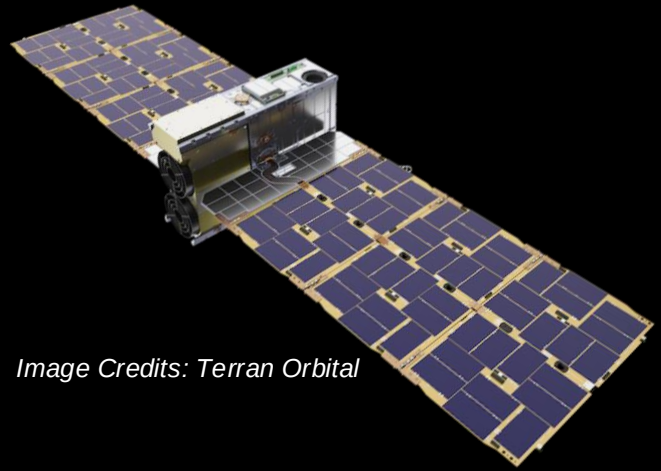


Image Credits: Terran Orbital

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

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

Addresses Shortfall ID#
1626 Advanced Sensor Components: Imaging

Upcoming U-Class Technology Demonstration Missions – 2025-2026

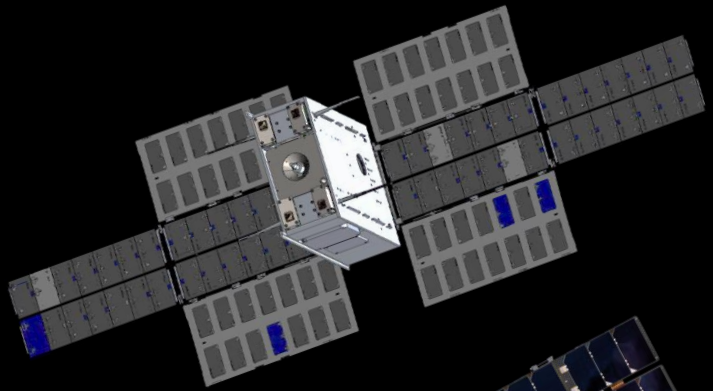


Image Credits: NASA

Green Propulsion Dual Mode (GPDM)
Launch Timeframe: Q3 2025

Demonstrate chemical and electrospray characteristics (higher thrust and higher efficiency) for in-space propulsion using ASCENT/green propellant on a 6U-sized CubeSat.

Addresses Shortfall ID#
701 Green Propellant Propulsion Systems;
1430 Small Spacecraft Propulsion

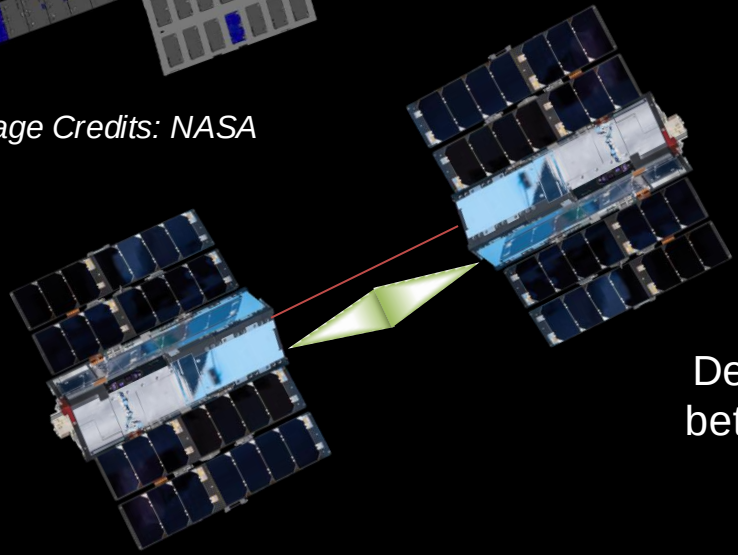


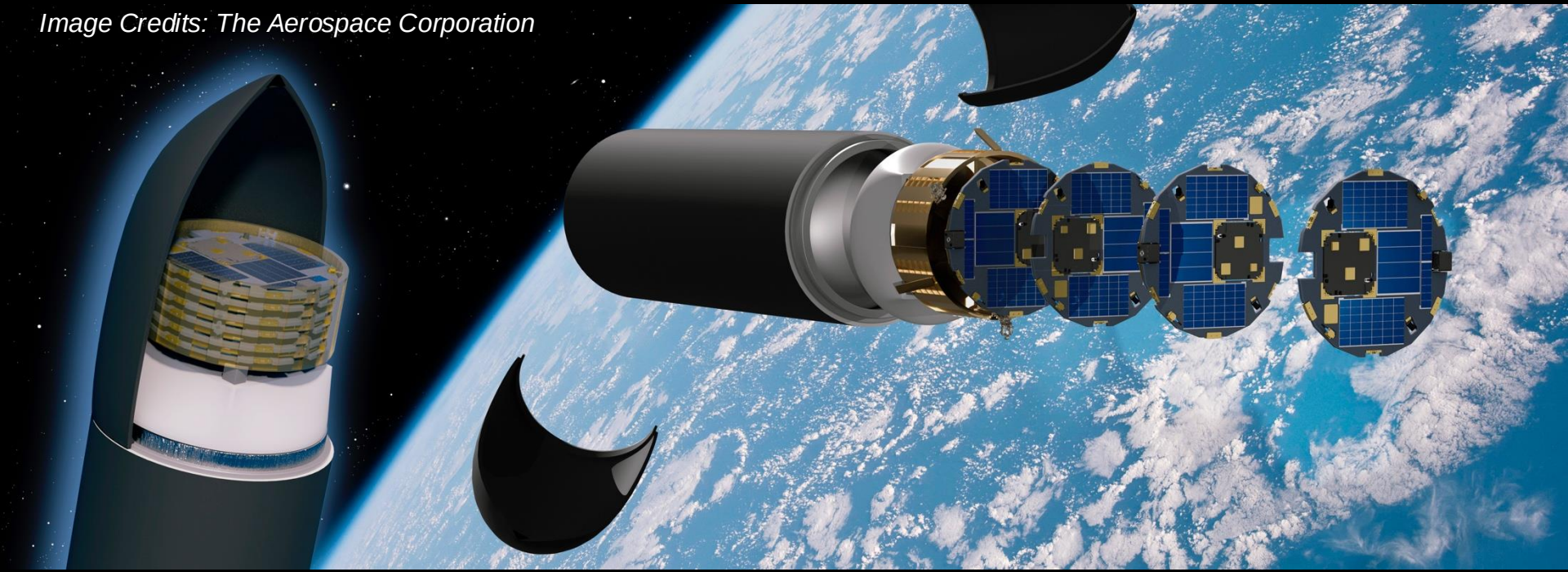
Image Credits: Blue Canyon Technologies, Inc

CubeSat Laser Infrared CrosslinK (CLICK B/C)
Launch Timeframe: Q2 2026

Demonstrate optical crosslink and precision ranging between two 3U CubeSats at a data rate of 20 Mbps and range up to 580 km

Addresses Shortfall ID#
1434 Communications Technology and Capabilities for Small Spacecraft

Image Credits: The Aerospace Corporation



DiskSat DiskSats are high-power and high-aperture alternatives to CubeSats. They are launched in tight stacks but are deployed individually to ensure no recontact between satellites. This first DiskSat demonstration is anticipated to launch no earlier than April 2026.

Addresses Shortfall ID# 1431 Access Beyond LEO for Small Spacecraft; 1430 Small Spacecraft Propulsion


NASA